DFID Department for International Development

guidance manual on

water supply and sanitation programmes

WELL
WATER AND
ENVIRONMENTAL HEALTH AT
LONDON AND
LOUGHBOROUGH

Prepared by WELL

WELL is a resource centre funded by the Department for International Development (DFID)
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Background:	Eritrean women returning to the village from the river bed carrying full jerrycans of water. The climb is steep and arduous and takes several hours. (WaterAid/Caroline Penn)
Top insert:	WaterAid/Jim Holmes
Centre insert:	WEDC/Darren Saywell
Bottom insert:	LSHTM/Sandy Cairncross

Foreword

The White Paper on International Development sets out the Government's policy to seek to strengthen the international commitment to meet the international poverty elimination targets. Improved access to safe and affordable water supply and sanitation is an essential component of the strategy. Lack of such access is a clear determinant of poverty. It results in millions of children dying annually from diarrhoea and water-related diseases. For women and children, collecting water is wearisome and time consuming and often results in children not being able to attend school.

Better access to safe water and sanitation not only leads to improvements in health, but also saves time and energy and enhances livelihood opportunities.

The Department for International Development commissioned this Guidance Manual to assist staff and partners to develop effective and sustainable water supply and sanitation programmes. It represents collaboration across a range of professions within my Department and from key UK professionals in the sector. It details inter-disciplinary approaches to planning and implementation of partnership-based programmes.

The challenge is vast, and cannot be met simply by development aid and public funds. Partnerships between governments, the private-sector and civil society are central to sustainable solutions. I hope that this manual will make a significant contribution to enhancing the effectiveness of our efforts.

Clare Short

Clare Short
Secretary of State for International Development

Preface

This Manual has been prepared as a tool to help improve DFID's support for water supply and sanitation (WS&S) projects and programmes in developing countries. Its particular focus is on how DFID assistance can best meet the needs of the urban and rural poor for WS&S services. To facilitate the targeting of the poor reflects the objective of UK international development support set out in the White Paper on International Development 'better education, health and opportunities for poor people' — one of three objectives contributing to the general aim 'the elimination of poverty in poor countries'.

The Manual has been written primarily for DFID staff: both those identifying, appraising, and evaluating WS&S projects; and those developing, managing, and monitoring such projects. DFID believes that the discussions of WS&S sector issues and approaches, and the resulting policies and procedures, will also be of interest to its project partners in national and local governments, non-governmental organizations (NGOs), and other external support agencies. The Manual will also inform DFID contractors and consultants of the Department's objectives and the approaches to be followed in achieving them.

Professional engineers, health scientists, economists, and sociologists are all closely involved in the achievement of sustainable WS&S services for the poor. Each needs to know not only his/her own role and objectives, but also the experiences and approaches which guide the others. The comparatively lengthy discussion of key principles and practices in Section 2 of the Manual is intended to contribute to this cross-fertilization. Specialists are urged to read the sections related to other disciplines and to accept the extended elaboration of concepts which should be familiar to them in their own sections.

The *Guidance Manual* has been prepared for DFID by WELL (Water and Environmental Health at London and Loughborough), with the following specialist authors contributing material: Jo Beall, Sandy Cairncross, Ben Cave, Andrew Cotton, Val Curtis, Pete Kolsky, Jeremy Parr, Sarah Parry-Jones, Bob Reed, Kevin Sansom, Ian Smout, Hugh Tebbutt, and Judy White.

Numerous DFID staff assisted with discussion of ideas and experience.

The contributions were co-ordinated and drawn together by WELL Associate Director, Ian Smout, with assistance from Technical Editor, Brian Appleton.

About this manual

The overall aim of the Department for International Development (DFID) is identified in the UK Government's White Paper on International Development as *'the elimination of poverty in poorer countries'*. Three specific objectives are set:

1. Policies and actions which promote sustainable livelihoods
2. Better education, health, and opportunities for poor people
3. Protection and better management of the natural and physical environment

In the White Paper, increased UK support for water supply and sanitation (WS&S) is seen as contributing particularly towards the second objective. In fact, improving WS&S services for the poor contributes significantly to the goal of sustainable livelihoods and community development. Better sanitation practices also have a major impact on the local environment and help to preserve freshwater resources. Investments in WS&S may therefore be justified as supporting all three objectives.

UK contributions are targeted towards programmes that enable the rural and urban poor to gain access to safe supplies of drinking water and hygienic means of excreta disposal. They favour too the 'software' components (hygiene promotion, local capacity and institution building, stakeholder involvement, monitoring, and feedback) that help to ensure that installed systems deliver the optimum health and social benefits and can be sustained in the long term.

The primary purpose of this *Manual* is to set out the principles, procedures, and practices that should guide decisions on the choice, design, and management of appropriate WS&S projects. Because the effectiveness and sustainability of WS&S projects depends not only on technology choice, but also, critically, on user involvement, the right gender approaches, innovative community-based financing, and the promotion of behavioural change, the guidance includes discussion of social, financial, and institutional aspects as well as engineering and health concerns.

Basis of the guidance

There is a wealth of literature covering experiences in the WS&S sector during the last 20 years. To consolidate the information into a form which could be most useful to DFID and its partners, WELL appointed nine 'Theme Leaders'. Their task was to prepare individual papers setting out current thinking on guiding principles and good practices in relation to the critical themes and to convert these into practical guidance for DFID staff involved in different aspects of the project cycle.

The themes chosen reflect the multidisciplinary nature of WS&S development:

- Social development and poverty
- The water and sanitation sector
- Health and hygiene
- Economics and finance
- Institutional development
- Engineering and technology
- Hygiene promotion
- Environmental sustainability
- Project management and the project cycle (the linking theme)

The aim is not just to provide individual guidance for each group of specialists, but to present the information in such a way that each specialist is aware of the needs and potential contributions of the others.

From the papers prepared by the specialist authors, the Team Leader and Editor assembled the guidelines to suit the anticipated readership and to promote cross-fertilization of knowledge and expertise during the progress of a WS&S programme.

Chapter 1 sets the scene. It explains the philosophy behind DFID's focus on WS&S services for the poor, provides working definitions of the terms 'water supply' and 'sanitation', describes the historical development of the sector and the co-operative process that has developed within it, and introduces the programme and project process within DFID that forms the background for the guidance.

Chapter 2 expands on the nine key themes. It describes the principles and practices that have evolved during the last 20 years, as engineers, social scientists, economists, and health specialists have shared experiences and reached consensus on the reasons for past failures and the recipes for future success. Wherever possible, the authors have explained the reasoning behind the recommended approaches. The intention is that professional staff in DFID and its partners will gain by understanding the background to all of the disciplines, not just their own speciality.

Chapter 3 is the operational part of the *Manual*, which it is expected will be used by DFID staff involved with different stages of the project cycle. It is arranged to follow the eight key stages of the project cycle and to identify the key issues to be taken into account during each stage. Regular reference back to Chapter 2 enables the user to find the justification for the advice given in Chapter 3.

Appendices contain examples of the Log Frame analysis which is used in DFID, specifically related to the WS&S sector.

The lengthy list of references and further reading indicates the broad basis for the guidance. It should not, however, be taken as an indication that the guidance is now definitive and unchangeable. Concepts and approaches to sustainable community WS&S services are evolving continuously. The participatory approach that is at the heart of these guidelines means that projects develop in line with the expressed needs of partner communities. The learning process leads to greater knowledge and to solutions for previously problematic issues. DFID intends to take advantage of improving sector practices by adapting the guidance periodically.

How to use the *Guidance Manual*

The guidance has been designed to help DFID staff involved in each stage of the cycle, recognizing that some will be ‘water professionals’ whose primary need is to be able to incorporate the cross-disciplinary issues of social development, health and hygiene promotion, and economic and financial analysis. Other DFID staff, specializing in related disciplines, need to understand the key issues of the sector and how they relate to the project cycle.

The manual is also intended to help DFID’s project partners (national and local governments, other donors, NGOs, and other external support agencies) who need to understand DFID’s concerns, policies, and procedures. Similarly, DFID contractors and consultants need to be aware of the rules guiding DFID approaches and to understand the key objectives of UK international co-operation.

Because of the need to cater for the different backgrounds of the intended audience, specialists may find that they can skip sections which detail their own field of interest for the benefit of others. The participatory approach to project development does require, however, that all those involved are aware of the needs of the other disciplines. Readers are therefore encouraged to familiarize themselves with the principles and approaches set out in Chapter 2 in respect of each of the disciplines and the summaries in the left hand margin provide an overview of each section.

Chapters 1 and 2 of the manual are seen as essential first-time reading for staff who will be applying the guidelines in any stage of the project cycle. They also offer a reasonably comprehensive background to the WS&S sector for other readers. Chapter 2 is an important reference source for users, as it provides the logic and justification for the procedures outlined in Chapter 3.

Chapter 3 should be read once by all readers, to gain an understanding of the interlinkages among different stages of the project cycle. Different users will then concentrate on the section relating to the stage of the project cycle which is their particular concern. Because the guidelines cover a wide range of projects, from small village latrine programmes to urban water supply and sanitation schemes involving multiple partners from the private sector, NGOs, and local government agencies, the guidance has to be equally wide-ranging.

After readers have an overall appreciation of the *Guidance Manual*, they can read specific sections for guidance on the particular issues they face. For example, if one is considering how to integrate hygiene promotion with technology at the project identification stage, the sections to read would be:

- Chapter 1 and Section 2.1 for the key overall issues
- Sections 2.7 and 2.8 for specific approaches to technology and hygiene promotion
- Section 2.9 for guidance on maximizing benefits
- Section 3.2 on specific issues to be considered at the project identification stage
- The Appendices for examples of logical frameworks for different types of project.

To avoid repetition, Chapter 3 refers back regularly to Chapter 2. The reader may also use the Index to look up particular topics and may want to refer to the list of Acronyms and list of References in the Appendices. The chapters are colour coded and the edges of pages are flashed for easy reference.

The *Guidance Manual* details many factors which are important for the success of WS&S programmes. In many circumstances, however, it will not be possible, or perhaps appropriate, to follow all of these. Compromises will have to be made, taking account of the partnership approach and the priority of ensuring sustainable provision of basic WS&S services to those in need.

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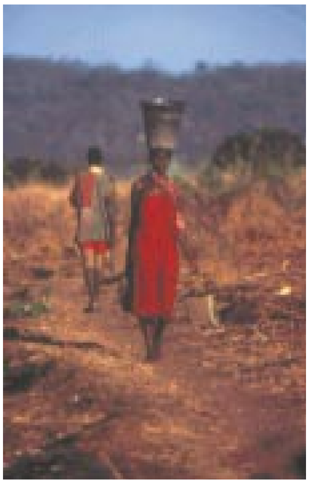
Chapter 1

Introduction to water supply and sanitation projects

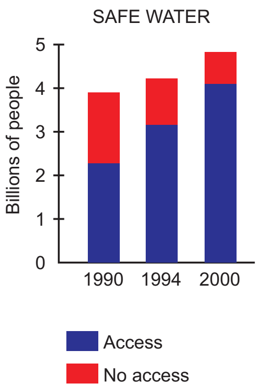


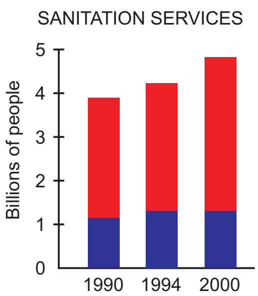
WaterAid/Jim Holmes

Impact on the poor

Over this decade the proportion of people in developing countries with access to safe water has improved.

Access to sanitation services has not.





Every year, millions of the world's poorest people die from preventable diseases caused by inadequate water supply and sanitation (WS&S) services. Hundreds of millions more suffer from regular bouts of diarrhoea or parasitic worm infections that ruin their lives. Women and children are the main victims. Burdened by the need to carry water containers long distances every day, they must also endure the indignity, shame, and sickness that result from a lack of hygienic sanitation.

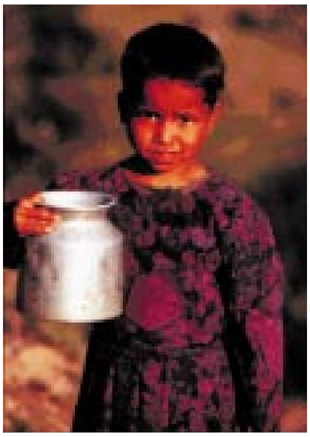
The impact of deficient water and sanitation services falls primarily on the poor. Unreached by public services, people in rural and peri-urban areas of developing countries make their own inadequate arrangements or pay excessively high prices to water vendors for meagre water supplies. Their poverty is aggravated and their productivity impaired, while their sickness puts severe strains on health services and hospitals.

Apart from the overwhelming social arguments, there are also powerful economic and environmental reasons for improving WS&S services for the poor. Human waste is a major polluter of rivers and groundwater resources. As water demand rises inexorably with social and economic progress, scarcity of water becomes a major consideration in development planning. Industrialization and food security may both be threatened, unless water resources are protected and conserved.

For all these reasons, improved WS&S services have been seen as a high priority need by the development community for more than 20 years. So why is the suffering and the squalor virtually unabated in so many countries? There are many reasons, and the problem is a complex one because solutions depend on a mix of political, social, technical, and institutional approaches, most of them involving changing established practices. An indication of the type of considerations that need to be taken into account can be gained from WELL's own Guiding Principles, set out in the box on the next page.

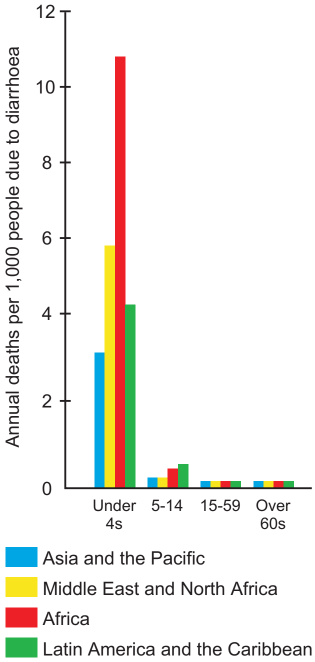
There is no standard blueprint for a sustainable and effective WS&S project. Each situation needs a co-ordinated approach by all of the stakeholders to ensure that the installation reflects the true demands of all sections of society. Discovering these demands can involve a lot of preparatory time and effort, which has not always been provided in the past.

Many committed professionals have been sharing experiences and developing common concepts and principles which can be used to guide the process of planning, implementing, and maintaining WS&S improvements. That collective expertise provides a basis for optimism that concerted efforts in the early years of the new millennium can make a major impact on the current depressing situation in so many countries.



WaterAid/Jim Holmes

Child deaths due to inadequate water and sanitation is a particular problem in Africa.



Bern et al., 1992

The WELL Guiding Principles

People matter more than science. Failures in environmental health in developing countries are usually human problems of conflicting interests, inadequate human resource development, or an inaccurate interpretation of the needs and priorities of various stakeholders. Whether or not technology and hygiene are promoted effectively has far more to do with specific institutional players and interest groups and their interaction than with medical or technical understanding. Despite lip service to gender awareness, all too often the perspectives and roles of women are ignored or undervalued. We need to understand demand for services from women, men, and children across all social groups before selecting suitable approaches and technologies.

Software and hardware must go hand in hand. Many public health engineering projects fail because the hardware has been provided but the means to sustain the intervention beyond construction have not been developed. An integrated approach is required to develop suitable infrastructure by integrating the social, health, technical, economic, financial, institutional, and environmental aspects and planning for sustainable management, operation, and maintenance. The many demands on the time of both female and male residents severely constrain what is sometimes naively viewed as the limitless potential of community management. We also know that efforts to improve hygiene are futile where the basic requirements of water, sanitation, or drainage cannot be met.

Both public and private aspects of environmental health count. Environmental health services often require both centralized resources (e.g. water treatment works, trunk sewers, landfills) and distributed resources (e.g. local public taps, house drains and street sewers, pit latrines, and street-level solid waste collection). In addition, both public and private environments play distinct roles in disease transmission. In times of structural adjustment, public authorities have learned that they cannot manage both central and distributed resources, and that there are benefits in devolving responsibility for the distributed resources to local communities. Such an approach can improve cost recovery and accountability to local residents, while reducing total cost.

Environmental infrastructure is about more than health. While improved health may be a project goal for infrastructural or environmental projects, it is not often a useful or complete indicator of success. On scores of occasions, water and sanitation projects have commissioned epidemiological or demographic evaluations of health benefits. Experience shows that, while fascinating for academic researchers, such studies are time-consuming, expensive, fraught with methodological defects, and frequently produce misleading or ambiguous results. Moreover, they do not help to diagnose the weaknesses of a project, or suggest ways in which its impact may be strengthened. Operational evaluations of facility functioning and consumer use, combined with studies of hygiene behaviour, are far more useful. Such studies can also illustrate other benefits of water and sanitation that are valued highly by the users, such as saved time, convenience, cost, and dignity, which are all too lightly dismissed in a narrow medical framework.

Community WS&S in practice

A typical community water supply and sanitation project in most developing countries will have both 'hardware' and 'software' components.
The water supply system may be:

- a handpump raising groundwater from a borehole or dug well;
- a standpost and tap connected to a pipe system (which may be supplied by motorized pumping or by gravity, from a borehole, stream, reservoir, or spring source, with or without any water treatment); systems may consist of only a few standposts in a village, or may be part of a larger regional or city-wide system; or
- a water butt supplied by rainwater from a roof catchment.

A number of families share each handpump or standpost (water-point), and family members (usually women and children) both collect water from it and often wash clothes or dishes there.

Improved levels of service are provided by increasing the number of water-points, so reducing the time and distance to collect water. Most convenient is the yard connection, where each family has a standpost on its own housing plot, or the house connection, where water is supplied into the house at a pressure which operates several taps in the bathroom and kitchen.

Safe excreta disposal for poor people usually involves the use of a family latrine, which the family themselves keep clean. The latrine will use one of many various designs of pit, slab, and superstructure, and may also include a lid, vent pipe, or water seal to control flies and odour.

The 'software' components will include such things as hygiene promotion and the training of operatives, water committees, and caretakers.

WaterAid/Jim Holmes

1.1 Definitions and scope of the *Guidance Manual*

Household water supply and sanitation services

The principles and practices set out in this manual apply to DFID programmes and projects for improving access to *household* water supply and sanitation services in developing countries.

Water supplies for agriculture, industry, power generation, ecosystem protection, navigation, etc., involve different considerations which are beyond the scope of these guidelines. There are, however, evident and important links between domestic WS&S and the management of water resources as a whole. Though water for domestic use accounts for only about five per cent of water consumption, it is a proportion that must be safeguarded in both quality and quantity as a basic human need. At the same time, poor sanitation practices are the major cause of surface and groundwater pollution.

Integrated water resources management strategies

It is for these reasons that WS&S programmes need to be part of integrated water resources management (IWRM) strategies in developing countries. For the purposes of this manual, the discussion is limited to the direct links between WS&S and IWRM, such as water allocation and pricing policies; regulatory and legislative issues in water conservation and pollution control; and the common capacity-building needs of local institutions. For the broader IWRM

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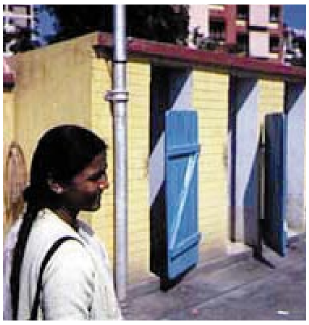
issues such as water resources assessment, river basin management, and agricultural/industrial water use, readers are referred to other information sources (e.g. EC, 1998).

These guidelines cover both rural and urban WS&S projects, but with the emphasis on meeting the basic needs of the unserved or ill-served poor in rural and peri-urban areas, inner city informal settlements and slums, and small towns.

Wider issues of basic infrastructure for poor people have been reviewed in an Occasional Paper (DFID, 1998).

In terms of **water supply**, those basic needs include access to a safe supply of water for domestic use, meaning water for drinking, food preparation, bathing, laundry, dishwashing, and cleaning. In many cases, domestic water may also be used for watering animals and vegetable plots or gardens. Definitions of 'access' (distance to the nearest water-point and per capita availability) and 'safe' (water quality) may vary from country to country.



WEDC/John Pickford

There are many possible definitions of **sanitation**. For the purposes of this manual, the word 'sanitation' alone is taken to mean the safe management of human excreta. It therefore includes both the 'hardware' (e.g. latrines and sewers) and the 'software' (regulation, hygiene promotion) needed to reduce faecal-oral disease transmission. It encompasses too the re-use and ultimate disposal of human excreta. The term **environmental sanitation** is used to cover the wider concept of controlling all the factors in the physical environment which may have deleterious impacts on human health and well-being. In developing countries, it normally includes drainage, solid waste management, and vector control, in addition to the activities covered by the definition of sanitation.

The poverty-eradication goal of DFID established the focus of the *Guidance Manual*. The target groups for DFID co-operation are rural communities and poor people living in peri-urban areas, inner-city slums, and small towns. To support them in their own efforts to improve WS&S services, the approach has to be participatory and to be based on partnerships which involve a wide range of stakeholders.

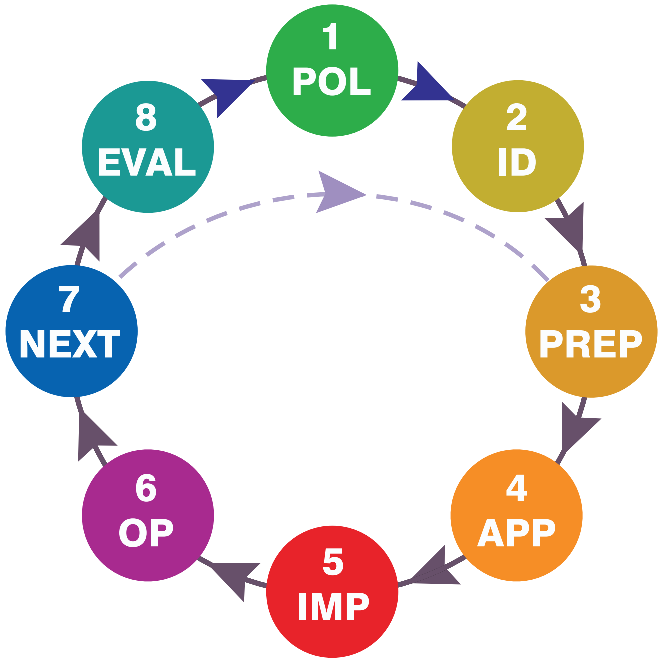
Participation and partnership

The **primary stakeholders** in WS&S projects are the intended users of improved facilities — the householders in target communities. It is worth noting right at the start that the partnership approach needs to involve all sections of the community. Exclusion of groups on the basis of gender, ethnicity, income level, or for socio-cultural reasons leads to unsatisfactory projects which will usually prove unsustainable in the long term.

Secondary stakeholders, in addition to governments and donors, will typically include local NGOs, private sector entrepreneurs, local government and water utilities, river management boards, consumer groups, clergy, and schoolteachers.

The guidance in this manual covers the full programme and project cycle, which is in eight distinct stages[1]:

[1] These abbreviations have been assigned only for the purposes of this manual, as use of the marginal icons helps to identify the relevance of particular sections later in the manual



POL	Policy development, sector planning, and programme formulation
ID	Programme and project identification
PREP	Programme and project preparation
APP	Programme and project appraisal and approval
IMP	Implementation and monitoring
OP	Operation and monitoring
NEXT	Extensions or Next phase programme and project identification
EVAL	Evaluation


SCF/Alan Nicol

1.2 Why WS&S matters

Water is a precious resource and vital for life. Without it we would die within days. Access to a safe and affordable supply of drinking water is universally recognized as a basic human need for the present generation and a pre-condition for the development and care of the next. Water is also a fundamental economic resource on which people's livelihoods depend. In addition to domestic water use, households use water for productive activities such as farming and livestock rearing in rural areas, or horticulture and home-based micro-enterprises in urban settlements.

Water shortage, poor quality water, or unreliable supply have profound effects on people's well-being. Providing safe water alone is not enough, however, as water can quickly become unsafe, and the faecal–oral transmission of diseases can occur in other ways. If people do not have adequate and appropriate sanitation facilities or the chance to develop good hygiene practices, diseases can be spread through the contamination of water or through other pathways in the home environment. At any one time around half of all people in developing countries are suffering from one or more of the six main diseases associated with inadequate water supply and sanitation: diarrhoea, ascaris, dracunculiasis, hookworm, schistosomiasis, and trachoma.

Assessing health impacts

Improving the health of the poor is a frequently cited goal of water and sanitation projects. The relationship is difficult to establish in practice at the project level, but over the longer term it can be demonstrated that there are significant health-associated benefits from improvements in water supply and sanitation provision, particularly when these are associated with changes in hygiene behaviour. The Water and Sanitation for Health programme (Esrey et al., 1990) found that in the 144 epidemiological studies that it had reviewed, the health impact of improved water supply and sanitation facilities was high, measured by significant reductions in morbidity rates (sickness) and higher child survival rates (see also Section 2.3).

The links between water use (and misuse), health impacts, and environmental degradation are influenced not only by poverty but also by affluence. Industrial development, economic growth, and improvements in living standards lead to greater use, abuse, and degradation of water quality, while water scarcity does not affect all groups in society equally.

Water is an economic and a social good.

The White Paper on International Development treats water as both an economic and a social good in the context of the goals of sustainable development. The benefits of safe water supply and sanitation provision go beyond improvements to health, well-being, and quality of life. Access to convenient and affordable water can save people's time and energy and enhance their livelihood opportunities. Improvements in sanitation will improve privacy and retain human dignity — significant and legitimate social development concerns. These less quantifiable benefits are among the advantages of water supply and sanitation most often reported by people in low-income communities.

1.2.1 Impacts on the poor and powerless

WaterAid/Jim Holmes

In rural areas poor people have to work hard for their water, often fetching it from far-off sources and using it carefully and sparsely. The time spent collecting water is a double burden, as it means less time is available for the productive activities on which subsistence economies depend. In cities, the urban poor suffer the indignities of inadequate sanitation and frequently have to purchase water from private vendors. Research in slum and squatter settlements in Jakarta showed that less than a quarter of the city's population have direct connections to a piped water system and 30 per cent depend solely on purchasing water from vendors (Jarman, 1997). In Lima, Peru, a poor family paid a vendor 21 times as much for water as a middle-class family with a household connection paid for their water (Briscoe, 1986). Poor households can spend up to 40 per cent of their total income on water (UNICEF, 1995).

Poor slums and informal settlements are commonly found on low-lying, flood-prone, or low-infiltration-capacity land with a high water table, leading to poor drainage and sanitation problems. Many poor people rely for bathing, laundering, and defecation on drainage channels, canals, and rivers which become clogged by garbage and flood when solid waste management is inadequate. Research in São Paulo, Brazil showed that only two per cent of slum dwellers have any form of sanitation (Hardoy et al., 1990). Improved access to natural sources of water or a piped water supply, along with appropriate and affordable sanitation, are essential ingredients in facilitating the social and economic development of poor rural and urban communities.

Children are the most vulnerable.

Although improvements to water supply and sanitation are important for everybody, children are the most vulnerable to the preventable diseases which result from lack of water, dirty water, and lack of sanitation. Over three million children die every year from diarrhoeal disease and dehydration, and over half experience more than fifteen attacks of serious diarrhoea before the age of five (Bern et al., 1992). A lack of water also means that children cannot wash often enough and so suffer from eye infections and skin diseases such as scabies. Another extreme example of how a lack of water can affect children comes from Huzi village in Tanzania. A mother there explained that in the dry season she shuts her children in the house during the hottest time of day because if they play outside they sweat too much and she does not have enough water for them to drink to replace the loss of body fluid (WaterAid, 1996a).

WaterAid/Caroline Penn

DFID/Dilshad Sheikh

There is also an important gender dimension. Improved water supply and sanitation provides particular benefits for women and girls. Not only do they do the bulk of the carrying of water, but they often suffer harassment on the way to and from community defecation areas and water sources. School sanitation facilities have a major effect on the enrolment and attendance of teenage girls. Also, with their responsibilities for family health, women are often the strongest advocates in the community for change and improved facilities.

Improved water supply and sanitation can lead to significant and tangible improvements in the way of life of many thousands of poor people, and since the beginning of the International Drinking Water Supply and Sanitation Decade considerable resources have been channelled into water supply and, to a lesser degree, sanitation. Unfortunately, however, not all people have benefited.

Poverty reduction through improved WS&S

Poverty reduction through improved water supply and sanitation can be achieved in a number of ways, for example by:

- using enabling strategies such as promoting inclusive policy dialogues and pro-poor policy frameworks;
- addressing inequities by using city-wide approaches; and
- directing activities at areas where poor people live or are particularly affected by lack of safe and adequate water supply and sanitation.

User participation throughout the project cycle

Whatever the means, good practice in water supply and sanitation provision involves the active participation of communities or their representatives in planning, construction, operation, and maintenance. Insufficient attention has been paid in the past to providing economic and other support to users in low-income communities and to their involvement in activities which will ensure long-term and sustainable services and supply.

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Twenty years of international efforts to improve WS&S coverage

1.3 Historical development of the WS&S sector

Water supply and sanitation rose up the development agenda more than 20 years ago. The 1977 UN Water Conference in Mar del Plata, Argentina, recommended that the 1980s should be proclaimed the *International Drinking Water Supply and Sanitation Decade* (IDWSSD). In preparation for the launch of the Decade, the World Bank and the World Health Organization (WHO) carried out rapid assessments of the WS&S sectors in more than 100 developing countries. These, together with WHO's five-yearly monitoring of WS&S coverage, provided the baseline statistics against which progress in the sector is generally measured.

The picture was a depressing one: 1.2 billion people out of a total Third World population of 2.2 billion (China was not included in the statistics at that time) were without access to safe drinking water; 1.7 billion had no proper means of excreta disposal. As a result, an estimated 10 million people a year were dying from diseases directly related to poor sanitation and half of the world's hospital beds were occupied by patients suffering from water-related illnesses.

1.3.1 Ambitious targets for the 1980s

The IDWSSD (1981-1990) was launched at the UN General Assembly in November 1980, with all countries adopting the declared target of achieving 100 per cent coverage in water supply and sanitation by 1990. To reach the targets would have meant doubling the rate at which new water supply services were then being provided, and more than quadrupling the provision of sanitation/sewerage facilities. Sector investments by governments and donors would have to rise threefold.

DFID/Howard J Davies

The launch of the Decade gave WS&S a publicity boost and led to concerted efforts to speed up progress. The economic climate of the 1980s, however, was not conducive to massively increased funding, and anyway most sector institutions in developing countries did not have the absorptive capacity to cope with the type of programmes needed to come close to the 100 per cent coverage goals. Provision of improved water and sanitation services did speed up in comparison with previous years, though in the case of sanitation, it still could not even keep pace with rising population, so the number of people unserved continued to rise.

1.3.2 Consensus on the way forward

A major gain from the IDWSSD was the spur it gave to global co-operation in the sector. Regular consultations and workshops encouraged sector professionals to share experiences and knowledge. This in turn led to a growing consensus on both the causes of past failures and the concepts and approaches which offered the best prospects for future success. When the Decade came to an end with a Global Consultation in New Delhi, India, in September 1990, the 600 WS&S specialists who gathered there were able to agree on guiding principles for accelerated progress. The New Delhi Statement, captioned ‘Some for all rather than more for some’ drew together the experiences of the Decade and updated the Mar del Plata concepts to take account of the challenges of the 1990s.

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1.3.3 The sanitation challenge

The challenges remain huge, and they continue to grow. This is particularly true in respect of sanitation. WHO now estimates that more than 3 billion people are without adequate means of excreta disposal.[2] The impact on the health, dignity, and quality of life of the poor is shaming. Squalid surroundings and continuous health hazards exacerbate the effects of poverty, particularly in the overcrowded slums which surround all Third World cities. According to WHO, 3.3 million people die every year from diarrhoeal diseases and at any one time there are 1.5 million suffering from parasitic worm infections stemming from human excreta and solid wastes in the environment.

[2] The most recent figures from the WHO/UNICEF Joint Monitoring Programme were published in 1996 and based on the situation at the end of 1994. They showed an estimated 2.9 billion people lacking adequate sanitation and 1.2 billion without access to safe water. By the year 2000 the number without sanitation was predicted to reach 3,300 million, approaching 70 per cent of the population of the developing world.

Increasingly it is recognized that neglect of WS&S services for the poor affects all segments of society. On top of the costs of healthcare and lost productivity, the contamination of rivers and aquifers by untreated human waste hinders industrial progress, slows economic growth, and deters tourism. The 1991 cholera epidemic cost Peru an estimated one billion dollars in lost tourism and exports. That same amount would have more than paid for all the water and sanitation systems Peru needed to prevent such an outbreak from occurring.

1.3.4 Improvements have to be maintained

The dismal situation created by inadequate access to WS&S services is aggravated still further by large numbers of broken down or malfunctioning water and sanitation services. The health benefits of an improved water supply can be destroyed overnight if people are forced to revert to contaminated sources when the public supply fails. Capital investment in new services is wasted unless there is adequate provision for the reliable operation and maintenance of installed facilities.

1.3.5 Signs of hope

The scale of the problems should not be underestimated, but the picture is not entirely bleak. Developments in the later years of the 1980s and the early 1990s offer hope that damaging trends can be reversed. During the IDWSSD, the development and demonstration of low-cost water and sanitation technologies was a key strategy for matching costs with affordability. The 1980s saw real progress in the development of technologies and approaches for improving WS&S services for low-income communities. Technological innovation continues to be important in facing new challenges in urban sanitation, waste management, and water conservation, where conventional technologies are often unaffordable.


WaterAid/Jim Holmes

The 1980s showed too that properly motivated communities are ready and able to devote considerable financial, material, and human resources to water supply improvements which meet their own aspirations and needs. It is also becoming apparent that, under the right circumstances, the same motivation can be stimulated for accompanying water improvements with better hygiene behaviour and the construction of improved sanitation systems.

Rehabilitation can be an economic way of deferring investment in new facilities.

The legacy of disused and defective WS&S systems contains important lessons too. Rehabilitating an old system can be an economic way of deferring investment in new facilities, but only if it is accompanied by the correction of previous operation and maintenance shortcomings. It follows that remedial programmes must be accompanied by full analysis of the reasons for past failure and by planning, design, and implementation procedures which take account of operation and maintenance needs.

1.4 Evolution of guiding principles

1.4.1 The Dublin Principles

The Dublin Principles are the basis of an international consensus on development in the water sector.

As part of the preparations for the 1992 UN Conference on Environment and Development (The Earth Summit) in Rio de Janeiro, Brazil, an International Conference on Water and the Environment was convened in Dublin, Ireland, in January 1992. The resulting Dublin Statement and its accompanying four Guiding Principles have remained the common basis for policy dialogues among donors and partner governments, not just in the WS&S sector but in the wider field of water resources development, management, and conservation. The four 'Dublin Principles' are quoted in full in the box on page 11. The Conference Report (Dublin, 1992) also includes a 40-page Action Agenda.

In June 1992 in Rio, world leaders endorsed *Agenda 21*. This blueprint for sustainable development in the 21st Century contains 42 'chapters' setting development priorities under different headings. Chapter 18 of Agenda 21 is entitled 'Protection of the Quality and Supply of Freshwater Resources'. The Dublin Principles are at the heart of Chapter 18, and its negotiated text continues to be the basis of global discussions on progress in all water resources areas.

Since Rio, a series of international meetings (most notably Noordwijk 1994, Harare 1998, and Paris 1998) have assessed the progress of Agenda 21 and tried to put into operation its recommendations.

The UN mechanism for monitoring the implementation of all aspects of Agenda 21 is the Commission on Sustainable Development, which holds annual sessions in New York (CSD1, CSD2, etc., the name relating to the number of years after Rio). The Noordwijk recommendations were a basis for discussions on Chapter 18 at CSD2, and the Harare and Paris meetings fed into CSD6, held in New York in April 1998.

The CSD6 final text re-emphasizes the need for urgent government actions to enable the unserved poor to gain access to basic water and sanitation services. The recommendations reinforce the need for participatory approaches, gender sensitivity, and the integration of

The Dublin Principles

1. Freshwater is a finite and vulnerable resource, essential to sustain life, development, and the environment

Since water sustains life, effective management of water resources demands a holistic approach, linking social and economic development with protection of natural ecosystems. Effective management links land and water uses across the whole of a catchment area or aquifer.

2. Water development and management should be based on a participatory approach, involving users, planners, and policy-makers at all levels

The participatory approach involves raising awareness of the importance of water among policy-makers and the general public. It means that decisions are taken at the lowest appropriate level, with full public consultation and involvement of the users in the planning and implementation of projects.

3. Women play a central part in the provision, management, and safeguarding of water

The pivotal role of women as providers and users of water and guardians of the living environment has seldom been reflected in institutional arrangements for the development and management of water resources. Acceptance and implementation of this principle requires positive policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programmes, including decision-making and implementation, in ways defined by them.

4. Water has an economic value in all its competing uses and should be recognized as an economic good

Within this principle, it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Past failure to recognize the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources.

The Dublin Statement, January 1992

water projects into national water strategies. Specific recommendations from the Harare meeting are quoted in Chapter 2.

WS&S issues are raised on a wide range of international platforms.

Other global meetings, while not directly concerned with water, have had a significant influence on WS&S sector programmes and targets. They include: the World Summit for Children (UNICEF) which gave a high priority to achieving universal WS&S coverage as soon as possible; the 1996 Habitat II Conference in Istanbul, Turkey, where provision of basic WS&S services for the urban poor was highlighted as a priority need; the 1995 Beijing Conference on Women, at which the demand for greater influence of women in decision-making roles was seen as especially important in the WS&S context; the Global Conference on the Sustainable Development of Small Island Developing States in 1994, which highlighted the vulnerability of the small islands and the need to develop basic WS&S services as part of an integrated water resources plan; and the World Food Summit in

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1996, for which the plan of action stresses the role of water in food security and poverty alleviation. The UK Government subscribes to each of these Conference recommendations.

1.4.2 Global co-operation

A key development during the 1980s was the fostering of inter-agency collaboration. One outcome was the formation of the Water Supply and Sanitation Collaborative Council (WSSCC), which holds global meetings attended by a wide range of participants, the majority of whom are from developing countries. Although not a policymaking body, the Council generates outputs through working groups and networking and is becoming increasingly involved in global advocacy for the sector. DFID (then ODA) was a founder member of the Council and has continued to play an active role in its activities.

The World Water Council (WWC) was constituted in 1996 to cover policy issues in the broad field of water resources management. Its subscribing members include public and private sector agencies along with UN agencies and donors. The WWC is currently spearheading the preparation of a *Vision for Water, Life, and the Environment* with four components, including one on water supply and sanitation.

The Global Water Partnership (GWP) was also formed in 1996 with the aim of facilitating improved implementation of programmes in the water resources field. It has been looking at gaps in sector knowledge and capacity-building needs in the different sectors.

Concerted action on sanitation by WSSCC and GWP

Two recent initiatives by the WSSCC and the GWP are of particular relevance to WS&S sector planning. The WSSCC is co-ordinating a *Global Environmental Sanitation Initiative*, aimed at enabling stakeholders to share information about ongoing sanitation programmes and to develop common advocacy materials to raise the profile of sanitation with decision-makers. The GWP is putting together a programme on *Urban Environmental Sanitation* to address technological and capacity-building needs in this critical area.


WaterAid/Jim Holmes

Some multilateral institutions have a primary interest and a strong mandate in the WS&S sector. The objectives of their WS&S programmes are as follows (taken from the UN Secretary-General's Report to CSD6 — see the Appendices for a list of acronyms):

- Co-operation and Co-ordination Mechanisms in Water Supply and Sanitation: Habitat, UNICEF, and UNDP

Many multilateral agencies are actively involved in WS&S

- Interagency Steering Committee on Water Supply and Sanitation: DESA, FAO, IAEA, World Bank, INSTRAW, Habitat, UNICEF, UNDP, ECA, ESCAP, ECE, ECLAC, ESCWA, UNESCO, UNEP, UNHCR, UNIDO, UNU, WHO, and WMO
- Joint Activities towards Universal Access to Water Supply and Sanitation in Asia and the Pacific: DESA, World Bank, INSTRAW, UNICEF, UNDP, ESCAP, and WHO

- Joint Initiative on Participatory Methods for Hygiene Behaviour Change and Sanitation: World Bank, UNICEF, UNDP, and WHO
- Joint Initiative on Prevention and Control of Water-Related Diseases in Europe: ECE, UNEP, and WHO
- Joint Monitoring Programme (JMP), for Water Supply and Sanitation: UNICEF and WHO
- Memorandum of Understanding on Water and Environmental Sanitation: World Bank and UNICEF
- Promotion of Sustainable Water Supply and Sanitation Programme: World Bank, UNDP, and WHO
- Water Supply and Sanitation Programme: World Bank and UNDP
- Water Supply and Sanitation Programme in Rural Areas: DESA, UNDP, and UNCDF (United Nations Capital Development Fund)
- Water Working Group of the System-Wide Special Initiative on Africa: DESA, FAO, IAEA, World Bank, Habitat, UNICEF, UNDP, ECA, UNESCO, UNEP, UNIDO, WHO, and WMO.

All these major actors and the donor community as a whole have agreed to operate with a set of common guiding principles which are the basis of sustainable progress in the delivery of improved WS&S services to the unserved and under-served poor. The key elements of those principles are summarized in Section 2.1 of this manual.

1.5 Organization of the WS&S sector

It is important to have a clear understanding of the institutional arrangements for sector planning.

In the development of projects and programmes, it is obviously important to have a clear understanding of the institutional arrangements for sector planning. Larger countries, for example India and Pakistan, may have a state government structure operating below the federal level. This structure affects both the way in which overall financial and human resources are allocated to sector programmes, and also the mechanisms through which programmes and projects are planned, implemented, and managed.

Matters are frequently made more complex by the large number of institutions with a stake in different aspects of the WS&S sector in most countries. This situation arises partly because old institutions are rarely dispensed with at the same rate that new ones are created. Historically too, responsibility for rural water and sanitation often rested with health ministries, while urban WS&S was divided among city administrations and central water ministries. Other aspects of water resources management are sometimes the responsibility of dedicated water ministries, or may come under the ambit of an agriculture, energy, or industry department. This makes the job of developing integrated programmes particularly difficult.

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Increased commercialization and private sector participation

It has been fashionable over the last decade or more to create semi-autonomous public bodies such as water utilities as a means of increasing private sector participation. The arguments underlying this are well known, and relate to effectiveness, efficiency, and distancing service/infrastructure providers from what has been perceived as undue political influence or budgetary restraints. While there are clear benefits to this approach, an important side effect has been the removal of powers from local government, particularly in the urban sector. This is not automatically to the general good, as in practice it distances service providers from direct accountability to both the local political system and its consumers.

Utilities have paid little attention to the poor, to sanitation, and to small towns and rural areas.

To date, utilities tend to exist only in large urban centres, and focus primarily on water supply to middle- and high-income consumers, with relatively little attention to the urban poor, who may as a result be further marginalized. Also, they are much less successful in dealing with and applying commercial principles to urban sanitation. In small urban centres, it is mainly urban local governments which will retain responsibility, and policy has to be directed at improving performance within the context of their operational constraints; it is not an ideal world.

Planning ahead for O&M in Cuttack

DFID is funding an urban services improvement programme focused on the urban poor in the Indian city of Cuttack. This includes improvements to water supply and sanitation. Project preparation studies and previous experience from DFID urban projects elsewhere in India indicated that operation and maintenance of the assets created would be problematic, and that it was essential to bring O&M to the fore. Common problems include:

- Inadequate information and accounting systems make actual performance assessment difficult.
- O&M work programmes are not based on actual needs.
- A lack of transparency in the subsidies being directed at the operation of a small sewerage scheme which benefits the better-off residents; this has a distorting effect because cost-recovery proposals for the urban poor are very hard to justify unless these hidden sewerage subsidies for the better off can be dealt with.
- The set levels of cost recovery do not allow for adequate expenditure on O&M.

The crucial point is that despite these weaknesses, the programme goes ahead. The ideal policy and institutional environments exist only in theory. The key issue is to identify the problems during project identification and preparation and ensure that they are being addressed in the Project Memorandum and Framework, as is the case in Cuttack.

This is currently being addressed as part of the main programme; a study is underway to carry out a situation analysis and produce a phased development plan for improving O&M over the lifetime of the project. Both institutional performance and community perceptions of O&M are being investigated.

By the end of the project, actions will have been taken in conjunction with the local project partners both at the city and state levels to improve the performance of O&M. This will take at least five years to achieve.

Nevertheless, such situations offer important opportunities and challenges for well-focused technical co-operation and investment in the sector; careful problem analysis is required to ensure that the project purpose and goal can be met, as the Cuttack experience shows (see box left).

Other generic problems can arise where WS&S is handled by different ministries and departments of local government and where rural and urban responsibilities are different. The institution responsible for post construction management, operation, and maintenance of the service is often different from the one that planned and implemented it, and is relatively poorly resourced. There is therefore a potential problem with the sustainability of the service, which has to be anticipated and overcome in the project development phase. In the same way, communities which have not been involved in design and planning are likely to have a low level of ownership and therefore they should be brought in at these earlier stages and not just for O&M.

The existence of different tiers of planning authority vested in the federal, state, and local government systems creates difficulties with regard to norms and standards used in planning. There may also be various commissions and standing bodies of government who have developed planning norms relating to matters such as per capita water supply, public and private connections, sanitary guidelines, etc. This raises two important issues:

Planning should be demand responsive, based on user choice from locally appropriate levels of service.

The planning mechanism needs to be *demand responsive*. This means locally appropriate *levels of service* rather than the adoption of universal norms and standards on an *a priori* basis. It is not helpful to apply general classifications such as *rural, middle-income*, and the like. Levels of service should not be fixed in this manner, but be linked to the issues of *demand*, commonly expressed through user willingness-to-pay for a particular level of service, rather than just need (see Section 2.5 on the demand-responsive approach).

There is a strong case for standardization in relation to the choice of technology.

Engineering design standards relating to detailed technical design, use of materials, and construction practice are often based on local codes of practice, or in some cases national standards, and are used routinely by local engineers. Some such standards may be inappropriate, but it can be very difficult in practice to convince people to go for wholesale change within the context of a development assistance project. This is more of a problem than levels of service, where there is usually more scope to move away from the concept of planning norms. However, there may be scope for innovation through developing standard details which are appropriate for the project or programme but which are based on locally agreed standards. Also, there is a strong case for *standardization* in relation to the choice of technology, where this can simplify operation and maintenance by limiting the range of spare parts and technical expertise which need to be available. This is discussed in more detail in Section 2.7.

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1.5.1 The nature of urban WS&S

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Urban water supply, and in some circumstances urban sanitation, functions through a hierarchy of distribution (or collection) systems known as primary and secondary networks. These feed the neighbourhood-level tertiary distribution systems which are the mechanisms of service delivery. The crucially important implication of this is that the ability to deliver a particular level of service to the consumer is dependent upon the capacity of the larger secondary/primary network. Thus, in order to target improvements to the urban poor, it may be necessary to augment the city supply system, which will also benefit those outside the direct target group. Failure to appreciate and act on this can result in yet more taps with no water coming out of them. The concept and context of 'management at the lowest appropriate level' requires careful interpretation; the 'unbundling' of responsibilities can lead to piecemeal, unco-ordinated approaches.

A related issue is the extent to which it is either possible or desirable to decentralize city-wide infrastructure systems on a zonal basis. For water supply, this is related to the nature of the water resources. Groundwater in principle can be developed and supplied on a scale ranging from city-wide down to individual on-plot wells. For example, one-third of the population of Calcutta is served by street corner handpumps on tubewells. This has greatly improved access to water for the city's poorest, many of whom had previously had no choice but to use cholera-infested canals. If sewerage is the means of sanitation, it is again possible to envisage local collection and treatment rather than single, centralized facilities. The guiding factor is one of institutional capacity and capability to operate and maintain, rather than one of technical feasibility.

Harnessing community action

It is ironic that many urban poor people may be located quite close to existing service lines, but the informal and unplanned nature of the settlements frequently precludes access to services. Individuals and community groups develop coping strategies to deal with the lack of formal service provision; these are not always in a form which is recognized in the conventional planning sense. The challenge is to harness these actions through microplanning at the community level and, most importantly, to look for ways in which these plans can interact with city-level development plans.

There is a wide range of technical and management options available for planning and procuring urban infrastructure. In particular, the development of local solutions including on-site and on-plot technologies can offer both affordable and sustainable long-term solutions. For example, on-plot latrines should not necessarily be regarded as a short-term solution which is conditional on a longer term plan which includes upgrading to a sewered system.

There is good evidence to support the active role which urban poor communities can take in infrastructure procurement, for example by using community contracting. This brings in additional benefits of income generation and enterprise development.

Unbundling is a way of dividing investments and service provision into more realistic and manageable components. These separate components can be relatively independent or linked so that performance of one is dependent on that of others.

Horizontal unbundling refers to the way in which services in different areas are provided by different organizations and/or in different ways.

Vertical unbundling refers to the way in which services at different levels in a hierarchical system are provided by different suppliers, e.g. dividing water supply into bulk supply and water distribution.

Unbundling should be undertaken with caution because it generally requires good capacity and the overall co-ordination of the various components. Rebundling may be appropriate in some cases.

The Strategic Sanitation Approach to affordable services for the urban poor

The UNDP World Bank Water & Sanitation Programme has developed a theoretical basis for approaching urban sanitation problems, known as the Strategic Sanitation Approach or SSA. This approach emerged as a response to the perceived failure of the large, supply-driven investment programmes of recent decades. In particular, its underlying principles are that sanitation investments should be demand-based in operational terms, and the institutional arrangements need to be incentive-driven. The operational implications of SSA include:

- providing technical support at the community level;
- widening the technological options;
- assessing sanitation demand;
- unbundling sanitation investments to permit incremental improvements at affordable costs; and
- financing and cost recovery.

The unbundling of investments can happen in two ways.

Horizontal unbundling, in which services are subdivided geographically. In large urban areas, this form of decentralization can be based on 'command areas' in relation to natural drainage patterns. It also provides opportunities for creating competition in managing the services.

Vertical unbundling, in which programmes are divided according to the scale and cost of components, for example at the trunk, secondary, and neighbourhood levels.

Care is needed to avoid unco-ordinated and wasted resource inputs.

Incentives are required to stimulate the required behaviours from key actors. SSA suggests the development tools which can be used to create the appropriate enabling institutional environment, which must have:

- rules governing interactions within and between enterprises;
- referees who monitor and enforce compliance; and
- rewards and sanctions in relation to compliance.

The crucial component in putting these concepts into operation is that there needs to be clearly defined responsibility and capacity for overall planning at the town or city level.

At the time of writing, DFID Engineering Division's research programme is currently funding work in conjunction with the UNDP/World Bank W&S Programme in South Asia. The output from this work will be operational guidelines for SSA, available in 1999.

A.M. Wright, 'Towards a Strategic Sanitation Approach', UNDP/World Bank Water & Sanitation Programme 1997, the World Bank, Washington DC

1.5.2 The nature of rural WS&S

In rural areas the outreach of central government agencies is often very limited, and based at best on rural district centres which may be physically remote from communities in need. The situation is aggravated by differing institutional responsibilities, for example for water, sanitation, and health. Mobilizing programme support can be


WaterAid/Jim Holmes

problematic in terms of local institutional commitment, and staff are frequently reluctant to spend time at remote locations and work under very difficult conditions. The whole issue of managerial and logistical support in the field requires close attention during project identification and preparation.

In contrast to many urban situations, there is an obvious lack of physical infrastructure. There is naturally a strong reliance on local initiatives, and programmes need to build on what is already happening. People themselves are at the centre of any actions, far more obviously than in the urban sector. A key aim of local government is therefore to support the existing village level institutions, as these are likely to offer the most effective means of sustaining any new facilities.

Where effective and accountable village institutions do not exist, the task of creating and nurturing them is essential for sustainable community infrastructure, and should not be underestimated.

The VLOM Approach reflects the importance of maintenance for sustainable rural WS&S.

Operation and maintenance considerations predominate in the planning and implementation of rural water and sanitation programmes. The more traditional system of centralized maintenance, using teams of trained technicians who travel out from a depot in order to inspect and repair facilities, has been largely ineffective. From the start of the water and sanitation Decade, attention has been devoted to ‘Village Level Operation and Maintenance Management’ — known as VLOM. Routine inspections and minor repairs are carried out by trained people from the community, and the concept of ‘community management’ is virtually interchangeable with VLOM in rural areas. There still needs to be an additional mechanism for reporting and repairing major faults. Most rural programmes now focus on VLOM, implying:


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- the use of local resources;
- solutions based on local capacity and technical capability; and
- solutions which are sustainable through local human and financial resources.

1.5.3 Priority issues

The list of common principles gets longer every year, and it forms the basis for Chapter 2. It is worthwhile, though, to consider some generic themes which should guide the approach to any future WS&S project analysis.

The challenge is to make the components work together coherently.

Integration is one such theme. The challenge is not just to set up multi-component programmes, but to make the components work together coherently, so that the whole is greater than the sum of the parts. It is a particular challenge when combined with decentralization and management at the lowest appropriate level (two of the common principles). On the other hand, the integrated approach is an intuitive one for communities, who live on a daily basis with the links which are at the heart of it.

Partnerships are the driving force of sustainability.

Partnership is the next theme. Embracing the political, governmental, and civil groups in society in relationships which are inclusive and dynamic is the driving force for developing sustainable programmes. There is a wide range of stakeholders who can contribute to WS&S programme development. Some may need to be motivated and equipped through capacity-building programmes if they are to contribute their full potential. (For example, training and credit facilities for private low-cost drilling contractors can speed up implementation and reduce the costs of community borehole programmes).

In addition to these themes, the evidence has been accumulating for many years now that there are two important focus areas which need priority attention.

Sanitation is the first priority.

Sanitation is the first. National governments and the international community have continued to ignore the clamour from sector professionals for increased attention to sanitation for far too long. The situation has been described as ‘shameful’ and correcting it is now a global imperative (Richard Jolly, Chairman of the WSSCC at its conference in Manila in 1997). Change will require political commitment and diversion of resources and it will take time to achieve demonstrable results, but the longer it is delayed the worse the crisis will become and the harder it will be for the poor to escape the squalor and indignity they now endure.

Complexity is not an excuse for inaction to improve services to the urban poor.

The urban poor make up the next focus area. The sheer complexity of the urban and peri-urban scene can be an excuse for not getting involved. It must not be so. Investments in improved basic WS&S services can have a major impact on health and quality of life in the squatter settlements. They can also be the trigger for income generation and hence poverty alleviation. Failure to invest would mean further degradation of soil and water resources and the living environment, and a continuing brake on social and economic development.

1.6 The programme and project process

The White Paper on International Development emphasizes the partnership approach as the basis of UK co-operation in all development sectors. The other key element is the focus on poverty eradication. The identification and development of WS&S projects and programmes will emerge from the partnership approach and that approach will continue throughout the project cycle.

1.6.1 Building partnerships

In implementing UK Government policy on international development, DFID will work closely with other donors and development agencies to build partnerships with developing countries. In establishing these partnerships, the aim will be to strengthen the commitment to eliminate poverty and to mobilize the political will to achieve international development targets.

Long-term partnerships, negotiation, and compromise — UNICEF WS&S programmes in India

UNICEF has been working continuously in WS&S in India since 1966. It has established long-term partnerships with both central and state governments, with much greater influence than its share of expenditure in the sector. An evaluation found that it had made a major contribution in policy, design, and standards at the national level, by supporting innovative elements and pioneering approaches in both national and state programmes. UNICEF have supported, for example, a range of options for hygienic latrines, and promotion of sanitation through shops and demonstration sites; new hardware (for example India Mark II and Mark III handpumps); work on information, education, and communication; the involvement of NGOs; and the integration of hygiene, sanitation, and water supply.

UNICEF also provided long-term partial funding with cash or material supplies for established government programmes, and the evaluation found that these gave legitimacy to UNICEF and its efforts to get innovative ideas incorporated into government programmes. Without this financial commitment, UNICEF might not have had any influence in the on-going programmes. Inconsistencies were identified, however, between policies UNICEF was promoting centrally (for example elimination of subsidies for household latrines) and programmes it was supporting at state level (which still included latrine subsidies for the poor). This is understandable in the context of a long-term relationship, which provides support to partners while also advocating a change of policy, and government representatives compared this approach to partnership favourably with that of other donors. Weaknesses were also identified in the standard of delivery of the programmes at village level by the state government partner, which reduced the effectiveness and impact of the programmes.

Overall it is notable that UNICEF had a significant influence on national rural water supply and sanitation policy, while contributing only 1 per cent of the investment.

Smout et al., 1997

In pursuing its aim of eliminating poverty in poorer countries, DFID will work in partnership with developing countries, multilateral agencies and the private and voluntary sectors.

Programmes will be developed to pursue these targets in co-operation with poorer countries which are committed to achieving them. DFID also intends to work closely with the UK private and voluntary sectors and the research community in pursuit of the agreed targets. New ways of working together with these UK partners are being put in place. Among the targets is the goal to halve the proportion of the world's population living in extreme poverty by the year 2015, and the UK Government wants to measure the effectiveness of its own efforts, alongside others, in relation to this and other targets.

The approach is to be promoted through UK involvement in multilateral development assistance and in the bilateral programme through 'development partnerships'. Among the criteria for embarking on these long-term partnerships, involving all types of assistance, are that partner countries will be low-income and contain a large proportion of poor people. They will also be countries where the UK is wanted as a partner, has the influence to play a positive role, and has a comparative advantage in being able to make a strategic contribution to poverty reduction.

Previous experience of partnerships for WS&S development may have some lessons. The example of UNICEF in India (see box left) shows slow but significant influence on policy over the medium term, which could be seen as the result of mutual respect and understanding developed through technical assistance and support for partners' programmes. In such circumstances policy and institutional reform may be one of the outcomes from WS&S programmes followed over a period of working in partnership, rather than a pre-condition for partnership in the first place.

Partnership is not easy — careful negotiation and compromise may be required.

The issue of ownership is also important here. Whose programme is it? The partnership approach and concern for sustainability suggest that the programme should clearly be the host government's, supported by DFID and other external support agencies. Practice is more difficult. There may be several programme partners within the host government, and possible competition or differences in interest among them. Also where DFID-contracted staff or consultants have a major technical co-operation role, there is a danger that they (and DFID) may come to be seen as leading the programme. These issues require careful attention, at the outset and throughout the programme. The Gomti Project (see box below) describes some of the pitfalls and suggests ways of avoiding them.

1.6.2 Poverty eradication

DFID (1998c) has adopted a Poverty Aim Marker (PAM) in its Policy Information Marker System (PIMS). This identifies three types of action against poverty:

Focused, inclusive and enabling actions against poverty

- *Actions **focused** predominantly on the rights, interests, and needs of poor people.* An example might be where a project's benefits are targeted on low-income households, by restricting its scope to deprived rural regions, or to slums and informal urban settlements.
- ***Inclusive*** broad-based actions which improve opportunities and services generally, and also address issues of equity and barriers to participation of poor people. An example might be a project to

The Gomti River Pollution Control Project at Lucknow — Phase 1

The Gomti project originated in the DFID-supported Ganga Action Plan, which was primarily concerned with river water quality. It included the previous government partner and engineering consultant on a new project with an additional objective — improved cleanliness of the city of Lucknow — and a new management structure — a Project Management Unit. The main difficulties included partners' different objectives and different communication and decision-making channels, and a lack of focus on the agreed features of the new Gomti project. Another partnership issue was that DFID and state government had different expectations as far as preliminary studies were concerned. Misunderstandings and frictions contributed to poor project progress, and failure to proceed to Phase 2 as planned.


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support reform of a utility to improve its overall performance, but also to help it provide better services to low-income consumers, for instance through reform of tariff structure to allow cross-subsidy from high-income to low-income consumers, and through provision of more public standposts.

- ***Enabling*** actions, which support the policies and context for poverty reduction and elimination. An example might be a project to develop a national policy framework for water supply, which aims for higher levels of cost recovery overall and a more transparent use of public subsidy to be targeted on improving water services for poor people.

1.6.3 Types of DFID assistance

The type of assistance which may be provided within partnerships includes both the conventional capital aid (financial support for specific projects or activities) and technical co-operation (transfer of skills). There is also the option to provide resources more strategically in support of sector-wide programmes. In WS&S, these types of assistance may be managed through longer term development assistance programmes, possibly following a multi-donor Sector-Wide Approach (SWAp), or a Sector Investment Programme (SIP).

The following description of the SWAp process is taken from *A Guide to Sector-Wide Approaches for Health Development*, WHO, 1997, by Andrew Cassells.

Sector-wide approaches involve medium-term programmes of work based on joint commitment to shared goals.

‘Sector-wide approaches will only succeed if there is sufficient commitment to shared goals on the part of government and key players in the donor community. Also, in unstable macro-economic conditions, no form of development assistance is likely to produce sustainable benefits. Sectoral programmes therefore depend on sound macro-economic policies and the need to form part of an overall public expenditure framework.

‘At the heart of the sector-wide approach is a medium-term collaborative programme of work concerned with the development of sectoral policies and strategies; projections of resource availability and expenditure plans; the establishment of management systems by governments *and* donors to facilitate the phased introduction of common management arrangements; and institutional reform and capacity building, in line with agreed policies. In addition, structures and processes need to be established for negotiating strategic and management issues, and reviewing sectoral performance against jointly agreed milestones and targets.

Implications

- ‘The most fundamental change is that some donors will give up the right to select which projects to finance, in exchange for having a voice in the process of developing sectoral strategy and allocating resources. For these donors, becoming a recognized stakeholder in negotiating how resources are spent replaces project planning, and joint reviews of sectoral performance replace evaluation of discrete projects.

- 'In many countries, there is no clear policy or strategic framework, budgets do not reflect spending priorities, and management systems are insufficiently developed to allow for common management arrangements. However, the components of the programme of work are defined in terms of *development objectives* — setting out what is to be achieved over time, rather than as a set of *prerequisites* which have to be in place before the form or volume of external investment can change.
- 'Components of the programme of work need to be implemented at a pace which is appropriate to the country concerned, and in line with local priorities. As confidence in both policies and management systems grows, a wider group of donors will use national systems for disbursing funds — thereby decreasing the reliance on separate projects. In the interim, project support must be consistent with agreed policies and strategies.
- 'Defining SWAps in terms of intent rather than eligibility does not preclude donors from identifying the steps needed to overcome key constraints to effective sectoral performance. Necessary actions will form part of the agreed programme of work, rather than being imposed as unilateral conditionalities.
- 'Involvement in sector-wide approaches will require that donors review the appropriateness of the forms, channels, and systems that they currently use to provide development assistance. However, it is important not to equate the attributes of a sector-wide approach with the specific characteristics of the aid instruments used to finance it.'

Sector Investment Programmes are similar to SWAps and emphasise strong partnerships and local leadership.

The SIP is very similar in approach. The World Bank has identified the six 'essential features' of a genuine SIP:

- It is 'sector-wide' in scope and covers both current and capital expenditures.
- It is based on a clear sector strategy and policy framework.
- Local stakeholders (meaning governments, direct beneficiaries, NGOs, and private sector representatives) are fully in charge.
- All main donors sign on to the approach and participate in its financing.
- Implementation arrangements should to the extent possible be common to all donors.
- Local capacity, rather than long-term technical assistance, should be relied upon as much as possible.

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1.6.4 The process approach

WS&S projects will follow a flexible process approach rather than a fixed blueprint.

Individual WS&S projects are likely to follow the process rather than the blueprint approach. Process projects have agreed objectives, but the exact modalities for achieving these may at the outset be unknown and unknowable. As described in DFID Technical Note No.4, implementation takes place in successive, defined, stages and future stages are planned in the light of the outcome of initial interventions. Instead of defining in the initial Project Memorandum the activities and outputs necessary to achieve the objectives, the process of identifying them is specified. This is usually done on an annual basis with the setting of milestones, and the annual work programmes may then include conventional inputs and outputs. Process projects are therefore subject to more regular, thorough, reviews than conventional projects, with greater scope for radical changes in project design (ODA, 1996a).

The logframe as a live management tool

The annual review cycle should be seen as an opportunity for constructive learning and planning, rather than as a policing exercise. It was found on the Gomti project in India that the logical framework could be useful here as a live management tool. This needs to be agreed with project partners, however, with the involvement of both primary and secondary stakeholders. There is a related need for regular review and planning workshops or events throughout the programme and project cycle, but particularly early on in the life of the programme, to foster commitment to agreed objectives. Again, these can include a review of the programme's logical framework.

1.6.5 Developing the WS&S programme

Programmes are the outcome of partnerships, and can be seen as a series of projects, covering an extended time period.

Many factors influence the formulation of programmes and projects, and their progress.

Programmes and projects emerge from interaction between stakeholders and external support agencies. There are milestones in the process, but the route is only loosely defined and relies on the judgement of the individuals involved, among partners and within DFID. The resulting project may then reflect the professional and personal interests of these individuals. Progress also depends on their skills and power as project champions to find solutions to the various problems which arise, and on the skills and power of other people with differing views on the proposed programme or project. These differences of opinion occur within host governments and within external support agencies, as well as between them.

Project proposals often have a history, and it is important to recognize this. Some have been around in one form or another for many years. Similarly the stakeholders involved will have a past relationship with each other and a record of work which may have a strong influence on what they will be able to do in the future. It is unrealistic to assume that projects start with a blank sheet, and important to recognize the difficulties in introducing change.

The starting point is likely to be an analysis of existing WS&S policy and the identification of constraints.

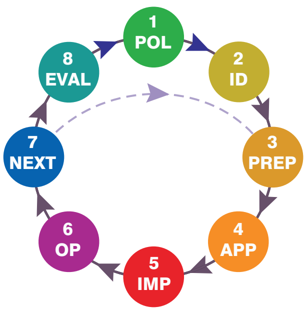
For future DFID programmes and projects the starting point is likely to be an analysis of existing WS&S policy in the country and the identification of constraints on reaching the poor with WS&S services, coupled with studies of people's current practices and their views on options for the future. The negotiation of partnerships will probably entail compromise on some issues, and difficult decisions on whether differences in approach make partnership impossible.


DFID

Before going further it is important to ensure political agreement to the basic principles or strategic framework required for meeting the conditions of success. If there are to be some fundamental changes in the way key institutions operate in the sector (e.g. much higher levels of cost recovery, greater responsiveness to users' demands, more participatory planning and management, privatization) it will be important from the outset to have strong political commitment to change, and agreement on what the financial targets should be.

The complexities and interlinkages of WS&S could make it difficult to get through this prior stage, which would be regrettable and frustrate the political commitment to a substantial increase in spending in WS&S. Policy-focused projects and process projects seem to provide a way of travelling forward, learning, and strengthening a partnership and then clarifying the route and endpoint during the project itself.

In this case, a key step may be developing agreement among the key stakeholders (donors, local government, utility, representatives of the poor and of other users, etc.) on the purpose of a specific programme or project.



1.6.6 Managing the project cycle

The DFID project cycle (see Section 1.1) is the basis for the guidance in this manual. The cycle is described in more detail in the DFID Office Instructions (ODA, 1996c), and is considered here as comprising eight elements:

1. Policy development, sector planning, and programme formulation
2. Programme and project identification
3. Programme and project preparation
4. Programme and project appraisal and approval
5. Implementation and monitoring
6. Operation and monitoring
7. Extensions or Next phase programme and project identification
8. Evaluation

To keep a continuing and consistent check on progress and the achievement of project objectives, the logical framework (logframe) is used in various forms by most external support agencies, including DFID and the EU, though not the World Bank. It provides a systematic way of developing and presenting the rationale of a project and its key features.

1.6.7 The project framework and the project cycle

The diagram illustrates the conventional use of the logframe during the project cycle, with a shifting focus from the *Goal* and the *Purpose* at Project Identification stage, to the *Outputs* and the *Activities* during the stages from Project Preparation/Design to Project Completion, reverting then to the Goal, Purpose, and Outputs at the Evaluation stage. Note however that DFID practice is now to retain a focus on the Purpose throughout the project cycle, and this is particularly important for the process approach to projects which is now being followed.

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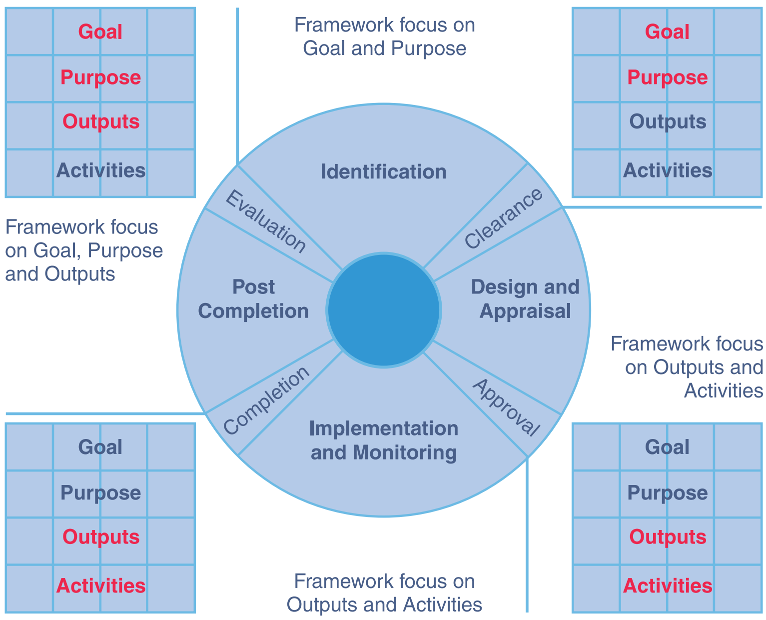

Figure 1.6.1. The project framework in the project cycle

Considering DFID's overall Aim and Objectives, a reasonable *Goal* for DFID WS&S programmes and projects would be:

'A sustainable improvement in health and well-being for poor people'

Suggested *Purposes* for WS&S projects

Depending on the existing constraints to improvement, individual programmes or projects to achieve this goal might include such *Purposes* as:

- Establishment of sound, sustainable environmental services for N000 poor people in water supply, sanitation, and hygiene promotion
- Expansion of coverage (to N% of the poor urban population in X town or city or N% of the rural population in Y district or region) with adequate, safe, and conveniently located domestic water supplies they are willing to use, at prices they are willing to pay

- Expansion of coverage (to N% of the poor urban population in X town or city) with appropriate household sanitation (and possibly wastewater disposal and solid waste disposal services) at prices they are willing to pay
- Expansion of coverage (to N% of the rural population in Y district or region) with appropriate household sanitation
- Development of safer water, sanitation, and hygiene practices among N000 poor people in X town or city or Y district or region
- Increased involvement of N000 primary stakeholders (including marginalized groups) in decision-making and management of water supply and sanitation and other services
- Provision and utilisation of improved, community-based and sustainable water and sanitation services and hygiene practices in (x) project villages, with successful approaches disseminated outside the area.

Improved performance of institutions is often required to achieve the project purpose, which necessitates institutional development of some kind. This is particularly true where there are concerns about operation and maintenance, cost recovery and sustainability. When developing a logframe, it is then necessary to have institutional development components at the output level such as:

- cost recovery system developed, agreed and functioning;
- HRD plan developed, agreed and implemented; and
- management development programme designed, agreed and implemented.

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Chapter 2

Principles and practices

WaterAid/Jim Holmes

Improved water supplies, adequate sanitation facilities, and hygienic behaviour are all vital and interlocking elements in the water supply and sanitation sector. Investment in one element without complementary efforts in the others carries a strong risk that health benefits will not be achieved.

The poor face the greatest risk from faecal-oral disease transmission. It follows that sanitation and hygiene promotion activities have to accompany all poverty-focused water supply interventions (recognizing that there is a tension when participatory studies reveal a strong user priority for water supply only).

2.1 Key issues and interlinkages

In keeping with the aim of this manual to promote and facilitate an interdisciplinary approach to WS&S, the *Principles* and *Practices* of WS&S programmes and projects are described in Sections 2.2 to 2.8 from seven different perspectives:

- Section 2.2 Social development
- Section 2.3 Health
- Section 2.4 Environmental sustainability
- Section 2.5 Economic and financial
- Section 2.6 Institutional
- Section 2.7 Technical
- Section 2.8 A social marketing approach to hygiene promotion and sanitation promotion

First it is helpful to look at a number of key issues which apply to several — in some cases all — of those perspectives.

2.1.1 Water supply, sanitation, and hygiene promotion as a coherent sector

The WS&S sector has been described in Chapter 1, and it is important to consider the sector as a whole. But in what sense do water supply, sanitation, and their promotion constitute a coherent sector? Why do sector professionals insist on considering these issues simultaneously, even where implementation often reflects a higher priority for one component than another? The history of the industrialized world and current experience in developing countries do *not* show the individual elements to be inextricably linked in the minds of the general public. They will almost always see water supply as the highest priority.

There are several good reasons for considering WS&S as a sector:

- **Health aspects** The main health benefits of improved water supply lie in the reduction of faecal-oral diseases, as described in Section 2.3. But faecal-oral diseases are spread through a multitude of routes, most of which are best controlled through improved sanitation and hygiene promotion. If water supply is intended to improve health, it is critical that efforts to control this single route of disease transmission are linked with control of the many others


WaterAid/Jenny Matthews


WaterAid/Jim Holmes

through basic sanitation and hygiene promotion. The simple logic of public health also suggests keeping drinking water clean by isolating human wastes through sanitation.

- **Technical aspects** The widespread historical experience of piping water into homes without sufficient attention to what subsequently happens to the wastewater has taught sector professionals that they need to consider both simultaneously. Environmental sanitation becomes the mirror image of water supply, particularly where water-borne sanitation is adopted.
- **Behavioural aspects** Throughout both the industrialized and the developing world, governments have seen the need to 'sell' the services together. Where sanitation is effected through sewerage, the costs may be viewed logically as a consequence of water piped to the home. It is then easier to capture willingness-to-pay for water to recover the costs of sewerage too.

  The need to consider *promotion* as a necessary accompaniment to the provision of water and sanitation hardware also stems from behavioural experience. It is the *use* of hardware that changes the quality of people's lives, not its mere construction/installation; supplying hardware that people do not want is a waste of both time and scarce resources. The bitter experience of so many projects in the 1980s where newly installed facilities were not always being used — led to promotion being established as the third component of the sector.

Participatory approaches may reveal a much stronger demand for water than for sanitation. So, in the short term, it may seem expedient to address only the water supply side of WS&S. This should be resisted in a poverty-focused project, unless for some exceptional reason the reduction of faecal-oral diseases is unimportant for the project. After fifty years of learning lessons in the sector, the need to link water, sanitation, and hygiene promotion has become clear to those who have seen what happens when they are dealt with in isolation.

Safeguarding community water supplies (quantity and quality) depends on an effective *integrated* approach to the management of national and regional water resources. World leaders have endorsed the concept of integrated water resources management (IWRM), most notably at the 1992 Earth Summit in Rio de Janeiro. In practice though, there is a danger that irrigation, industry and, latterly, ecological interests dominate IWRM thinking, with the WS&S sector sidelined.

2.1.2 Integrated water resource management

All the agenda-setting international meetings of recent years (New Delhi, Dublin, Rio, Noordwijk) have led their recommendations by urging the adoption of sector strategies based on integrated water resources management (IWRM). The latest recommendations of the Commission on Sustainable Development, CSD6, continue to urge governments to accelerate moves to implement IWRM strategies. In the case of WS&S, that means integrating demand forecasts into national plans for allocating water resources nationally; it means ensuring that proposals for sanitation and sewerage improvements are consistent with national strategies for water conservation and pollution prevention; it means institutional linkages to ensure compliance with river quality objectives and other environmental standards; and it means a role for communities in catchment stewardship as well as the local focus of WS&S improvements. The implications pervade many of the topics discussed in later sections of Chapter 2 and particularly Sections 2.4 (Environmental sustainability), 2.5 (Economic and financial perspectives), and 2.6 (Institutional perspectives).

2.1.3 Sustainability, effectiveness, equity, efficiency, and replicability

Since the Rio Earth Summit, *sustainability* has been a prime criterion in development projects. Historically, the WS&S sector did not have a good record in achieving sustainable projects. Many broke down or fell into disuse once the external support came to an end. The participatory approach, more appropriate technology choice, better provision for access to spare parts, and the equipping of communities for operation and maintenance and financial management have led to significant improvements in recent years.

In WS&S programmes targeted at the poor, sustainability is linked to four more success criteria: *effectiveness; equity; efficiency;* and *replicability*

These concepts are linked together and need to be considered as a package of issues, most importantly at sector-policy level, but also in the planning and design of any project. There are tensions: financial sustainability typically means charging users for services, but equity emphasizes keeping charges to poor people affordable, which may require public subsidy and which will restrict replicability, as subsidies are limited.

Reaching a compromise between these conflicting objectives is a political process. DFID should encourage stakeholders to conduct this process in a transparent manner, making certain that decision-makers are well-informed of the results of sound analysis, for instance on levels of subsidy and cost recovery; on what people currently pay and are willing to pay; and on the costs and benefits of alternative options/ levels of service and pricing regimes. DFID's primary objective should be to resolve these issues in a way which provides sustainable and affordable basic services to the maximum number of poor people.

Sustainability

Sustainability has become the top item on many development agendas since the Earth Summit, and rightly so. In sectoral terms, aiming for sustainability means ensuring that WS&S services and interventions continue to operate satisfactorily and generate benefits over their planned life. In broader terms, it means ensuring that WS&S project interventions support, rather than threaten, overall environmental sustainability.

Sustainability has environmental, institutional, financial, technical, and social dimensions which are considered in the corresponding sections of Chapter 2. Fundamentally, it is about the operation and maintenance of installed facilities, but it has to be considered from the very start of a project, to ensure that the prerequisites for long-term sustainability are in place. Strategies most likely to contribute to the improved sustainability of WS&S programmes and projects incorporate activities which ensure that the services provided reflect the true demand, that the benefits are optimized, and hence that users appreciate the value of the services. Those activities include:

- Mobilizing and facilitating the active participation of both women and men in decision-making around technology choice, siting, O&M, and management processes.
- Taking culture and context into account and understanding local priorities and preferences for WS&S, as well as formal and informal power structures and institutions.

- Establishing an institutional framework which aims to provide the levels of service that different sections of society want and will use and pay for at the prices to be charged.
- Setting charges for services at levels which will generate sufficient income to cover the operation, maintenance, and replacement (i.e capital) costs of infrastructure, and ensuring timely collection of revenues due.
- Ensuring that if subsidies are used, they relate to capital costs, with O&M costs recovered in full from users.
- Enhancing hygiene promotion programmes, which focus in turn on men, women, and children, to stimulate demand for and use and care of improved water supply, sanitation, and waste disposal facilities.
- Ensuring that the technical, institutional, and budgetary needs of consultation and decision-making are catered for in the planning, design, and implementation phases.
- Matching capital investment with both information sharing and capacity building at community level and corresponding training and career development programmes for O&M staff, technicians, mechanics, and caretakers.
- Encouraging and equipping local water associations and water committees to manage community WS&S systems, with technical backup where required.
- Establishing preventive maintenance schedules, leak detection programmes, and regular quality surveillance, with formal reporting and follow-up procedures.
- Making optimum use of existing retail outlets and distribution channels, strengthened where necessary, to assure the accessibility of spare parts, tools, and materials for the operation and repair of WS&S facilities.
- Enabling private sector agencies to offer support services where these can be provided more effectively than through public utilities.
- Using demand management measures, including tariff structures, to encourage water conservation and minimize waste.
- Ensuring the continuing availability of a safe and adequate supply of water, and protecting the environment against adverse impacts from wastes, by following integrated water resource management principles.

By measuring *effectiveness*, the concept of sustainability is extended to ensure that improved water and sanitation systems deliver the anticipated benefits to the intended people. That means coupling hardware projects with hygiene promotion, and ensuring that all sections of the community have access to affordable and reliable services.

Effectiveness

Effectiveness is the degree to which WS&S services and interventions meet their objectives. In the case of DFID programmes, that implies that WS&S reaches poor people and that poor people use the services (see Sections 2.2 and 2.7), that facilities and services are integrated as required to deliver benefits (as described in Sections 2.3 and 2.8 for health benefits), and are kept in good operating condition (Sections 2.6 and 2.7).

This last point is also related to *equity*. Too many WS&S projects benefit the better off and further marginalize the poor. Subsidies enable higher income users to use more water, while the poor still cannot afford basic services. Women often have the burden of paying for, as well as carrying, the water. It is vital that charging systems and choices of service levels are designed to enable women to obtain and pay for convenient water supplies, and to invest in improved sanitation systems. It is quite possible to do so without abandoning the concept of water as an economic good or the principle that the full costs of WS&S services should be recovered from users.

The huge numbers of people who lack access to safe water and hygienic sanitation will only be served when investment *efficiency* is related to the number of people served for every thousand dollars invested. Right now, too high a proportion of government and donor finance is directed towards high-cost projects serving urban élites. Even then, far too much water is wasted through leakage, inadequate billing, or illicit connections. Cutting unaccounted-for water needs to be an element of WS&S programmes.

A crucial requirement for effectiveness is that programmes and projects are designed from the start in an interdisciplinary way, so that all the necessary components from the various disciplines are integrated into the programme. Without this co-operation, early decisions may preclude some important options being included later, leaving inadequate preparation time for preparatory activities such as data collection on existing practices and views, and training of hygiene promoters.

Equity

Current provision of WS&S often fails to reach the poor and other disadvantaged groups. Frequently it also fails to take account of the particular needs of women, children, old people, the sick, and people with a disability. Reaching these groups involves both practical concerns (for example design issues which are considered in Section 2.7) and strategic issues of status, power, pay, etc. (see Sections 2.2 and 2.6). Gender issues in particular are *crucial* for the success of WS&S programmes, therefore gender perspectives pervade all the sections.

The real needs and potential contributions of disadvantaged groups and presently unserved populations must be reflected in programme planning, through an appropriate institutional framework.

Equity issues also arise when new approaches require communities to pay when their neighbours or urban/rural counterparts previously have not (see Section 2.5). The level of contribution of the poor is a particular concern in situations where middle/high-income users in the locality are paying tariffs which are well below the cost of WS&S. Equity objectives may require mechanisms, such as targeted subsidy or cross subsidy, to ensure that the prices that poor people pay for basic services are affordable, even where the overall thrust of sector policy is towards charging users the full costs of services provided.

Efficiency

Efficiency represents the output produced per unit of resources (water, staff, funds) and shortages of resources imply that high efficiencies will be needed to meet the gap in WS&S coverage. Past WS&S projects have been inefficient in a variety of ways. In coverage terms, the focus on high-cost projects serving urban élites has severely restricted the number of people served per unit invested; neglect of sanitation and hygiene education has reduced benefits from water schemes; and poor operation and maintenance has led to high water losses and low cost recovery. Efficiency issues are considered in Sections 2.5 and 2.7.

Replicability and transferability

The immediate challenge is to enable poor people to have access to WS&S. This means keeping basic services for poor people affordable, while aiming to recover a high proportion of capital and recurrent costs from users. Available public subsidy can then be used effectively to extend services to as many people as possible. National

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The last extension of the 'sustainability' criterion is *replicability*. So many projects and programmes are necessary to combat the appalling backlog of inadequate WS&S services, that replicability (and extendability and transferability) needs to be a key consideration in the design of all individual projects. High levels of subsidy, institutional complexity, and dependence on long-term external support are all factors which make programmes hard to replicate.

Local manufacture, community management, skills development, and standardization of hardware and spare parts all contribute to replicability.

The water supply service level which can be provided ranges from a communal handpump shared by more than 100 users to a house connection giving 24hr individual service. Sanitation may be a simple pit latrine or a flush toilet connected to a sewer system or septic tank.

The distant handpump may be seen as a 'basic' service level, but it should not be assumed that this will be the preference of all poor people. Yardtaps provide a more convenient supply than handpumps or public standposts and this may be reflected in the willingness

and international efforts in the 1980s and 1990s have improved coverage, but much remains to be done (Section 1.3). In addition, population growth, increased urbanization, and aspirations for better WS&S levels of service, will necessitate continued expansion of WS&S services for the foreseeable future.

Therefore it is essential that services and interventions can be replicated to provide this expansion. Services which are heavily subsidized, or not replicable for other reasons, fail to address the challenge of coverage, and may make it more difficult by establishing unrealistic expectations or standards.

Replicability should not imply rigidity. The model needs to be flexible to meet demand for improved levels of service. Section 2.7 describes technical replicability through standardization of a range of designs from which choices can be made (handpump standardization is an example). Similarly, approaches to tariffs and to hygiene promotion are described in Sections 2.5 and 2.8. The empowerment of community motivators to spread best practices features in Section 2.2.

An important consequence of the focus on replicability is that external support agencies accept the national approaches and standards, rather than insisting on their own. A focus on transferability highlights the fact that technologies as well as development processes may need to be adapted to local contexts and conditions, rather than simply replicated. DFID is addressing this through the concept of partnership (see Section 1.5).

2.1.4 Levels of service

Levels of service can be expressed in technical design terms (for example, for sanitation, a simple pit latrine, a pour-flush latrine, or piped sewerage; or for water supply, the quantity and quality of water available within a given distance), or in performance terms (for example with a stipulated measure of reliability). Typical levels of service are shown in Table 2.1.1.

It may well be that a range of levels of service are available, and it is clear that people have strong views on these, particularly where they are asked to pay for the service (see Section 2.5). This is reasonable enough, as the levels of service differ in terms of convenience and health benefits as well as cost.

Technical departments often start with particular ideas about what level of service may be appropriate for a given community, but under a demand-responsive approach these need to be put to one side, and instead a wide range of technically feasible options explored with the primary and secondary stakeholders.

Basic needs for public health

A minimum level of service is vital to meet people's basic needs for water for drinking, washing, and cooking, and for disposal of excreta and other wastes in a manner which is safe for them and the wider community. The sustainability of this basic-needs level of service

Table 2.1.1 Typical levels of service providing access to safe water supply and sanitation in rural and urban areas

Level of service	Water supply	Sullage disposal	Sanitation
(Deficient)	(Water source unsafe or inadequate or return travel time more than 30 minutes)		(Open defecation OR dirty communal latrine)
Minimum	Communal point source with safe and adequate water and appropriate drainage, return travel time less than 30 minutes	Soakaway or other drainage at public waterpoint. Some sullage disposal at household level on plot or onto field, or, in urban areas, gutter or open or covered sullage channel	Simple pit latrine on householder's plot
Intermediate	Point source on household plot with safe and adequate water supply (usually metered) and appropriate drainage	Soakaway on plot OR open or covered drain from plot to safe disposal; connecting channels within plot (made by householder)	Improved pit latrine or pour-flush toilet on householder's plot
High	Piped connection (usually metered) into house with safe and adequate water under continuous pressure	Open drain to safe disposal OR pipe to septic tank or sewerage	Flush toilet with septic tank OR sewerage (if water supply is sufficient)

1. Point sources include collection from handpumps, open wells, standposts/ tapstands, roof catchment, protected springs and ponds, and purchase from water vendors.
2. Return travel time includes queuing time (see Section 2.3).
3. Sullage comprises all used water, excluding toilet wastes.
4. Improved pit latrines include sealed lid, VIP, and pour-flush pit latrines.
5. Safe water does not represent a health hazard to the users (see Section 2.3).
6. Adequate water means sufficient to meet users' demands at the waterpoint, and may be intermittent or continuous supply.

of users to pay more for the increased level of service. However, designs and charges need to reflect the need to dispose of the extra water used, including safe disposal of sullage.


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depends on users' willingness-to-pay the recurrent costs, or failing that, the government's willingness to subsidize the service over the medium term. In some circumstances neither poor users nor the government will pay. Further work is then needed to establish conditions for sustainability (possibly focusing on policy and institutions, maybe including cross-subsidy from richer or industrial consumers), or to identify a different (possibly higher) level of service which would be sustainable because users would be willing to pay for it.

Convenience

Higher levels of service are often desired for convenience, and people may be willing to pay for this, especially if the effective tariffs are no higher — this may happen for example with an intermediate level of service (a yardtap) where they are purchasing water themselves instead of through a vendor at a standpost. See Sections 2.5 on willingness-to-pay and 2.7 for examples of costs. In addition, higher levels of service can provide the conditions for greater health benefits (see Section 2.3). Therefore programmes should aim to provide people with the option of choosing a higher level of service, or

'Appropriate technology' may not be acceptable

Women do not always welcome 'appropriate technology' which has the approval of engineers. An example of this was from the Yucatan Peninsula of Mexico, where pit latrines had been recommended by an engineer who was normally well attuned to social considerations. Yucatan women did not want pit latrines — they wanted a flush latrine which they thought was more modern and convenient. Instead of assuming that we know what people want we should listen to them and find out what they really want and why.

Bingham, World Water, 1984

upgrading to a higher level in the future. The technical issues of designing communal systems taking account of individual choices and willingness-to-pay are discussed in Section 2.7.

2.1.5 Affordability, tariffs, cost recovery

The issue of water pricing and cost recovery is complex and is dealt with in considerable detail in Sections 2.5 and 2.6. The big challenge is to enable the poor to obtain basic services at an affordable price while still achieving the full cost recovery needed for sustainability. In fact, the evidence is that poor people's willingness-to-pay for improved water services is quite high (many already pay high prices to water vendors for unsatisfactory supplies). On the other hand, willingness-to-pay for sanitation facilities depends on promotion and motivation.

Without adequate cost recovery, WS&S services will not be sustainable or replicable. The concept of water as an economic good is gaining currency, but it has to be read with the condition which was attached to it at the Dublin Conference: *'within this principle it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price'*. This basic right is open to different interpretations. For this *Guidance Manual* it is the right to a minimum level of service, for water supply, sullage disposal, and sanitation, as described in Table 2.1.1. The affordable price should be interpreted on a case-by-case basis, as described in Section 2.5, taking account of:

1. recurrent costs (which should usually be recovered in full, to facilitate sustainability);
2. capital costs (in both financial terms, based on depreciation and interest costs, and in economic terms, reflecting the long-run marginal cost of new services);
3. users' willingness-to-pay for the service;
4. users' poverty; and
5. subsidy policy, (including on cross-subsidy opportunities) and the likelihood that a higher degree of cost recovery may allow available public subsidy to be used to extend coverage and meet the 'basic rights' of a larger number of poor people.

Safeguarding the poor from hardline economic approaches, while pursuing the objective of full cost recovery, is a major challenge for all countries (see Section 2.2). Tariff structures and subsidy policy are discussed in Section 2.5, and cost recovery arrangements in Section 2.6.

2.1.6 Stakeholder participation

Community participation has been accepted as a principle for many years. In the WS&S sector, and particularly where DFID is concerned, decision-making needs to involve all stakeholders as partners. And participation goes beyond the involvement of communities in decision-

DFID is committed to the participation of primary and secondary stakeholders and to ensuring that their perspectives and knowledge are incorporated in any development. The full involvement of users in decision-making is of special importance in WS&S services.

making. It is the *empowerment* of communities to manage and control their own affairs which can have the greatest impact on poverty and equity goals.

Participation may occur in project planning, environmental assessment, monitoring, O&M, and evaluation. Participation may affect effectiveness and efficiency goals. But DFID's approach is also concerned with participation as a process of empowerment, promoting equity, and the sustained concern and involvement of primary stakeholders with their living environment.

These issues are discussed in Section 2.2, with detailed recommendations in Chapter 3 for each stage in the project cycle.

A related issue is the devolution of management responsibilities to the lowest appropriate level — a principle endorsed in Agenda 21 (see Section 2.6).

2.1.7 Operation and maintenance, and community management

Community management is also the key to improved operation and maintenance, particularly in rural areas.

Operation and maintenance (O&M) is a crucial element of sustainability, and a frequent cause of failure of WS&S facilities in the past. Many failures are not technical ones. They may result from poor planning, inadequate cost recovery, or the outreach inadequacies of centralized agencies. Analysis has to seek out the causes as well as the symptoms. For example, poor cost recovery may be down to poor billing, or it may be caused by excessive waste through poor leakage control, or it may mean that users will not pay for an unreliable or inappropriate service.

2.1.8 Technology choice

The selection of a suitable technology is not an isolated activity, but needs to be based on delivering the chosen level of service in a way which will be effective, equitable, sustainable, efficient, and replicable. This is a major consideration in Section 2.7, but also has important implications on institutional development and financing mechanisms. Crucially, the technology must be within the capacity of the responsible institutions (government, utility, or community) to manage, operate, and maintain it.

The essence of a demand-responsive approach is that users decide for themselves what are the most practical options to meet their own perceived needs. Those decisions can only be taken after participatory discussions and analysis of available options. The problem is that planners and funders need advance information on the likely outcome of the participatory process, so that projects can be properly appraised and financed.

2.1.9 Demand assessment

Robust demand assessment is central to effective water supply and sanitation services. It is necessary to inform decisions at the policy stage of the programme and project cycle, as well as the project preparation and appraisal stages. Without information from demand assessment studies, it is harder to predict what the response of users will be to service improvements, especially when they are accompanied by tough cost recovery (see Section 2.5).

A demand-responsive approach to the water and sanitation sector needs to ascertain what levels of service users are willing and able to pay for and what mechanisms might ensure that poor people have affordable access to services. At the centre of this approach is the process of demand assessment itself. Demand assessment techniques

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Assessing the likely demand is an important early activity, for which a variety of analytical techniques are available. Choice of the right technique depends on the size and complexity of the proposed programme and the existing capacity in the community for self appraisal. If resources are available, the Contingent Valuation Method is the most reliable. In different circumstances, less costly options can yield worthwhile results.

are discussed in Sections 2.2 and 2.5. Some examples of key techniques and their possible application are summarized in Table 2.1.2.

General points to take into account when considering demand-assessment techniques are:

- The assessment techniques highlighted represent examples along a continuum of quantitative and qualitative research methods; a combination may often be appropriate.
- The wider the range of technically feasible levels of service, or the more complex the existing situation, then the more thorough the demand assessment should be.
- Economic techniques such as the contingent valuation method (CVM) may be more relevant for utilities planning larger investments and where overall programme or project expenditure is high.
- Participatory rapid appraisal (PRA) methods are both more flexible and less costly, and are particularly appropriate where significant community consultation and management is required.
- Demand assessment studies of different scale or depth may be needed at different stages of policy, programme, and project development. In larger and more complex systems, there will be a need to develop institutional capacity for continuing demand-responsiveness.

2.1.10 Demand creation

Lack of demand for sanitation is not a signal to do nothing. Nor is it right to go ahead with sanitation improvements which the community has indicated are not wanted. Hygiene and sanitation promotion should be the starting point (even preceding the demand assessment, where possible).

In some poor communities there may be little demand for hygienic forms of sanitation. People may be satisfied with their existing practices, or not familiar with alternatives. Nevertheless there may be substantial scope for a poverty-focused WS&S project. The appropriate approach for a project to increase sanitation coverage in these circumstances is *not* to provide facilities for which there is little demand, but rather to focus first on hygiene and sanitation promotion as described in Section 2.8. This should create demand for improved facilities, to which the project can respond at a later stage.

Similarly, some poor communities may show little demand for an improved clean water supply, especially if their existing water source is convenient and tastes good and they would have to pay for an alternative system. Again, hygiene promotion is the appropriate focus of a WS&S project until there is effective demand for a new system. One of the startling findings of the 'Evaluation synthesis study of rural water and sanitation projects' (White, 1997) was the large number of new water facilities which were in good order but were not used for lack of demand. It is important not to repeat this mistake by confusing need with demand.

Table 2.1.2 Demand assessment techniques: Water supply and sanitation

	1. Elicit relative demand between different services *	2. PRA option selection: Internally facilitated *	3. PRA option selection: Externally facilitated *	4. Revealed preference surveys (RPS)	5. Contingent valuation method (CVM) *	6. 'Real' detailed options considered by community groups or ballot
Description of technique	Improvements to a wide variety of different services such as water, drainage, roads, etc., are considered by the communities, who express their relative demand for these services. Total funds available for each community area should be reasonably fixed.	Community volunteers are encouraged and trained to undertake a participatory survey in their own community. Preferences and commitments are then agreed in meetings.	A variety of PRA techniques are used by trained researchers or facilitators to triangulate and confirm the preferences of different community groups, who are also involved in the analyses.	RPSs estimate time and financial costs of current household behaviour, (e.g. payments to water vendors) and time saved in collecting water.	A questionnaire survey to determine the maximum willingness-to-pay of individuals for various options for level of service (including improved reliability), payment arrangements, within the context of the current or specified institutional regime.	Detailed options and their implications (costs, O&M, institutional, etc.) are considered by communities using PRA or ballot.
Potential benefits	simple and easily understood expresses 'real' demand if only in relative terms preferences can be refined during micro-planning inexpensive compatible with PRA work	very good community sense of ownership enhances empowerment useful if demand assessment involves on-going negotiation	good community sense of ownership extension staff can assess appropriate time to elicit demand can enhance empowerment can be used in changing institutional environment	can provide reasonably accurate estimates of current time and cost expenditure and hence possible willingness-to-pay for service improvements data and analysis requirements are modest good baseline data for impact assessment compatible with PRA	provides good data for Project Appraisal good data on WTP and potential revenues for different service levels, assuming a thorough survey is undertaken can guide tariff subsidy and cost-recovery policy similarity to public opinion polls means results conceptually easy for non-specialists and politicians to understand	more precise cost estimates lead to less confusion institutional charging of O&M implications can be thoroughly assessed can be used in a changing institutional environment
Potential risks and constraints	possible group or strategic bias WTP for different service levels not readily known process can be manipulated by extension workers, who do not use sufficient technical or financial rigour	possible group bias liable to lack technical/financial rigour reliant on skills being in the community requires substantial flexibility by external funding agencies and local support institutions	possible group bias process can be manipulated by extension workers, who may not use sufficient technical/financial rigour if not adequately supervized extension workers with good facilitation skills are required	cannot estimate h/h response to price increases (including for new levels of service options) poverty may constrain ability of poor people to convert time savings resulting from service improvements into cash payment for them rarely useful for sanitation projects	risks inhibiting community decision-making and ownership, for instance by raising expectations about particular options relatively high cost and requires specialist consultant for reliable results inaccuracies may occur in a changing institutional environment	risk of key decisions being based on misleading results from an unrepres-entative group unless care is taken to avoid group bias requires detailed cost information, so earlier demand assessment may need to use other methods detailed work on some options can be redundant requires flexibility by funding agency
Typical usage	suitable for village or slum general improvement projects. NGOs often use this technique	more suitable where low-tech, low-cost solutions are definitely viable, e.g. handpumps and latrines	suitable in most situations, possibly complemented by other methods	suitable where substantial water supply problems exist. To be used in conjunction with say PRA methods	suitable for informing strategic decisions on levels of service, cost-recovery policy, etc. in large investment programmes, e.g. urban systems, or policy framework for small rural supply schemes	suitable where difficult choices are to be made between different options

* estimated costs of technically viable options are needed for these techniques

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2.1.11 Capacity building

The demand-responsive approach is new to many stakeholders in WS&S. The concept is appealing, but unfamiliar. Different skills are needed in all phases of the project cycle. Capacity building is needed, so that communities and their partners can continue the participatory process in the long term, as well as on the initial project.

If partners change their approach to WS&S (for example by moving to a demand-responsive approach with choices) there will be a need for institutional capacity building. This will involve empowerment of primary stakeholders and the development of people's capabilities at local level. It will also involve developing institutional mechanisms and capacity within and among secondary stakeholder organizations, to enable them to respond to demand in a more flexible manner than that with which they may be familiar. The requirements of institutions which are involved in programme and project identification and design will be different from the capabilities required of implementing agencies. Each of the Sections 2.2 to 2.8 has implications for capacity building, and the requirements for institutional development and human resource development (HRD) are particularly addressed in Section 2.6.

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Participatory approaches to WS&S planning and implementation are very different from the supply-driven, technology-based approaches of the past:

- Their inclusive nature ensures that the voices of the poor and underprivileged are heard.
- They empower people to take responsibility for their own services.
- They respect the traditions and cultures of different societies and use them to develop appropriate solutions.
- They recognize that women have a beneficial influence on key decisions, and that gender considerations matter.
- They mobilize public and private resources and create partnerships to make optimum use of all stakeholders.
- They make user demand, demonstrated by willingness-to-pay, a primary criterion for selecting levels of service and technologies.

2.2 Social development perspectives

The days of solving water supply and sanitation problems with concrete and pipes alone are over. Integrated approaches to WS&S now have people at the centre. A social development perspective, which supports this approach, means understanding and involving users and responding flexibly towards their concerns.

Social development objectives in WS&S include ensuring that dialogue and interventions: are responsive to demand; reach poor or disadvantaged populations and socially excluded groups; promote empowerment, local voices, and ownership; and recognize the different needs and contributions of women and men. A social development perspective is supported by social analysis and by incorporating social issues and participatory approaches into development planning.

Principles

The response to WS&S which evolved during the 1980s was the basic services approach. It identified lack of access to basic services such as water, healthcare, and education as both a cause and a symptom of poverty and therefore a basic right (Jarman, 1997). The World Summit for Social Development held in Copenhagen in 1995 persisted with the point that over one billion people in absolute poverty live lives characterized by deprivation of basic human needs, including those of safe drinking water and sanitation facilities. The Social Summit urged that in formulating strategies for eradicating absolute poverty, governments and the international community should implement the commitment to meet basic needs including providing 'on a sustainable basis, access to safe drinking water in sufficient quantities and proper sanitation for all' (UNICEF, 1995). The DFID White Paper supports this commitment, along with an emphasis on demand responsiveness and participatory approaches.

2.2.1 Understanding the context

The priorities of donors and governments do not always coincide with those of primary stakeholders — women and men in rural and urban communities, particularly the poor. Prior to the 1980s, the practice of WS&S provision hardly ever involved consumers in decision-making and management. Recipients of WS&S projects were referred to as *beneficiaries* and to the extent that assessments were made of felt needs, they were not made on the basis of wide consultation and participatory methods. As a result, the services provided often did not reflect user preferences, were not maintained, and were used inappropriately or not at all, reducing potential benefits. It is now accepted that, for reasons both of equity and efficiency, programmes and projects need to be responsive to people's felt needs and based on genuine demand. Assessing demand before project preparation and design — whether it is expressed or latent demand — helps to achieve interventions which are socially acceptable. It is also a way of starting out with a genuine commitment to partnership and empowerment.

In summary, participatory approaches put people at the centre of the development process. The implications are wide-ranging. Government agencies, NGOs, donors, and communities themselves need new ways of working, new skills, and new attitudes. There is no doubt that the change is worth making; the legacy of past failures is reason enough. The challenge is to equip and empower people to take rational decisions for themselves, and to ensure that government and donor practices are able to respond effectively to consumer choice.

2.2.2 Custom and culture

Just as customary water and sanitation sources existed prior to WS&S projects, so the people involved do not come to projects as 'blank sheets'. People have existing notions of health and well-being, they have long-standing hygiene practices, and they operate within complex webs of formal and informal institutional arrangements and local power relationships. These include very specific arrangements for the management of common property resources. People generally act rationally and consistently, although often not in accordance with the expectations of engineers, planners, or officials.

A vivid example is that many villagers will not share Western notions of the germ theory of disease. They almost certainly have some other explanation of disease, and may regard pollution of a water source by animals, for example, with as much horror as would a medical officer of health — but for different reasons (ODA, 1995). When people are ignored and the local context is not taken adequately into account, WS&S schemes fail. So, as well as being technically appropriate and financially sound, WS&S projects need to pay particular attention to cultural factors and to the social and organizational context in which the schemes take place.

For instance, in countries with large Moslem populations it is essential to take account of *purdah*, the seclusion and/or veiling of women, in the design and siting of rural water supplies and sanitation facilities. In South Asia, waste and sanitation services cannot be designed without recognizing notions of ritual pollution and social relations influenced by caste. To illustrate the point, there is often great resistance to efforts to encourage community participation in waste and sanitation projects in contexts where the maintenance of these systems is seen to be the ancestral occupation and birthright of particular groups or castes (Beall, 1997b).

In recognizing culture it is important to be alert to two critical factors: first, culture is context specific; and second, it adapts to changing circumstances. So for example, caste taboos around water use are often more strictly observed in rural than in urban areas of India, while in Pakistan the pressure of unemployment means that caste-based jobs around waste removal are being taken on by other groups (Beall, 1997c).

2.2.3 Local-level informal institutions

WS&S is not just an individual or household issue. It is a collective concern and requires the active involvement of communities in planning, construction, or operation and maintenance. In any community, there are customary networks which form the basis of individual trust and co-operation, currently being referred to in broad terms as 'social capital'. They also underpin the way in which communities organize collective activities and pool resources such as water sources and communally owned land. In South India and parts of Africa, for example, entire villages manage community-based irrigation systems and have developed monitoring systems to discourage water theft.

On the other hand, it cannot be assumed that people living in the same neighbourhood or village constitute a single community. They may be divided by caste, ethnicity or political factionalism, and do not necessarily possess institutions to resolve conflicts between those divisions and to reach and implement decisions, or to decide whose authority will be accepted.

It is not always easy for engineers to accept the validity of community decisions which seem to contradict their professional judgement. They may not appreciate the priorities related to land tenure, local power bases, or socio-cultural conditions. Only by working through existing local structures and recognizing the efficacy of community preferences, can development agencies design projects which are equitable and sustainable.

The priorities of user groups may well differ from those engaged in project design or implementation. Engineers or government officials may be concerned with providing water of an acceptable quality, but rural communities will choose their source for different reasons. These may indeed be based on the perceived quality of the source (often based on its taste), but also on factors such as the time, distance, and effort involved in collection. Other important factors may be who owns the land on which the source is located, the nature of the route leading to the source, or the others who use it. To appreciate these priorities and preferences it is vital to recognize who owns, controls, or has rights of access to land, and to understand how this relates to local power structures and arrangements for the use of common pool resources.

Attempts to speed up a community development process by circumventing existing or customary institutions and investing in new externally designed organizations have frequently failed in their aims. They also carry the danger of undermining and being sabotaged by local power brokers, and so diminishing the ability of community

Different approaches to care of water in Tanzania

In the varied ethnic groups and natural environments of East Africa, attitudes to and care of water differ within the family circle and of the wider community. Concepts of ownership and attitudes towards community or individual responsibility for water sources are important. Where there is sharing of sources there is usually some feeling of responsibility for keeping the facilities clean and in working order. The strongest tradition of co-operation is found among the Chagga in Tanzania, with their long record of irrigation from the streams of Kilimanjaro. Among other groups work crews and periodic cleanup operations tend to be informal and established in response to the initiative of concerned households. The Gogo do not improve sources much and there is no strong organization for this purpose. Among the Lango a group of women will dig and clean a small hole which constitutes a well. They will not prevent other women from using the well but will make remarks about their laziness in failing to build their own or to maintain the common one.

Where sharing of water sources has been the custom, the introduction of piped supplies serving only part of the population may cause a problem. At Karuri, one resident complained that people who own supplies are prevailed on by neighbours for water. Some owners of piped supplies solved this social dilemma by selling water to their neighbours by the tin, or by collecting rainwater from the roof in drums and letting their neighbours use this freely.

White et al., 1972

members to co-operate and organize effectively. Community-based programmes need to use and build on existing stocks of social capital and, where possible, to work through existing power structures and organizations. Examples of successful new organizations are those which draw upon what is already in place and are as much the creation of members as organizers. Working with existing leaders and building on indigenous principles of organization is the approach adopted by the Orangi Pilot Project (OPP) in Pakistan. OPP has taken an incremental approach to challenging local power relations and to developing women's empowerment in its work helping local people to attain sanitation services.

There are times, though, when creating new groups or structures is the only means of promoting the participation of disadvantaged people. Projects that wish to challenge highly inequitable social organization, which specifically target poor communities, or that have gender equity goals face this dilemma. After the first democratic elections in South Africa in 1994, it was recognized that new institutional arrangements were necessary to redress historical imbalances in the distribution of infrastructure and services. The Department of Water Affairs and Forestry (DWAF) in Eastern Province realized the structural limitations it faced in working with diverse communities at local level. Therefore it has developed an effective partnership with the NGO Mvula Trust. The NGO works at community level, both forming and building the capacity of local organizations to participate in district-level *indabas* or consultative fora.

The lifestyle of a young girl in Ethiopia

Elma Kassa is a thirteen-year-old girl from Addis Ababa, Ethiopia. Her father is a labourer and her mother is a washerwoman. She has one younger sister and a brother.

'I go to collect water four times a day, in a 20-litre clay jar. It's hard work! When I first started collecting water I was about seven years old. In those days we used to have to walk for over a mile to fetch water. Now there is a tapstand about 10 minutes from my home, which has made life easier.

I've never been to school as I have to help my mother with her washing work so we can earn enough money. I also have to help with the cooking, go to the market to buy food, and collect twigs and rubbish for the cooking fire.

Our house doesn't have a bathroom. I wash myself in the kitchen once a week, on Sunday. At the same time I change my clothes and wash the dirty ones. When I need the toilet I have to go down to the river in the gully behind my house. I usually go with my friends as we're only supposed to go after dark when people can't see us. In the daytime I use a tin inside the house and empty it out later.

If I could alter my life, I would really like to go to school and have more clothes.'

WaterAid, 1996b

DFID/Lorraine Chittock

Gender is a vital issue in WS&S programmes. It is not just a question of giving women a voice, though that is important. Nor is it right to make women more influential by increasing their workload — that is counterproductive. Fetching and carrying water for their families is a huge burden for millions of women. Relieving them of that burden is a laudable aim. Filling the time thus saved with other duties, such as hygiene education or community work, is a gender-blind approach which can undermine the benefits of improved WS&S facilities.

It is the decision-making role of women which can have the greatest impact on the sustainability of WS&S programmes, and that needs to be brought into play at all levels, not just community level.

2.2.4 Recognizing gender issues in water and sanitation

Women and men use water and contribute to water management in different ways. For example, it is mainly women and girls who use water for domestic purposes, while men and boys may compete for water from the same sources for farming and livestock purposes. What is meant by a gender approach is that the different responsibilities and needs of both women and men are taken into account in the design and management of projects. Gender relations need to be understood as context specific and efforts need to be made to ensure the fullest possible participation of both women and men in programme and project processes.

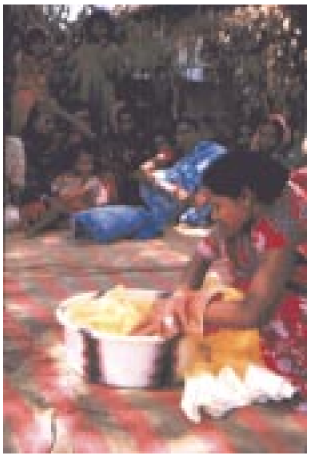
For millions of women around the world, fetching and carrying water is part of their daily routine. Water containers typically hold about 20 litres of water and weigh 20 kilograms. Carrying such a heavy weight on the head, back, or hip has severe health implications for women, who commonly experience backache and joint pains. In extreme cases, curvature of the spine and pelvic deformities result, creating complications in pregnancy and childbirth (WaterAid, 1996b).

Collecting water is not only physically stressful but also time consuming. Women in rural Africa often walk ten miles or more every day to fetch water. As well as travelling these long distances, women have to wait in line to collect water, sometimes for hours. In the dry season, customary water sources are depleted and it can take up to an hour for an East African woman to fill her bucket (White et al., 1972). Children and particularly girls are required to help their mothers with water collection and other domestic tasks. This means they are not able to attend school and often have little time left for play.

With regard to sanitation, women often have different privacy requirements from men. For example, in densely populated urban settlements without adequate sanitation, they are required to use public spaces by cover of darkness in the early morning and late evening, and can suffer health problems related to urine retention as a result. In a project in El Salvador it was found, for example, that women would not use the communal latrines designed by male engineers, because the toilets had been designed with a gap at the bottom of the door which exposed their feet and offended notions of privacy (Moser, 1989).

Although women play a major role as custodians of water sources and in the management of environmental hygiene and sanitary services at the household and community level, they have rarely been consulted in WS&S programmes and projects. A survey of 300 women in 30 villages, conducted in 1989 with the support of the NGO the Self-Employed Women's Association in Gujarat, India, found that:

- 42 per cent of women said they were never consulted about the site of the borehole or the water supply standpost;
- 63 per cent of women showed readiness to learn skills of water harvesting, drip irrigation, afforestation, and desalination; and



DFID/Howard J Davies

- in most projects women were not consulted on decisions concerning the site, budget, formulation of the scheme, and its operation and maintenance.

It is now recognized that the success of programmes and projects depends on the active involvement of women, because it is they who fetch and store water, dispose of domestic waste and children's excreta, teach hygiene habits to children, and provide much of the healthcare in the family. Women are thus invoked to participate in hygiene education schemes and are recruited as community mobilizers and healthworkers (see also Section 2.8). This can have a negative effect on women themselves however, as they are already busy with childcare, domestic tasks, and often income-generating activities as well. Time savings through improved water supply can easily be undermined by the opportunity costs and increased workload of ill-conceived and gender-blind efforts at involving women in community participation. Thus attention needs to be paid in project design not to over-burden women or to make them environmental custodians under conditions over which they have little control. The best way to do this is to involve women directly in decision-making from the outset, and for implementing agencies to employ women in positions where they can influence programming decisions.

In the poorest communities where sanitation is inadequate and water supplies are sufficient only for the bare necessities of life, decision-making, for both women and men, may come down to hard choices between water needs for the household and for income-earning activity outside.

These most hard-pressed groups are perpetually at greater risk of health problems and are often suffering from chronic poor health, impacting on their ability to earn a living.

Frequently, these conditions go hand-in-hand with poor environmental surroundings and such fragile existences are correspondingly more vulnerable to the exceptional climatic conditions that produce floods or drought.

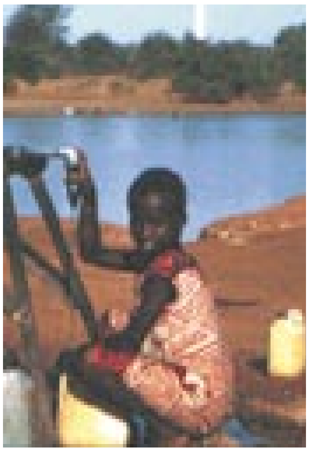
2.2.5 Livelihoods, vulnerability, and the environment

There is a substantial literature attesting to the impact of poor living and environmental conditions on people in poverty. As Douglass argues in the case of Asia, 'When viewing environmental distress and poverty together, the major conclusion to be drawn is that the consequences of environmental deterioration fall heaviest on the poor' (Douglass,1992: 11). Suffering comes as a consequence both of the environmental health risks associated with inadequate infrastructure and services, and because environmental degradation impinges negatively on livelihood strategies. Nowhere is this more evident than in the case of water supply and sanitation.

The health impact of absent or inadequate WS&S is discussed in Section 2.3. The impact on livelihoods results in part from the toll on the health of household breadwinners, dependants, and carers, and in part from the competition for scarce water resources between domestic and income-earning activities. For example, in rural areas decisions sometimes have to be made between water for domestic use or for keeping livestock alive. Such choices are often intricately tied up with gender relations and the gender division of labour.

Balancing the roles and relationships that make up household livelihood strategies is made all the more difficult in times of scarcity and risk. In relation to water supply, seasonality is an important factor. In rural areas, customary sources may disappear during the dry season, involving women in longer journeys to fetch water. In urban areas, water shortages can affect some sanitation options such as pour-flush latrines, or can reduce the availability of water for some income-generating activities, leading to more hard choices.

In the wet season food is often in short supply because the harvest is not yet in, there is often more illness (especially malaria), and rural women's time may be in high demand for planting and weeding crops. If it is not feasible to provide improved water supplies nearby on a year-round basis, wet season wells and rainwater catchment may be more useful in these circumstances than they might seem.



DFID/Howard J Davies

This manual does not cover water supply and sanitation in emergency contexts. However, it is important to note that beyond poverty, some households or communities can be at particular risk. For example, households or settlements may be vulnerable to floods due to their location, or communities may be at risk through being prone to drought. In such cases, the natural and man-made components of such disasters need to be factored into both environmental (Section 2.4) and social impact analysis.

2.2.6 Achieving cost recovery and advancing equity

Experience world-wide shows that water supply and more particularly sanitation programmes face sustainability problems if they are not based on genuine demand, conventionally expressed as willingness-to-pay. It is assumed that cost sharing reflects a commitment to the project in question, and in recent years cost recovery has become a feature of most WS&S programmes. It is further argued that while sharing capital costs fosters ownership, recovering recurrent costs helps programme sustainability. This is true, but there are caveats.

A causal relationship between cost recovery on the one hand, and project ownership and sustainability on the other, is by no means automatic. An influential study of rural water supply conducted in Lesotho during the 1970s (Feachem et al., 1978) demonstrated that the level of cash contributions collected from villagers was so modest and the administrative costs so high, that cost sharing had a negligible effect on project sustainability. Also, rather than instilling in villagers a sense of ownership and responsibility, contributing cash, labour, and local materials towards construction convinced them that they had already paid their fair share and that the government should take on the longer term responsibility of operation and maintenance.

This example serves to underscore the importance of on-going consultative processes and the development of a mutually agreed and shared agenda from the outset. It does not imply that water supply and sanitation services should be free to users. Some contribution from users is certainly desirable.

Cost-recovery policies can improve the position of poor people in a number of ways. For example, if collected revenue improves the sustainability and reliability of water supply systems, this benefits the poor, who are least able to cope with bad system performance. Cost-recovery mechanisms can also be used to charge higher income

In such circumstances the obvious WS&S needs may be accompanied by the expressed willingness of households or communities to pay for improvements, but the ability to contribute to the associated costs will be strictly limited. The principle of cost recovery, bringing recognized benefits in terms of sustaining community interest in a programme, can still be pursued, but the charging regime must be carefully tailored and balanced with the assessed means of the users.

Making this assessment and linking household or community incomes to an affordable level of service improvement that meets community demands and aspirations can only come from early and ongoing discussion with these intended users.

consumers, determined by area, for example, according to the number of taps in a dwelling or by metering water use, so as to cross-subsidize lower income households and communities. Section 2.5 addresses this issue in more detail.

Private input has traditionally played an important role in service provision. It carries the danger that vulnerable groups may be sidelined for several reasons including poverty, geographical location, or local prejudices. If programmes are alert to these difficulties local private input can lower project costs and, where extended into operating and maintenance activities, can offer the additional benefits of increased activity and opportunity in the local work environment.

There are various means of pursuing cost recovery while at the same time being alert to issues of affordability. For example, the developing of financing mechanisms built on customary practices such as revolving funds can play a useful role. Affordable appropriate technologies, which accord with local demand and can be operated and maintained by local users, have a vital role to play (see also Section 2.7). Private entrepreneurship currently plays a significant role in service delivery to people in poverty and building capacity in the private sector can improve both affordability and livelihood opportunities, particularly when it includes local level and informal sector enterprises.

However, it should also be noted that risks and problems of equity are associated with private provision. While many low-income households and communities are able and willing to pay for the services they want, some remain vulnerable. In poor rural communities, for example, vulnerability may result from being cut off from existing or proposed sources of water or from sanitation services, due to 'social invisibility' or distance from centres of decision-making and investment. In urban areas certain households and communities may be excluded from services as a result of poverty or for reasons of social identity, for example ethnic marginalization.

Thus cost recovery from very poor households and communities must take into account their ability to pay. This is often different from expressed willingness-to-pay. For example, in low-income urban communities where people are reliant on vendors for their water, they may be willing to pay a relatively high price for water, so long as it is below the vendors' rates. However, this may result in them keeping their consumption at minimal levels, with increasing health risk. Even then, water payments may still absorb a disproportionate and far larger share of household incomes than the cost of water and sanitation to better off households (see also Section 2.5). Whereas the better off households can sacrifice non-essential expenditure to pay their water bills, poor families have little choice but to reduce their food budget, with obvious implications for their nutritional status.

For the poorer communities a degree of subsidy will nevertheless sometimes be necessary. Setting the level of subsidy needs care, not least because of the movement towards cost recovery in current and more recent programmes. This can lead to inequities in

A balance has to be struck when determining charging policy. The charging structure needs to take into account people's poverty as well as information from willingness-to-pay studies. It also has to be recognized that the higher the level of cost recovery, the more public subsidies can be directed towards extending basic services to more poor people, instead of subsidizing existing consumers.

Additionally, people need to know and agree to exactly which aspects of water supply and sanitation they are willing and able to pay for. It may be easier for members of low-income communities to reconcile

charges between these and earlier projects where cost-reflective charging was not a common feature.
The implications of this can be seen, for example, in established urban areas where the piped water mains and sewers of the central zone, laid some years ago under conditions of heavy subsidy, will typically serve higher-income families. Newer investments in the peri-urban zones, which will be seeking cost recovery, will usually be directed towards lower-income groups.

Setting a charge that is affordable and equitable to all can be achieved by a system of cross-subsidies, using the increased revenues from higher charges in the higher income communities to aid cost recovery in the less favoured areas, with an appropriate lowering of service charges to these households.

In the terms of the DFID's Poverty Aim Marker (PAM), actions targeted on specific areas of low-income households can be described as *focused actions*.

themselves to paying user charges for on-plot sanitation, for example, rather than for communal latrines, or for secondary or primary infrastructure where the benefits might not be immediately apparent. Members of low-income households also need to know how often, in what manner (for example weekly, monthly, or annually) and for how long they are expected to pay. Willingness-to-pay is not only tied to issues of household budgeting, which in themselves have important gender dimensions, but is closely linked to the legitimacy and effectiveness of the agencies and organizations responsible for service delivery. How people pay, and to whom, therefore influences *how much* they are willing to pay.

Subsidies are not a magic cure for poverty. Indeed, they do not necessarily reach poor households or communities. They can be both socially and politically motivated and have often been channelled to services rather than people. Urban areas may benefit from subsidized water supply at the expense of rural areas. Within urban areas, subsidized centralized water and sanitation systems reach only a minority of city dwellers, as mains water and sewerage are concentrated in middle-class and better-off areas. Moreover, new investments often tend to be in existing serviced areas. In developing countries, those who receive services are estimated by the World Bank to pay on average 35 per cent of the costs and, in effect, governments heavily subsidize urban élites (Black, 1994). As cost sharing and user charges usually characterize new investment in WS&S in low-income areas, inequities may be further compounded (Jarman, 1997) unless careful attention is paid to technology choice and means of cost recovery.

In order to avoid this inequity, policy approaches can target efforts specifically at low-income households, for example by discrete area-based interventions in deprived rural regions or in slums and informal urban settlements. In terms of DFID's Poverty Aim Marker (PAM) (see Section 1.5), this would constitute *focused action*.

In urban systems in particular, when services are being extended into low-income areas, steps must be taken to ensure that the unit cost of water to poor people does not exceed what better-off consumers pay. Mechanisms for doing this are discussed in Section 2.5.

2.2.7 From participation to partnership

During the 1990s it was recognized that extending access and sustaining service provision would demand a lot of human energy, including the efforts of local communities and local private sector actors. The role of governments in actual service provision is on the wane, their emphasis changing to the development of economies of scale, the co-ordination of wide coverage and multiple sectors, and building partnerships of service providers and service users. UNICEF (1995) also sees the public sector as having a role in ensuring equity, and in situations where local institutions and the private sector are weak, it sees government service provision as of continued importance.

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In tandem with moves towards cost recovery, the 1990s has seen a transition in the respective roles of the various parties to WS&S improvements. Except in particular situations, perhaps where local government structures are lacking or weak, national governments have tended to distance themselves from service provision in favour of a broader co-ordinating and planning role.

The private sector, formal and informal, is therefore playing a bigger part and at the same time users, now required to contribute money as well as labour and time to improvement enterprises, have increasingly come to be recognized as programme partners rather than beneficiaries.

Where this leads to user input at the earlier stages of project preparation it has the positive result of relating project content more closely to community requirements. The increased involvement reinforces user commitment to the project and encourages a more questioning user relationship with the participating agencies — more demands are made on the successive layers of contributing groups and organizations — CBOs, NGOs, local, regional, and national governments.

The agencies most closely involved with users are therefore having to adjust

The role of the *private sector* is discussed in Section 2.6 and elsewhere but it is important to make two observations here. First, private involvement in water supply and sanitation spans a broad range of activities, which includes households and communities engaging in the private informal provision of infrastructure and services, in the absence of public or formal private sector provision (Batley, 1996; Beall, 1997b). Second, the private sector is not monolithic and embraces an informal economy, which is involved in construction, production, and service provision (Beall, 1997c). This in turn provides both services and livelihoods for low-income people.

Civil society organizations are diverse in both structure and motivation, from community-based organizations (CBOs) engaged in self-help activities or procurement (Cotton and Sohail, 1997), to non-governmental organizations (NGOs). NGOs are involved in activities ranging from service delivery, for example of low-cost water supply and sanitation, to intermediary activities such as negotiating with local government on behalf of communities. They can take on broader advocacy activities as well, such as issues related to poverty reduction, equitable service provision, or public health. It is not unusual for NGOs to establish themselves to perform one kind of activity, and to find themselves inexorably drawn into others, so that one organization may be active across a spectrum of activities.

Many national and international NGOs provide an important intermediary function, whether it is channelling development resources to community-based organizations, providing them with services and technical assistance, or helping them to strengthen their capacity to make demands on government.

NGOs have a number of advantages as intermediaries, not least because they are usually familiar with low-cost techniques and local innovations, and have field presence and good rapport with local communities. NGOs do not always solve the problem of linkages, but some try. The Orangi Pilot Project (OPP) model involves a multitude of small informal organizations, each of which takes responsibility for tertiary services in its own lane or immediate neighbourhood. Government, through a local government department or the appropriate line agency, continues to be responsible for 'external services' to use the OPP terminology. The OPP acknowledges that it has experienced difficulties in establishing linkages between internal and external services (Hassan, 1997).

Local and international NGOs have demonstrated that they are often well placed to reach low-income communities and households in terms of commitment, location, relationships, and planning methodologies. However, there are also a number of risks and assumptions relating to NGOs. The case of the World Bank's JAKPAS project in Nepal is instructive. Up to 1996 this project provided funds to NGOs to organize the construction, operation, and maintenance of schemes with villagers, but experience showed that NGOs tended to their roles and answer new questions arising from this evolution towards partnership arrangements that look beyond the base practical details of WS&S improvements and seek to integrate them with the associated aspects of social development.

This can present some difficulties for the partnering agencies. They now have to forge stronger links with users. The CBOs, NGOs, and local governments in particular must extend their interest beyond the initial focus on the technology-oriented needs of interested users and seek also to address gender issues and other aspects of culture and established social and hierarchical order in the target communities.
Only in this way can the welcome movement towards integration of social issues into WS&S programmes be expanded to the point where it becomes accepted as the norm.

take over the implementation (with diversion of funds) rather than to facilitate the process as intended.

In the end, there is no substitute for strong user involvement whatever the institutional mix. User participation has played a central role in meeting the challenges of the water and sanitation sector. Consulting and involving users in the design and preparation as well as management and maintenance of WS&S provides a means of revealing both expressed and latent demand and of ensuring that services match what people want, are able to pay for, and will strive to maintain. Participatory approaches can also help to resolve conflicts over water resource allocation among competing uses, and to ensure that choices are anchored in demand and not unduly influenced by contractors, consultants, or other secondary stakeholders.

Conventionally, participation in rural water supply has been through the development of village water committees, which in turn mobilize and manage people in providing contributions of cash and labour in self-help initiatives during the construction and maintenance phases of a project. Best practice examples also involve users in design, and work synergistically with existing formal and informal institutions and political structures. Previously the focus has been on the contribution

The Self-Help Rural Water Supply Programme in Malawi

The Malawi gravity-fed rural water supply scheme was one of the earliest examples of popular participation in large-scale, government-sponsored development projects in Africa, and it delivered sustainable benefits over a wide area. Forty-seven piped water schemes supplying over one million people have been completed since the Programme was first developed in the late 1960s. The popularity of the project lay in the fact that the piped water was brought to villages from a year-round source such as a spring or stream, located above the line of habitation, making the water both pollutant free and reliable.

New schemes were only undertaken at the request of local communities who were involved in system design and planning. Appropriate technology was developed that matched local needs and local resources. Sharing responsibility between the government and local communities, based on their respective comparative advantages, meant that communities were expected to perform only the tasks they could manage, given appropriate training, resources, and organizational and technical support. They were required to supply nearly all the labour for construction and to carry out continuing maintenance after construction.

The Programme devised appropriate institutional solutions. Working with existing patterns of organization appropriate to local conditions and with recognized local leadership, both traditional and political, enabled the programme to expand quickly and yet leave behind effective local management capacity. Political backing was an important factor. Initially the Malawi Congress Party was a constructive force at village level, providing a bridge between traditional leaders and the self-help committees. In later years the Party became alienated from its roots and its actions undermined the spirit of self-help, providing a reminder that the role of politics cannot be discounted.

Krishna and Robertson, 1997

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of people's participation to the efficiency and effectiveness of projects (Narayan, 1995), but increasingly it is recognized that asking people to contribute towards the costs of improved services means they will make more demands on the project. They will ask what benefits they will obtain from the investment of their time, energy, and money into the development, improvement, and operation and maintenance of WS&S services. 'The greater the contribution from users, the less they can be treated as beneficiaries, and the more they must be seen as partners' (Evans, 1992), and as partners, communities are likely to make more demands on governments and agencies. This poses new issues.

While projects such as the Self-Help Rural Water Supply Programme in Malawi were able to scale out horizontally with much success, existing institutional relationships were not tested beyond the community level. Moreover, just as there are risks and assumptions associated with NGOs, so there are with CBOs as well. Inequities and power relations within a locality can mean that communal rubbish bins are never placed outside the homes of high status families, while handpumps may very well be located next to the headman's homestead. Within a partnership approach, developing appropriate linkages between users and providers of services remains a challenge. It is often low-level field staff or workers who provide entry points for developing linkages.

Socially sensitive partnerships depend, in the end, on the attitudes and capabilities of local government to understand and undertake social development processes. This is a difficult problem given the limited capacity of local government departments and the technical orientation of most training provided to professionals involved in both rural and urban water supply and sanitation. An example of an organization trying to change is provided by Shrestha and Pyakural (1996).

Practice


DFID/Howard J Davies

How do the principles of social development translate into practice? How can they become an automatic part of good practice in WS&S? A social development perspective is supported by two key methodologies: social analysis, and the incorporation of social issues and participatory approaches into the process of development planning. *Social analysis* is particularly important in the identification, preparation, and appraisal of WS&S programmes and projects. It also provides socio-economic baseline data for on-going monitoring and subsequent evaluation. A *social development perspective in development planning* includes:

- responding to the demands and needs of those affected by projects and policies;
- reaching poor and disadvantaged populations;
- recognizing the roles and needs of women, as well as men;

- encouraging participation of all stakeholders in the development process; and
- creating an enabling environment for inclusive partnerships.

Adopting a social development approach is not a once and for all exercise, but a process which informs policy dialogue, programme and project formulation, design and implementation, as well as management and evaluation.

2.2.8 Conducting social impact analysis

If a social dimension is to be included in a project it must be introduced to all the partner groups at the outset (project identification stage).

It must be founded on a comprehensive baseline study (a social impact analysis) of social conditions applying at household, community, and local institution levels in the populations concerned. The study should classify information according to sex, age, class and, where appropriate, language, ethnicity, and religion.

Key outputs must include analysis of:

- cultural beliefs and sensitivities, particularly as they apply to water, water sources, and sanitation;
- community power structures and hierarchies; and
- current rights and practices concerning existing water sources and supplies, including water vending activity.

For reasons of equity and effectiveness and to avoid risks, attention to social issues needs to be built into programme activities as early as possible, ideally at the identification stage. This is particularly important in the context of a partnership approach. If DFID is to introduce and gain acceptance for social objectives and participatory approaches among all programme partners (including other donors and the private sector as well as government, NGOs, and communities), this has to be introduced before the appraisal stage when negotiations are usually already well advanced.

Primary and secondary data which describe socio-economic conditions and analyse social relationships in a proposed project location are collected at an early point in the project cycle, so as to provide benchmarks and indicators for planning, monitoring, and evaluation. Known as situation analysis, baseline studies, or — the term used by DFID — social impact analysis (SIA), studies are conducted during sector reviews and at the identification stage of all projects.

In social impact analysis, information collected should include *general demographic information* about the population, disaggregated according to sex, age, class, and settlement, and, where appropriate, religion, ethnicity, and language. Cultural issues with regard to water and sanitation are especially sensitive and may differ among different groups or on the basis of socio-economic status; gender, age and the life-cycle; and according to physical ability. Particularly important are: perceptions about the healing and health properties of traditional water sources; preferences around the taste and smell of water; customary hygiene practices and perceptions of ‘clean’ and ‘unclean’ water; customary sites for bathing, washing clothes, and ablution for women, men, and children; and issues of privacy with regard to sanitation. Analysis of social customs and norms will permit better dialogue about the siting of new water installations and sanitation facilities, for example, as well as facilitating appropriate hygiene promotion.

The household

Information about *households* should include residence patterns, their average or typical size, composition, and organization. There should be a solid understanding of the gender division of labour in the household, the tasks undertaken by children, and the hierarchies and power structures within the household. Livelihood systems and strategies should be understood, including patterns of migration and who contributes to and controls different assets and areas of household budgeting. This information is crucial for understanding key water uses. It is also helpful in assessing how much time and resources different household members have for participating in WS&S provision, and whether all household members are willing and able to pay for it.

Jo Beall

The community

Socio-economic data on *the community* should include information on whether the community is rural, urban, or peri-urban, whether it is large or small, homogeneous or heterogeneous. Customary approaches to cross-subsidization within communities need to be understood along with the way in which care and social safety nets are provided. Economic information should include the type and size of enterprises and employment opportunities. This also provides an opportunity for understanding competing water uses at household and community level, as well as the impact of water supply projects on traditional water sellers or owners of traditional sources of water. They may stand to lose income or status in the community and they may play a dominant role in consultation processes as a result. Where possible, groups with a special relationship to existing water sources should be involved in the planning and possibly management and maintenance of proposed WS&S projects.

Local-level institutions

Participatory approaches need to be built on a thorough understanding of the *leadership and organization* of the community, including both formal and informal groups and structures. It is crucial, for example, to discern the importance of traditional leaders and other hierarchies, including informal power structures. These issues are important for identifying and analysing natural resource management, use of common resources, and the customary operation and maintenance of infrastructure. Understanding of community organization and informal institutional arrangements may influence the siting of installations, technological options such as pour-flush versus simple pit latrines, and cost-sharing arrangements.

Time spent on the initial study is time well spent. As well as describing current conditions it forms the basis for assessing user demand, defining appropriate improvements and estimating likely user participation and outcome benefits. Finally, when those benefits, the impacts of the improvements on user livelihoods, are evaluated, it provides the benchmark for doing so. In all these areas the results are directly affected by the quality of the initial analysis.

Monitoring and evaluation

Establishing both good baseline information which feeds into benchmarks and indicators for monitoring and evaluation allows for better social impact assessments when the project is finished. Traditionally assessment of improved WS&S provision was made against construction targets and the percentage of people with access to improved services. Then water supply projects came to be measured against the criteria of quantity, quality, accessibility, and reliability, using indicators such as distance to old and new sources of water, and time and energy saved in collecting water. It is only quite recently that evaluations have assessed the impact of WS&S provision on poverty, understood through the perceptions of poor people themselves. Combining participatory approaches with other methods not only deepens understanding but also provides the conditions for developing inclusive processes and responsive projects. Indicators are discussed further in Section 3.5.2 and also in Narayan (1993). See the further reading at the end of Section 2.2.

2.2.9 Methods

Social analysis includes a range of methods which help to assess whether a community, sets of communities, or groups within a community, want a project or are likely to participate in and benefit from it. The extent of the investigation required will depend on how much is already known, for example from existing socio-economic studies or previous projects. The methodologies employed will depend on the size of the proposed location and budget, as well as the nature of the problem and the project. However, a combination of methods is often advisable so that robust benchmarks are identified. Indicators should be relevant, measurable, and comprehensible to all stakeholders and should be developed, probed, and checked with primary stakeholders.

Some of the following research methods may be useful:

- review of available information and previous projects
- formal surveys
- semi-structured and 'conversational' interviews with key informants
- observation
- group interviews with households, occupational groups, or segments of communities
- life, work, and organizational histories
- public meetings
- workshops
- participatory rapid appraisal (PRA) methods

The strengths and weaknesses of the three methods commonly used for demand assessment — revealed preference, contingent valuation, and participatory rapid appraisal — are referred to in Section 2.1.9 and Table 2.1.2. Participatory rapid appraisals, as well as being quick to implement, have the prime advantage of fully involving users in both information gathering and analysis, thereby promoting local capacity building and strengthening partnering attitudes.

A general rule of thumb is that quantitative methods are best suited to exposing what and how much, while qualitative methods are more appropriate for their explanatory value and answering the question 'why?'. They are also good for answering the question 'what next?' and feed well into policy decision-making processes.

Social impact analysis can be used to explore attitudes to water such as quality and taste, its use in domestic and livelihood activities, and whether water from certain rivers or sources is imbued with magical or spiritual qualities. Social impact analysis can also reveal whether water is considered a 'free' good in a particular context, and whether people are willing and able to pay for new or improved services. This is invariably related not only to issues of affordability, but to existing water supply or sanitation facilities and the improved options on offer.

Three main types of **demand assessment** are used within DFID. First, *revealed preference* (RP) methods measure demand indirectly by examining current behaviour, such as time spent fetching water or the price paid to water vendors. Second, *contingent valuation* (CV) methods ask people directly what they would be prepared to pay for different or improved services in the future (see Section 2.5). Both direct and indirect assessments of demand can also be undertaken through a third approach, that of participatory rapid appraisal methods. These usually constitute a number of qualitative research methods used in combination and triangulated or cross-checked against one another. They usually take a participatory form and include indirect methods of assessing the services and practices people already have, what they currently pay for water and to whom, and what their perceptions are of proposed changes to services and charges.

In conducting demand assessment, different methods have different strengths (see Section 2.1.9). Large-scale CVM surveys of randomly selected households can give a reliable indication of what proportions of people might be willing to pay various prices for different levels of service, but focus groups might better tell you why. Care needs to be taken in drawing strategic-level conclusions from focus group or community meeting discussions, however, because the participants in these discussions may not be representative unless they are randomly selected (see Davis and Whittington, 1997).

Participatory rapid appraisal

Often resources and time do not permit extensive social research. Instead, participatory rapid appraisal (PRA) methods are used as a 'quick and clean' means of conducting social analysis and of ascertaining social impact. The advantage of including participatory methods of enquiry is that when they are well done, the research itself

The Community-based Environmental Management Information System (CEMIS) Project

On the basis of pilot work in Indonesia, the Community-based Environmental Management Information System (CEMIS) project advocates that communities themselves assess effective demand. The approach is to train communities to assess their own demand for services through self-survey of needs and community workshops. It uses community leaders and volunteers, uses locally available information and resources, and leads to local-level empowerment and self-determination.

At the beginning of the process local people are consulted at a community meeting held to prioritize environmental problems. If water supply tops the agenda, for example, the community may decide to determine effective demand. During the research, workshops are held with community volunteers to familiarize them with the methodology and develop a plan for the self-survey which they would then conduct. After the data is collated and analysed, the results are presented back at a community meeting. There consensus would be reached on the commitment of individual households to contribute to the provision, operation, and maintenance of the service.

UNCHS, 1996

belongs to local people, who contribute to its analysis as well. Facilitators help them to analyse and understand their situation in relation to a wider context, so that they can plan their role in projects and assess the impact on their future. In this way, PRA not only contributes to the process of information exchange but also to the goal of developing a shared agenda and to local capacity building.

PRA draws on the following menu of sources and activities:

- use of secondary data, maps, and reports for background information
- direct observation
- case studies, work, and incident histories from local experts
- semi-structured interviews with key people
- transect walks: systematically walking through an area with local guides, observing, asking, listening, and learning about water sources and uses, sanitation provision, settlement patterns, technologies, etc.
- group discussions of different kinds (casual, focus, community)
- mapping and modelling to show local world views
- matrix scoring and ranking exercises to compare preferences and conditions
- well-being grouping to establish local criteria for deprivation and disadvantage
- time-lines and trend and change analysis to show chronologies of events and to analyse local trends and causes of change
- seasonal calendars and daily time use analysis to show work patterns and activities

Information from PRA should be made available to all stakeholders as early as possible in order that it can feed into and facilitate participative processes. Further reading on PRA techniques is included in the references at the end of this section.

Gender-separated statistics are an important output of the impact analysis, assisting the planning and implementation of WS&S improvements around the separate needs, functions, and responsibilities of men and women in the community.

Stakeholder analysis and gender planning

Stakeholder analysis as outlined in DFID planning guidelines (ODA, 1995a; 1995b; 1995c) provides a means of identifying those groups who may directly or indirectly be affected by projects, both positively and negatively. It also ensures that not only users or primary stakeholders are recognized as having vested interests in the project and the planning process, but secondary stakeholders also, such as donors, governments, and project staff.

Once people as well as pipes are recognized in WS&S planning, it is easier to disaggregate all categories of stakeholders on the basis of gender or other important categories such as ethnic groups and rural–urban distinctions. Gender planning techniques include the use of sex-disaggregated statistics, task analysis in which the activities of men and women are defined, relational analysis which explores the relative position of women and men in society, and gender planning checklists for project planning. Together these help respond to the different responsibilities and needs of women and men, and allow for gender differences in the way women and men engage in the planning, implementation, and management of programmes and projects.

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2.2.10 Developing participatory practice

Participatory practice as now envisaged is a step forward from earlier examples where user input was usually limited to practical matters centred on the construction and subsequent operation and maintenance stages.

For a long time the case for community participation in WS&S was made simply on the grounds of cost effectiveness and efficiency. Participation provided the opportunity of incorporating indigenous technical knowledge into planning and design, of devolving responsibility for operation and maintenance to the level where there was most at stake, and of relying on community 'self-help' in the context of increased emphasis on cost sharing. In this case, participation was advocated on the grounds of long-term project or programme sustainability and this rationale remains valid.

More recently, as cost-recovery has become an important element of WS&S programmes, financial input has been added to the user side of the participation equation. These arrangements are valuable as aids to project affordability and sustainability, but fall short of giving users a full role in the earlier planning and design decisions on matters that can significantly impact on their future lives.

However, in WS&S provision as in many other sectors of development, there is a growing emphasis on building both individual and community level empowerment. This involves approaching the development process from below and increasing people's role in shaping their own development. It is closely linked to the shift away from 'supply-led' to 'demand-responsive' approaches, which advocate the active involvement of primary stakeholders at all stages of the project cycle. Empowerment is also linked to strengthening civic engagement and government responsiveness. There are a number of examples of WS&S projects, such as WAMMA in Tanzania, highlighted in the box at right, which are actively attempting to incorporate demand into their project planning, usually through the use of PRA methods.

Correcting this by developing user participation into meaningful partnerships is a slow process demanding patience and, in many instances, changed attitudes and new skills in the secondary stakeholder groups, such as CBOs, NGOs, and local governments.

Building capacity and shared agendas

Sometimes local groups or secondary stakeholders need help to raise levels of awareness and sensitivity. For example, professionals may need gender training or capacity building in participatory research and planning techniques. At community level capacity building may involve skills training and confidence building to ensure participation in project fora and partnerships.

Linking demand and participation

' "Demand" is concerned with defining *what* is done: participation concerns *how* it is done. Responding to demand is an important first step but does not in itself create a sense of primary stakeholder ownership. Even where project interventions are welcomed by and appropriate to the needs of primary stakeholders, their exclusion from continuing decision-making and planning processes often prevent community management or maintenance systems from working effectively, and prevent poor people from developing and sustaining any sense of control over their own lives.'

Derbyshire and Vickers, 1997

WAMMA: Empowerment and partnership in practice

WAMMA is an example of how, during the five years up to March 1996, an evolutionary partnership between the government of Tanzania, an international NGO (WaterAid) and Tanzanian villagers helped attain sustainable water and sanitation services among 86 communities in the Dodoma region of Tanzania. In that same period, the villagers concerned raised the amount of money in their village water funds from nothing in 1991 to UK£25,000 (US$40,000) in 1996.

Today the WAMMA programme has become a model of an integrated participatory approach to community water supplies. The four multisectoral teams at the heart of the programme were formed principally from junior staff in three departments (Water, Health, and Community Development). Most were unskilled and demotivated by low pay, poor job satisfaction, and a lack of practical experience. As fieldworkers and agents for change, they have become dynamic and committed teams, respected by the villages they work with and by the managers and directors of their departments.

Integrated, participatory partnerships require patience, flexibility, and long-term commitment and cannot be achieved from a rigid blueprint. WaterAid has been working in partnership with the Tanzanian government in Dodoma Region for more than a decade. Relationships involving government officers at national, regional, and district level, WaterAid staff, and local community representatives have progressed from cautious suspicion to mutual respect, but not without significant difficulties on the way. Throughout, approaches were modified in response to local conditions and attitudes. The end result was teamwork. Government staff, WaterAid, and the villagers share common goals and recognize the benefits of collaboration.

Jarman & Johnson, 1997

Professionals and workers in these groups must adapt, sometimes with (additional) training, to the increased interactions with users that must become the norm. These will extend into areas of the programme cycle not previously exposed to consultation processes.

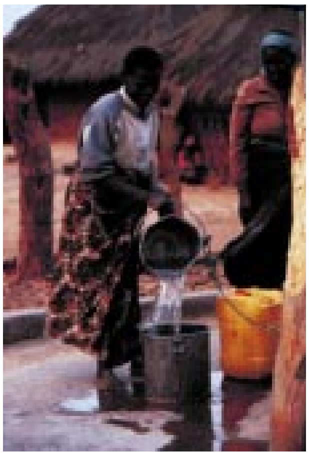
More consultation and interaction should ease the path to shared agendas, for example enabling professionals to illustrate and promote the substantial medium-term benefits seen to arise from a certain WS&S improvement which householders, with pressing daily concerns, might not see as an immediate priority.

In WS&S projects a balance has to be struck at times between an ‘objective’ assessment of aggregate need by professionals and the prioritized demands of communities themselves, not necessarily supported by all local people. An illustration is that sanitation provision is not always a prioritized demand among the urban poor, who may be more preoccupied with earning a daily income than with long- or even medium-term health risks. One approach to developing a shared agenda is to try and stimulate demand, for example through social marketing components of hygiene promotion, which might emphasize issues of dignity, status, and improved property values as much as health (see also Section 2.8). Another is to hold community-level or multi-stakeholder workshops. Whatever techniques are used, raising awareness to stimulate change in behaviour and attitudes is a long-term process which requires skill, resources, and time to work interactively at community level.

The demands of partnership

Not all stakeholders can or want to participate equally at all stages of a programme or project. Pretty et al. (1995) identify seven different types of participation ranging from low-level passive participation where people are simply told what is going to happen and what to do, through to functional participation and self-mobilization where people take initiatives themselves. DFID’s guidelines (1995a) on enhancing

It should be borne in mind that increased participation does not mean continuous participation on the part of all interested partners. Programmes are fluid and can be complex and multi-faceted. They therefore require inputs from and interactions between different partners at different stages of the project cycle.


WaterAid/Jim Holmes

stakeholder participation provide a useful model to assist in thinking through at which points in the programme cycle information, knowledge, and decision-making processes might be shared.

This is particularly important in projects concerned with water and sanitation, where a shared agenda needs to be developed around several issues such as technology choices, the level and location of services, and the deployment of different kinds of expertise. DFID's participation matrix illustrated at the end of Section 3.2.2 (Figure 3.2.1) recognizes that the specific circumstances and purposes of primary and secondary stakeholder participation can shift over the project or programme cycle. For example decisions around the structure and involvement of community-level organizations at various stages, or the procedures for operation and maintenance, require on-going clarification and negotiation. Beyond the information-gathering exercise of many PRA methods, these can extend into decision-making processes and prioritization. 'Planning for Real' (Gibson, 1996) is a version of participatory planning particularly well suited to projects concerned with physical infrastructure and urban services, and it accommodates the steps towards successful partnerships elaborated below.

The starting point for successful partnership is for all participating groups to know that:

- they are recognized and valued;
- they can do some things alone but also need the help of others; and
- they are included in decisions that will affect their work or lives.

Seven steps towards successful partnerships in water supply and sanitation

Professionals and officials look to the ground

1. Learn about communities and the different groups within them, and learn how to relate to them
2. Learn from the knowledge and experience of local actors and respond to their views
3. Explain what you are doing and break down big plans to show local details and how they fit in
4. Negotiate options for technology, siting of installations, cost sharing, and operation and maintenance
5. Agree division of responsibilities with community representatives
6. Explain your limitations and lines of accountability
7. Be accountable to partner communities and stay in regular contact with them

Changes in Professional Training

Capacity-building in public and private institutions

Learning from experience of other projects and sectors

CATALYSING ROLE OF SOCIAL DEVELOPMENT FACILITATION

Learning from experience of other projects and other sectors

Capacity building towards participation for empowerment

Linking local groups and agreeing agendas

7. Be accountable to partner professionals and officials and explain to them who else you are accountable to
6. Agree on a division of responsibility with professionals and officials
5. Negotiate for respect for contributions of money, time, and energy
4. Learn from the knowledge and experience of professionals and officials
3. Share local knowledge with professionals and officials and understand their role
2. Develop local-level skills, self-confidence, staying power and credibility
1. Involve everyone in assessing needs, resources, and assets within the community involving everyone

Local communities set their sights higher


WaterAid/Caroline Penn

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2.2

Further reading

Introductory texts

Cairncross, S., Carruthers, I., Curtis, D., Feachem, R., Bradley, D. and Baldwin, G. (1980) *Evaluation for Village Water Supply Planning*, Wiley, Chichester.

Feachem, R., Burns, E., Cairncross, S., Cronin, A., Cross, P., Curtis, D., Khalid Khan, M., Lamb, D. and Southall, H. (1978) *Water, Health and Development: An interdisciplinary evaluation*, Tri-Med Books Ltd., London.

White, G.F., Bradley, D. and White, A. (1972) *Drawers of Water: Domestic water use in East Africa*, University of Chicago Press, Chicago and London.

These three books represent early examples of interdisciplinary studies of rural water supply, which include a social development perspective. They were pioneering studies and continue to stand the test of time.

Poverty and social development

Beall, J. (1997a) 'Introduction' to J. Beall (ed.) *A City for All: Valuing difference and working with diversity*, Zed Books, London.

Jarman, J. (1997) 'Water supply and sanitation' in J. Beall (ed.), *A City for All: Valuing difference and working with diversity*, Zed Books, London.

A useful introduction to social development issues in an urban context. The chapter by Jarman examines the relationship between poverty and water supply and sanitation in the city, providing best practice examples of interventions.

Gender issues

FINNIDA (1993) *Looking at Gender, Water Supply and Sanitation*, Finnish International Development Agency, Helsinki.

SIDA (1996) *A Gender Perspective in the Water Resources Management Sector*, Swedish International Development Agency Department for Natural Resources and the Environment, Publications on Water Resources No.6, SIDA, Stockholm.

Together these provide a good overview of gender issues as they pertain to WS&S. The SIDA publication is particularly useful in that it provides a checklist in relation to gender at each stage of the programme cycle.

Participation

Dudley, E. (1993) *The Critical Villager: Beyond community participation*, Routledge, London.

Evans, P. (1992) *Paying the Piper: An overview of community financing of water and sanitation*, IRC Occasional Paper No.18, IRC International Water and Sanitation Centre, The Hague.

Narayan, D. (1993) *Participatory Evaluation: Tools for managing change in water and sanitation*, World Bank Technical Paper No.207, World Bank, Washington DC.

These texts are recommended for their analysis and application of participatory approaches in the context of infrastructure projects and water supply and sanitation respectively.

2.3 Health aspects

In the developing world inadequate water supply and sanitation facilities are the prime cause of widespread and serious health problems, but improvements in these services show few health benefits unless they are coupled to improved hygiene behaviour.

Inadequate water supply, poor sanitation, and poor hygiene all offer routes for transmission of faecally contaminated matter, the source of diarrhoea and many other diseases.

The main health benefits of both water supply and sanitation interventions lie in the reduction of faecal-oral diseases, of which diarrhoea, estimated to kill over three million people a year, is by far the most important.

DFID/Howard J Davies

Health is one of the most important reasons for investing in water, sanitation, and hygiene. While the measurement of health improvements is extremely difficult, rigorous studies (Esrey et al., 1985, 1991) have demonstrated conclusively that well-designed projects can make important contributions to health. Experience shows that the provision of water and sanitation technology alone, without changes in hygiene behaviour, will usually achieve little or no significant health improvement. On the other hand, water and sanitation improvements can be the spur to changes in hygiene behaviour (see Section 2.8).

Principles

2.3.1 How water affects health

Water affects health in the developing world mainly through helping or hindering the transmission of communicable diseases such as diarrhoea, scabies, schistosomiasis, and malaria. These diseases are characterized by an infectious agent (e.g. bacteria or parasites), a human or animal host containing these agents, and transmission routes from old hosts to new hosts. Bradley (1972, 1977) and Feachem (1977) developed a useful classification of such communicable diseases affected by water (see Table 2.3.1). The system looks at the ways in which water affects infectious disease transmission, and thus the ways in which water interventions may reduce the burden of disease.

Faecal-oral diseases

This group includes cholera and other diarrhoeal diseases, typhoid, hepatitis A and E, and many other diseases which are spread by people swallowing faecally contaminated matter containing the organisms which cause these diseases. The main health benefits of both water supply and sanitation interventions lie in the reduction of faecal-oral diseases; of all of these, diarrhoeal disease is by far the most important.

Diarrhoea is estimated to kill over three million people every year, the overwhelming majority of whom are children. The toll is not just in mortality, but also in heavy morbidity (sickness); the median frequency of diarrhoea is 2.6 episodes of diarrhoea/child/year for those under five, while the median frequency among infants is five episodes/child/year (Bern et al., 1992). These are median rates, and vulnerable communities will experience much higher rates of attack. Many of these attacks are serious, and all demand time, care, and often money from the family.

Faecal-oral transmission can follow a number of routes as shown in the ‘F-diagram’ (see Figure 2.3.1). Water and sanitation affect transmission in a variety of ways. Sanitation, with good hygiene, acts as a fundamental ‘primary barrier’ by ensuring that faecal matter is disposed of safely, and does not spread in the environment. Once in the environment, however, there are many ways in which infected faecal matter can be spread. Good water supply can support a number

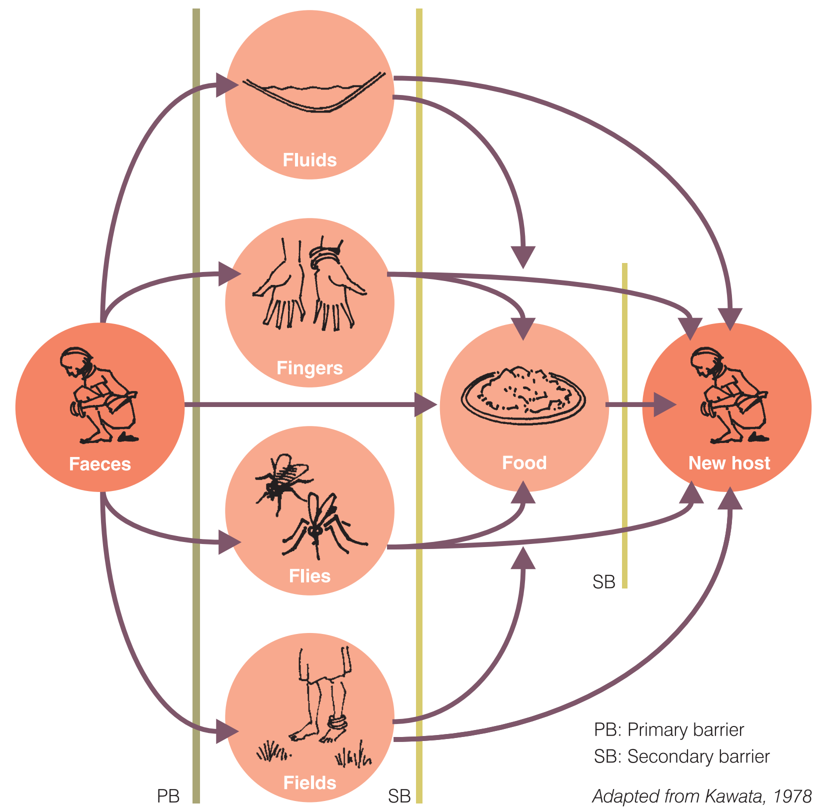
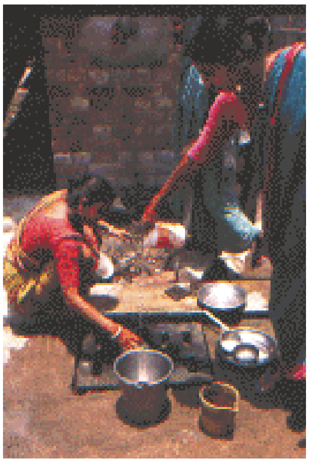


Figure 2.3.1. Transmission of disease from faeces


DFID/Howard J Davies

of the 'secondary barriers', which prevent the further spread of contamination and infection to new hosts.

There are two ways in which water can affect faecal-oral disease transmission. One is through *water-borne transmission,* in which faecally contaminated water transmits the disease-causing organisms directly to the new host. Contaminated drinking water can lead to dramatic epidemics, in which large numbers of people are simultaneously exposed to infection. The second way is through *water-washed transmission*, that is, transmission encouraged by poor hygiene due to insufficient quantities of water for washing. Where water is scarce, it is very difficult to maintain clean hands, clean food, and the clean household environment essential to control many of the other routes of faecal-oral transmission.

Water-washed transmission is not as dramatic as water-borne transmission, as it does not often affect so many people at the same time. On the other hand, the conditions for water-washed transmission are common, and exact their toll every day, whether or not an epidemic is in progress. Water-washed transmission probably contributes more to the endemic (continuous) toll of diarrhoea than does water-borne transmission.

The distinction between water-borne and water-washed is important, because while improving the *quality* of drinking water can reduce

Good water *quality* is important as a faecally contaminated water supply can lead to direct ingestion of disease-causing organisms by many, possibly causing an epidemic. An adequate *quantity* of water, however, is more important in controlling non-epidemic disease, which in fact exerts a higher toll. Increasing the quantity of water available allows better hygiene and can thus prevent disease transmission from faecal contamination of hands, food, or household utensils. Washing hands and utensils in dirty water can still reduce contamination, and is better than not washing them at all.

Adequate quantities of water are relevant to many other diseases. No mortality is generally associated with a range of skin and eye infections but some millions are blinded by the eye infection trachoma; many of these diseases can be reduced by increasing water quantity.

water-borne transmission, increasing the *quantity* of domestic water *used* is the most important way to reduce water-washed transmission. Where water use is low, water-washed transmission is widespread, and simply increasing the quantity of water used, *regardless of its quality*, can be expected to reduce the transmission of faecal-oral disease. Put very simply, washing faecally-contaminated fingers and utensils, even with dirty water, is better than not washing at all. Increasing the quantity of water used by households is probably more important than increasing the quality to reduce the day-to-day non-epidemic toll of disease. Of course, increased water use is not a goal in itself, but an indicator of changes in hygiene behaviour. Under certain conditions it will result directly from improved access to water (see Section 2.3.7). On the other hand, hygiene promotion efforts need to be directed at specific behaviour changes, rather than at an increase in water use *per se* (see Section 2.8.4).

Strictly water-washed diseases

These are the diseases, apart from the faecal-oral diseases, which can be reduced through increasing the *quantity* of water available to households, regardless of its quality. Skin infections (e.g. scabies, body lice, tropical ulcers) and several eye infections (e.g. trachoma, conjunctivitis) fall into this category. Thus, in addition to reducing faecal-oral disease, increasing the quantity of water used in the household will also reduce these infections. Improved sanitation would not be expected to have any effect upon strictly water-washed diseases, except through the control of flies, which have been incriminated in the transmission of eye diseases.

Water-based diseases

These are parasitic infections of humans in which the parasite spends a part of its life cycle in an intermediate aquatic host. The two most significant diseases within this category are schistosomiasis (bilharzia) and guinea-worm. Improvements in water supply can significantly reduce these infections; indeed, water supply is a major focus of the effort to achieve world-wide eradication of guinea-worm.

Water-related insect vector diseases

These consist of a number of insect-borne diseases where the insect (known as a vector) spends a significant portion of its life cycle breeding or biting around water. These diseases include malaria, filariasis, yellow fever, dengue, and onchocerciasis (river blindness.) Domestic water and sanitation projects are *unlikely* to influence such diseases, with the possible exception of filariasis. These diseases, however, should be considered in the planning, development, and execution of large-scale water-resources projects. Good management of urban infrastructure (e.g. solid waste management, drainage, and construction site management) can also can be significant in reducing urban breeding sites for malaria, yellow fever, and dengue vectors.

Chemical contamination

As stressed in the *WHO Drinking Water Guidelines*, many chemical water quality standards (such as those for salinity, iron, and hardness) have evolved in response to such real consumer concerns as taste,

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Table 2.3.1 Summary of Feachem-Bradley Classification of Water-Related Disease (after Cairncross & Feachem, 1993)

Type of water related infection	Examples	Water-related control measures
Faecal-oral diseases	diarrhoea, typhoid, hepatitis, cholera	• increase *water quantity used* • improve *water quality*
Strictly water-washed	scabies, trachoma, conjunctivitis	• increase *water quantity used*
Water-based (intermediate host)	guinea-worm, schistosomiasis	• restrict contact, provide alternative sources
Water-related insect vectors	malaria, filariasis, river blindness	• focus on insect breeding sites (not much scope in domestic water supply)

Table 2.3.2 Inorganic drinking water contaminants of public health significance

Substance	Maximum guideline concentration (mg/l)
arsenic	0.01 (P)
cadmium*	0.003
chromium*	0.05 (P)
cyanide*	0.07
fluoride	1.5
lead*	0.01
mercury* (total)	0.001
nitrate (as NO_3)	50
selenium*	0.01

* *contamination likely to be from artificial source.*
P *provisional guideline*

staining, and excessive soap requirements. These are important, as they will have a significant effect upon the consumer choice of water source, but they are not directly related to health.

The number of chemicals which are both widely distributed and which constitute a significant health threat is fortunately small. Nevertheless, natural contamination by such chemicals as arsenic and fluoride can contribute to very serious health problems.

The main inorganic chemical contaminants of public health concern are shown in Table 2.3.2, although the reader is referred to the *WHO*

As noted in the *WHO Guidelines for Drinking Water Quality*, microbiological contamination is by far the most widespread and serious threat to health from poor water quality. In some cases (e.g. where levels of arsenic and fluoride are naturally high) there may be chemical dangers to which programme planners must be alert, but in most cases a good water supply will benefit users without the need for refined chemical analysis.

An obvious example of the need for balance in this area is the interest in trace carcinogens that can be produced by the chlorination of some source waters; the protection chlorine affords against the deadly 'faecal peril' far outweighs any hypothetical increase in cancer risk.

Guidelines for Drinking Water Quality (1993a) for a complete listing. Those marked with an asterisk are unlikely to be found in these concentrations in natural waters, and usually occur only as the result of artificial contamination (e.g. industrial leachate, lead pipes).

There can be little general guidance on the vast variety of possible organic contaminants from agricultural herbicides and pesticides. Where these are suspected to be a problem, analysis is a worthwhile investment. Where there is no reason to suspect a problem, however, such analysis is unwarranted and far from routine. This point holds in general for chemical hazards. It is not realistic or worthwhile to propose chemical testing of all water sources, especially in rural areas, for possible contamination.

Most pesticides are insoluble emulsions, and tend to sink to the bottom of surface water bodies. They accumulate in the food chain, particularly in bottom-feeding fish. Long before pesticides reach concentrations which constitute a health hazard in water, therefore, they will have reached far greater and more hazardous levels in the fish, and in those who eat them.

Over the past twenty years there has also been growing concern in the engineering community about the formation of trace amounts of carcinogenic organic compounds (for example, carbon tetrachloride)

Table 2.3.3 Some orders of magnitude of the world-wide extent of water-related disease

	Morbidity	Mortality/year
1. Faecal-oral		
diarrhoeal disease	1,000 million episodes/year	3.3 million
cholera	>300,000	>3,000
enteric fevers	>500,000	>25,000
roundworm (Ascariasis)	20–40% rate of infection in developing countries	
2. Strictly water-washed		
trachoma	6-9 million blind	
skin infections	very common, millions	
3. Water-based intermediate host (parasitic)		
schistosomiasis	200 million	>200,000
guinea-worm	1989: 890,000 1996: 35,000 (and still dropping!)	
4. Water-related insect vector		
malaria	300-500 million cases	1.5-1.7 million
filariasis	128 million	
dengue	30-60 million infected/year	

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from the chlorination of drinking water. The risks from such compounds pale into insignificance compared with those from drinking water which is not reliably disinfected, and any claim that an alternative disinfectant to chlorine is safer on these grounds should be treated with suspicion.

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2.3.2 How sanitation affects health

The cycle that leads to faecal-oral disease transmission begins with poor sanitation. Failure to dispose of human excreta safely can contaminate the environment and new victims through a variety of routes. While contaminated water supplies are one route, poor personal and household practices can spread disease in other ways. Even where acceptable sanitation facilities are installed, the risks are not eliminated, as poor hygiene can still spread disease through a variety of faecal-oral routes.

Sanitation, defined in these guidelines as 'the safe management of human excreta', naturally has its greatest impact on excreta-related diseases. The chosen definition of sanitation rightly includes both 'hardware' and 'software' components, as effective interventions need to stimulate both the construction of sanitary *facilities* for excreta management, and their hygienic *use*.

Understanding the health aspects of sanitation requires some understanding of the types of diseases involved, how they are transmitted, and how sanitation hardware and hygiene promotion are likely to affect them. The classification described below was developed by Bradley and Feachem (Feachem et al., 1983), and this summary follows closely that of Cairncross and Feachem (1993).

Faecal-oral diseases

These diseases, described earlier by the 'F-diagram' (Figure 2.3.1), are among the most obvious targets of sanitation for health; they are endemic throughout the developing world. The effectiveness of sanitation as an intervention in reducing faecal-oral diseases can vary substantially with the required dose for infection. Bacterial infections, such as cholera, often involve large infective doses, and these are naturally more susceptible to control through sanitation than other diseases, such as polio or hepatitis, which require only a small dose to spread the disease. Many of the faecal-oral diseases (e.g. salmonellosis) involve transmission cycles that can pass through animal hosts, which therefore limits the benefits of controlling only human excreta. Controlling human wastes will do little good if the disease can be spread by the excreta of chickens in the household.

Soil-transmitted helminths

Sanitation alone has its greatest impact on parasitic worm infections. These diseases, like the faecal-oral group, are endemic in the developing world and can be significantly reduced by eliminating excreta or sludge disposal on the ground around habitations, including areas accessed by pigs and cattle.

These are parasitic worm infections where the eggs, passed in human faeces, require some time in favourable conditions, usually moist soil, to mature and become infective. These diseases include roundworm, whipworm, and hookworm, which are debilitating diseases that can contribute to malnutrition and can become severe conditions in their own right. These diseases are widespread throughout the developing world. Good sanitation facilities, which are regularly cleaned, can make a significant contribution to the control of these diseases; a poorly maintained latrine, however, can actually become a focus of infection.

Beef and pork tapeworms

These tapeworms require a period in the body of an animal host before they re-infect humans when the animal's meat is eaten without being cooked sufficiently . Any system which prevents pigs and cattle from eating untreated excreta, or grazing on soil contaminated by fresh sewage or sludge, will therefore control the transmission of these parasites.

Water-based helminths

This group is the same as the 'water-based intermediate host' group described for water, with the exception of guinea-worm, which is unrelated to excreta management. The most important member of this group is schistosomiasis. Since one worm can multiply in the snail host to produce thousands of larvae each day for over a year, faecal contamination must be practically eliminated to reduce transmission. Under these conditions, restricting human contact with water (e.g. through provision of convenient water supplies) is likely to be far more effective than sanitation alone.

Excreta-related insect vectors

There are two groups to consider. Firstly, *culex* mosquitoes, which do *not* transmit malaria but can transmit filariasis, breed extensively in septic tanks and flooded latrines. Secondly, flies and cockroaches often thrive on excreta and have been implicated in some transmission of faecal-oral disease. Mosquitoes, flies, and cockroaches all constitute a great nuisance, and poor urban households have consistently been shown to spend substantial amounts of their scanty household income on using control coils and nets.

Table 2.3.4 Sanitation-related disease, and the likely effects of interventions (after Cairncross & Feachem, 1993)

Category	Examples	Dominant transmission mechanisms	Likely effect of sanitation hardware alone	Likely effect of hygiene promotion alone
Faecal-oral (non-bacterial)	Hepatitis A Amoebic dysentery Rotavirus Giardiasis	Person-to-person contact Domestic contamination	Negligible (as very low infective dose required)	Moderate
Faecal-oral (bacterial)	Cholera Salmonellosis Shigellosis Many forms of diarrhoea	Person-to-person contact Domestic contamination Water contamination Crop contamination	Slight to moderate	Moderate
Soil-transmitted helminths	Hookworm Roundworm Whipworm	Yard contamination Communal defecation areas Crop contamination	Great	Negligible
Tapeworms	Beef tapeworm Pork tapeworm	Yard contamination Field contamination Fodder contamination	Great	Negligible
Water-based helminths	Schistosomiasis	Water contamination	Moderate	Negligible
Excreta-related insect vectors	Filariasis Some faecal-oral diseases	Insects breed or feed in sites of poor sanitation	Slight to moderate	Negligible

Experience shows that WS&S hardware improvements, without effective hygiene promotion, are not enough to improve health significantly among poor communities. Making water available in or near the house leads to a natural increase in washing, but other beneficial changes to hygiene behaviour require other forms of promotion.

In 1992, an informal WHO working group reviewed epidemiological literature and field experience in hygiene promotion, and identified three areas where particular attention should be focused:

- the safe disposal of children's stools;
- the washing of hands with soap after defecation and before touching food; and
- the safe storage of water in the household.

WHO, 1993b

The above classification summarizes the various ways in which sanitation can affect health. The faecal-oral group exacts by far the heaviest toll in human health of all the sanitation-related diseases, followed by the soil-transmitted helminths. While the above discussions only promise 'moderate' success in their control, this is far more significant than much greater success in controlling much rarer diseases.

2.3.3 How hygiene affects health

Hardware by itself cannot improve health very much; what matters is the way in which it is *used*, and the ways in which it *may promote changes in hygiene-related behaviour*. In some cases this change is fairly automatic; people across the world need little encouragement to increase the amount of water they use for washing once it is readily available at the household level. In other cases, however, a significant amount of time and effort is required to alter hazardous practices which are considered 'safe', or are simply not thought about.

Even after substantial investments have been made in water and sanitation hardware, hygiene behaviour in these areas often remains a substantial risk to health. In many cultures, for example, the excreta of young children are considered safe, and are thus not treated with the same hygienic concern as the excreta of adults. In fact, as children are the main victims of faecal-oral diseases, they are consequently the main reservoir of infection. This means that the faeces of children are more infectious than those of adults, as they are more likely to contain the disease-causing organisms.

The practice of washing hands with soap after defecation is another example of a behaviour that does not follow 'automatically' from the provision of hardware, and yet which has major health implications. A classic study by Khan (1982) in Bangladesh showed that the simple practice of washing hands with soap after defecation was sufficient to reduce the secondary attack rates of dysentry within participating families by 85 per cent. Similarly, B.C. Deb et al. (1986) examined transmission within families with one proven case of cholera. Some families were provided with a traditional *sorai* water storage container with a small diameter inlet and outlet which does not permit users to dip into the storage container; control families used the more widespread practice of dipping into a common bucket. The rate of cholera transmission within the families with the *sorai* was 75 per cent lower than that in the families using conventional water storage and dipping. While such an intervention may not have much impact on transmission *between* families, it is a simple, effective, and low-cost intervention to reduce transmission within the family (see Section 2.8.7).

2.3.4 Epidemiological summary of WS&S interventions

Esrey and colleagues (1985, 1991) have been involved in a number of reviews of the epidemiological literature of water and sanitation. These reviews have demonstrated a wide range of results for superficially similar interventions. Some discrepancies may arise from poor study design and an inability to control for such variables as hygiene and socio-economic status, while others may stem from the very complexity of the problem and the variety of transmission routes and disease-causing organisms. Esrey's results for the relatively few rigorous studies which were felt to be relatively free of methodological error are summarized below.

Table 2.3.5 Diarrhoeal morbidity reduction from WS&S (Esrey et al., 1991)

	Rigorous studies	
Type of intervention	No. of studies	Median % reduction
Water and sanitation	2	30
Sanitation	5	36
Water quality and quantity	2	17
Water quality	4	15
Water quantity	5	20
Hygiene	6	33

Looking at the effects of water supply improvements on other diseases, Esrey found the following:

Table 2.3.6 Effects of improved water supplies on non-faecal-oral disease

Disease	No. of rigorous studies	Median reduction in morbidity	Range
Guinea-worm	2	78%	75-81%
Schistosomiasis	3	77%	59-97%
Trachoma	7	27%	0-79%

Adding good hygiene to WS&S interventions is not the end of the story. Lack of attention to other aspects of community environmental health can detract from or nullify the intended benefits. Poor solid waste management encourages rats, flies, cockroaches, and other vectors of disease. Uncontrolled waste tips in poor areas often contain faecal matter and are fertile breeding grounds for pests. Indiscriminate rubbish dumping can lead to blocked drains and overflows.

Note that guinea-worm is the only one of these water-related diseases where water-quality was significant to the intervention; the benefits of water supply improvements in reducing schistosomiasis stem from reducing contact with infected bodies of surface water, and the reduction in trachoma resulted from increased quantities of water allowing better personal hygiene.

2.3.5 Health aspects of other components of environmental sanitation

There is more to environmental health than water supply, sanitation, and hygiene. In developing countries, the other main environmental health measures include drainage of surface water and sullage, solid waste management, and vector control. These will only be discussed in these guidelines as they relate to water and sanitation interventions.

Drainage

No sanitation system can be considered 'safe' if the area it serves is poorly drained. *Any* sanitation system (sewer, septic tank, pit latrine, or other) can become a source of faecal contamination when flooded, as the flood waters will mix with the excreta and spread the

In adequate drainage of surface water and sullage can lead to local flooding and spread of waste from foul sewers, septic tanks or latrines.

Sometimes the best investment in drainage is better solid waste management.

Where improving community health is a major objective for a WS&S intervention, appropriate health specialists need to be involved from the beginning. Unless health issues are properly reflected in the project design from the start, technical planners are unlikely to achieve significant improvements in community health.

contamination wherever the water flows. 'Sullage' consists of domestic water exclusive of toilet waste, but this does not mean that it is safe; water used for cleaning clothes and nappies can be heavily contaminated with the same disease-causing organisms that sanitation is intended to control. 'Runoff' consists of the portion of rainfall that runs off the surface during or after a storm. Sewers are often designed to drain all three liquid wastes (toilet wastes, sullage, and runoff) but they can be very expensive. Regardless of the technical option chosen for sanitation, both runoff and sullage need to be disposed of safely if a sanitation system is to be considered complete.

Solid waste management

Piles of rubbish in the streets or at dump sites can provide a habitat for rats and flies, and thus contribute to the spread of a number of diseases; rats are major vectors of plague, leptospirosis and other infections, and flies are one of the transmission routes in the F-diagram for faecal-oral disease. In addition, tin cans and tyres can contribute a significant breeding ground for *Aedes* mosquitoes, which transmit dengue and yellow fever. Apart from these direct health impacts, solid waste is also linked to the faecal-oral transmission route in a number of ways.

First, where sanitation is poor, faecal matter can often be a significant fraction of 'solid waste'. In Lucknow, for example, DFID-funded studies of sanitation and solid waste estimated that the contents of 'dry latrines' contributed 30 to 40 tonnes/day or five per cent of the total mass of the solid waste chain; this excludes the faeces discharged to the small and large drains of the city. Given the lead time required for replacement of dry latrines with more sanitary options, it was clear that attention had to be directed to the solid waste system in the short run to address the inherent health risks.

Secondly, unmanaged solid waste usually ends up blocking surface water drains or sanitary sewers, and thus contributes to flooding and the faecal contamination described earlier. Sometimes the best investment in drainage is better solid waste management.

Vector control

Many municipalities have a group that is responsible for pest and vector control. These operations are primarily aimed at reducing the hazards from mosquito-borne and rat-borne diseases. As mentioned earlier with regard to excreta-related insect diseases, septic tanks and flooded latrines can become a focus of *Culex* mosquito breeding, and construction sites can become 'temporary' (but dangerous) breeding grounds for malaria-carrying *Anopheles* mosquitoes. Consultation with the vector control staff at the municipal level can help to establish how serious these problems may be on a given project, and may forestall the possibility of water and sanitation 'improvements' actually making the situation worse.

Public and domestic domains

In thinking about environmental health, it is helpful to distinguish between the *public* and *domestic* domains of transmission. The domestic domain is defined as the area normally occupied and under the control of a household, while the public domain includes public places of work, schooling, commerce, and recreation, as well as public infrastructure, streets, and fields (Cairncross et al., 1996). Whereas transmission in the public domain can allow a single case to cause a large epidemic, transmission in the domestic domain, while less dramatic, can account for a substantial number of cases and a significant fraction of endemic disease. Infection in the public domain is relatively widespread and indiscriminate, whereas infection in the domestic domain is characterized by clustering around those households where sanitary conditions, for whatever reason, are poor.

Work done in Brazil (Moraes, 1996) studying ascaris (roundworm) and other worm infections found that the provision of drainage (which also acted as sanitation) reduced the overall level of infection. The work also suggested that as the infection level dropped, it tended to become more clustered by household. The results thus suggested that drainage made wastewater contamination of the streets less common, and reduced infection in the public environment. Once the public transmission had been reduced, however, the residual transmission between household members in the domestic environment became relatively more important.

There is a temptation when dealing with public services and public health to focus on the public domain, and this may well be a suitable first priority. The studies showing the benefits of hygiene in improving health, however, illustrate the critical role of promoting health at the household level as well as in the public environment.

Practice

DFID/Howard J Davies

How do the above principles translate into practice? What are the aspects of water and sanitation projects and programmes that are most important to consider in practice to maximize health? As shown above, the requirements for improved health involve good hardware and good software; providing reliable, effective, and low-cost hardware are described in Sections 2.5, 2.6, and 2.7, while the application of health principles to hygiene and sanitation promotion is described in Section 2.8. Given the detailed coverage in these specific areas, there are only a few fundamental points of practice to reiterate here.

2.3.6 Think about health from the start

A common difficulty in any multidisciplinary activity is the temptation for members of one discipline with a strong interest to develop most of the project, while involving the other disciplines only in the later stages of the work. This can be particularly troublesome when activities with a substantial lead time (such as the data collection and training of hygiene promoters, or the establishment of systems to develop and market low-cost sanitation options) are ‘invited’ into the project only in the later stages, when fundamental decisions about the level of service and the types of intervention have

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already been made by the 'lead' stakeholders. If health benefits are likely to be a major justification of the project, it is critical that competent public health specialists be involved from the outset to assess the scope and plausibility of these health benefits. These specialists can then contribute to the development of relatively low-cost project or programme activities which can ensure that such benefits are maximized. As with any discipline, it is easier to contribute when involved from the beginning than if added in as a 'bolt-on.'

2.3.7 Focus on quantity as well as quality of water supply

Quantity, as well as quality of water must be a focus of attention.

When water is brought within easy reach of the household water use increases dramatically. When water is further away or involves a return trip travel time exceeding half an hour water consumption drops off. (Note that queuing can be a significant contribution to this time.) Between these two extremes, however, water consumption is surprisingly constant and does *not* vary substantially when the return trip travel time is in the approximate range of three to thirty minutes. Reducing tap spacing in this range reduces drudgery and work and saves time but will not lead to increased water consumption and resultant health benefits.

It is intuitively clear that the quantity of water a household will actually use must somehow be related to its distance from a water source; we would all expect households with house connections to use more water than households an hour away from the nearest source of water. While this intuitive perception is certainly true, detailed water use studies carried out in the 1970s and 80s have reached a surprising consensus on water-use patterns between these extremes. Cairncross (in Cairncross & Feachem, 1993), developed the diagram below as a summary of the results of these water-use studies in East, West, and Southern Africa, Nicaragua, India, Sri Lanka, and Bangladesh. (While the exact levels of the graph vary from site to site, the shape and 'turning points' are similar at all sites. It has been noted — e.g. by Thompson (1998) — that the 'water consumption versus tariff' graph is conceptualy similar, and in fact has been observed to have a similar shape.)

Schemes which increase the number of public taps, in either rural or urban settings, but only move residents 'along the plateau' of the consumption vs. travel time graph, will *not* increase water consumption at the household level, regardless of how much water is available at the tap. Such an intervention cannot be expected to reduce water-washed transmission of disease, and therefore can claim relatively few direct health benefits. By contrast, schemes which permit more house connections, or which reduce long travel times to below half an hour, can be expected to lead to increased water

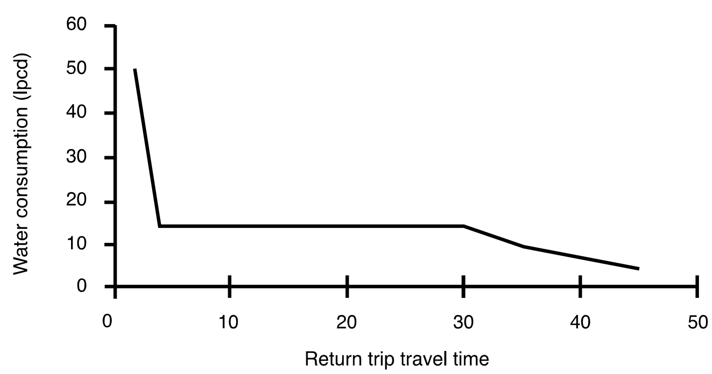

Figure 2.3.2. Water consumption vs travel time

consumption, and a reduction in water-washed disease. This principle is reflected in the policies of a number of organizations; WaterAid, for example, has as one of its main criteria for appraisal of rural water schemes the reduction of travel times from very distant sources.

2.3.8 Focus on changes at the household level

Programmes intended to improve environmental health must be driven by the impact they have at the household level. This is where most people (especially children) spend most time, and are most vulnerable to contamination. Unless improvements can be shown to have an impact at the household level, they are unlikely to improve health.

Changes to centralized infrastructure are unlikely to improve health unless they reduce contamination at the household level. People are likely to be most at risk from contamination when it is present in places where they spend the most time. One way to see this in an urban context is to think about the environmental priorities of many city-dwellers. The first environmental priority for most families is a clean and pleasant household, followed by a better environment in their street, followed next by a cleaner neighbourhood; only after these are all satisfied can there be much real concern over the city-wide environment and beyond (see Figure 2.3.3). This ranking is similar to the priorities from a public health perspective, which stresses the need for a clean and hygienic environment where people spend most of their time. In particular, the age distribution of sickness and death associated with poor water and sanitation stresses the need to look at where *children* become infected, and where *children* spread infection.

The health benefits of sanitation also reflect a household focus. A number of studies have shown that health benefits accrue to families who have latrines, even where neighbours do not. So, there is no minimum threshold of coverage required to achieve health improvements. The improvements are synergistic, however; additional benefits will accrue if the whole community is covered. ‘Coverage’ here, however, refers to household sanitation. Communal or public latrines are invariably either poorly maintained or else too costly to attract the most vulnerable; poorly maintained public latrines are a definite health hazard.

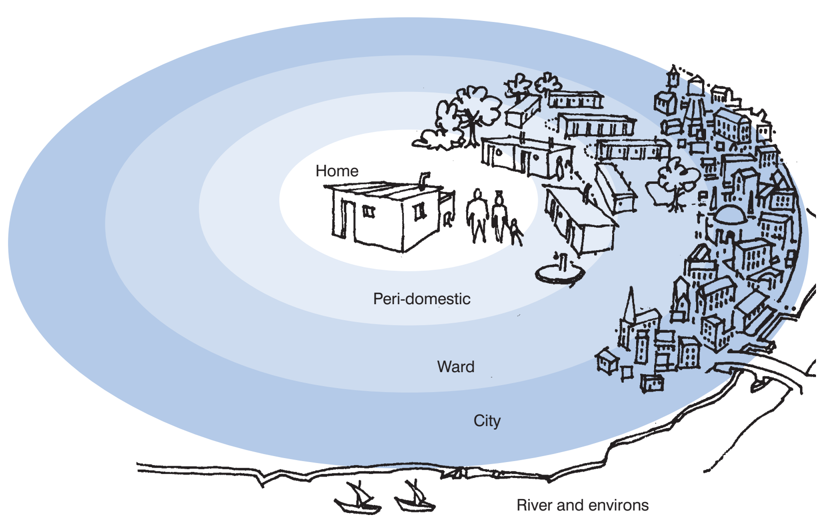

Figure 2.3.3. Environmental priorities of city-dwellers

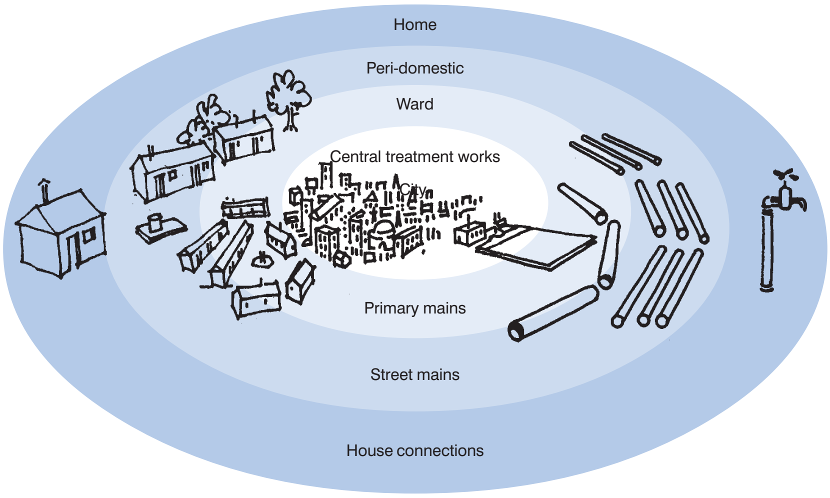

Figure 2.3.4. Environmental priorities of engineers and planners

This focus on the household can seem odd at first glance to the professional engineer, who may see instead that the whole system is dependent upon the centralized treatment works, or the functioning of the primary mains or sewers (see Figure 2.3.4). It is fair to say, however, that unless investments in such centralized resources reduce risk at the household level, they will not contribute to health. Investing in a water treatment system where intermittent distribution could result in re-contamination before water reaches the household, for example, offers little hope of improving health. A focus on the need to change practices at the household level also means that more effort must be spent on hygiene and sanitation promotion, and on ensuring that the services offered are what individual householders want (see Section 2.8.2).

2.3.9 Seek improved health indicators, rather than improved health statistics

Health impacts from WS&S interventions are notoriously difficult to assess. There are too many random variables to gain reliable information from statistics-based surveys. Better results come from observing practical outcomes such as the use and maintenance status of facilities, or improvements in hygiene practice.

Esrey's studies cited above, and earlier work by Blum and Feachem (1983), stress the enormous difficulty of managing rigorous studies that *prove* a health improvement is attributable to a water and sanitation intervention. Seasonal effects, the community-wide nature of the intervention (variations between health statistics in villages may well be due to chance), the difficulty in establishing controls, the epidemiologically short timeframe of most development projects, and the ever-present risk of confounding, make the epidemiological 'proof' of health benefits a far larger task than should be reasonably attempted in a development project. (For example, what kinds of people build latrines? Those who are more concerned about hygiene. It may not be surprising that they are therefore healthier than those who do not.)

Instead, it makes sense to look for practical indicators that point the way to changed health. Are the facilities in good order? If so, are they being used? If they are being used, have they contributed to changes in hygiene? The answers to these questions are much more reliable and sensible than most health statistics, especially where most diarrhoea goes unreported, and variations between seasons and years (with the odd epidemic) may contribute too much confusion to the analysis.

The logical frameworks for urban and rural projects in the Appendices include appropriate proxy indicators for health.

Further reading

Cairncross, S. and Feachem, R. (1993) *Environmental Health Engineering in the Tropics*, 2nd edition, Wiley, Chichester.

The first chapter of this book presents, in clear and simple terms, the basic issues of environmental health in developing countries, particularly those associated with water and sanitation. The remainder of the book describes the variety of engineering interventions developed to control these problems, and makes the necessary link between engineering intervention and health. Practical issues of management, institutions, and cost are also described.

Feachem, R., McGarry, M., and Mara. D.D. (eds.) (1977) *Water, Waste, and Health in Hot Climates*, Wiley, Chichester.

Although slightly dated, this book still has much to offer in its broad interdisciplinary perspective, and its realistic recognition of the financial, institutional, and economic constraints upon the improvement of water and sanitation in developing countries.

Hardoy, J.E., Cairncross, S. and Satterthwaite, D. (eds.) (1990) *The poor die young*, Earthscan, London.

An integrated review of the relationship between housing, infrastructure, and health among the poor in urban areas of the developing world. The book explores both the housing and health conditions in which the urban poor find themselves in different parts of the world, and the types of interventions most realistic for improving these conditions. The book is written for the general interested reader, and no previous technical knowledge is assumed.

Webber, R. (1996) *Communicable Disease Epidemiology and Control*, CAB International, Wallingford.

A clear and complete introduction to the issues of communicable disease control from the perspective of a public healthworker. Although this book was principally written for doctors working in rural areas in developing countries, the approach, text, and drawings are clear enough for the interested non-specialist; no engineer should be afraid to read it! The roles of water and sanitation are clearly recognized and explained.

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2.4 Environmental sustainability

Threats to water sustainability revolve around quality and quantity issues. Increasing demands from industry, agriculture and from the domestic sector place an increasing strain on natural water bodies. Also the proportion abstracted but not consumed contributes a similar threat. Untreated or poorly treated return flows to water bodies lower quality and reduce the net availability.

The inherent self-cleansing capabilities of surface waters and unsaturated ground layers above aquifers have, in the past, allowed them to cope with and degrade the wastes they have traditionally received. Increasing population, urbanization (concentrating polluting inputs), and industrialization (more wastes and less bio-degradable wastes) have stretched these powers to their limit.

Chapter 18 of *Agenda 21* gives a high priority to the 'protection of water resources from depletion, pollution, and degradation'. The emphasis given to the protection and conservation of water resources reflects a growing recognition that freshwater is becoming more and more scarce and that neglect of pollution control threatens the sustainability of future resources. Environmental resources may also need protection for their own intrinsic value (e.g. protection of biodiversity), and also because they represent an important economic commodity (e.g. lagoon/coral reef areas are opportunities for tourism which represent significant employment opportunities in many developing countries).

There are therefore issues of water *quantity* and water *quality.* The case for the integrated management of water resources is unchallengable. This means that WS&S programmes have to be considered alongside plans for water use in agriculture (irrigation is the major user of water resources in developing countries) and industry, and for the protection of water ecosystems.

The environment, and particularly the water environment, has been used as a disposal site for waste products for generations. Water can dilute and disperse a high volume of potential pollutants, and the aquatic environment can treat some wastes (water courses, for example, have a reaeration capacity). However, it is important that this capacity for self-treatment is not exceeded, and as communities grow and develop, the natural capacity for self-treatment will be limited. It is important that the environmental impact of developments, the management of water resources, and pollution control measures are addressed at early stages of developmental projects.

DFID programmes and projects are normally subjected to environmental appraisal in order to confirm that they meet the requirements for environmentally sustainable development. General procedures for undertaking appraisal are set out in the *Manual of Environmental Appraisal* (ODA, 1996b), and this appraisal is often carried out at the same time as social impact analysis (see Section 2.2).

The objective of this section of the *Guidance Manual* is to highlight environmental perspectives which are specifically relevant for WS&S projects. To provide a framework for discussion, environmental sustainability is initially discussed in terms of *water quantity* and *water quality*, although in practice of course these issues need to be considered at the same time for resources to be used sustainably.

These threats allied to the increases in demand from all sectors intensify the competition for water. Governments must therefore take decisions on allocation and can only do so rationally by associating demand with availability in an overall strategy, usually termed an Integrated Water Resource Management plan.

Within these plans allocation of water for drinking and personal hygiene is usually afforded top priority, but may still be threatened by high levels of overall demand.

The commended integrated water resources management approach extends to community level too. Communities live with the multi-purpose nature of water and can be motivated to protect catchments from pollution and look after water intakes. They must be encouraged too to conserve and not waste the water they are allotted.

Principles

2.4.1 Water quantity and resource management

Water in the earth's hydrosphere is part of a very active natural recirculation system with a relatively small available reservoir. Solar energy is the driving force behind the various reactions which occur in the cycle. If the water balance is to be sustainable in a river basin or sub-basin and its underlying aquifer, then the competing demands on the use of the available resources need to be managed.
In planning for the management of water resources, the demand for water must be balanced with the water resources available. Water resources need to be considered holistically — and these considerations are often brought together in an *Integrated Water Resource Management (IWRM)* plan or strategy (also known as a catchment management or river basin plan). See Section 2.4.4.

Water uses and allocation

There are many demands on water resources. These may be consumptive (WS&S, agriculture, industry, and ecosystem maintenance), as well as non-consumptive (hydropower generation, fisheries, and navigation).

Governments have to allocate water resources among competing users and, in many cases, this task is made much harder by a lack of knowledge of the true yields of rivers and aquifers. That is why water resources assessment is a key element in IWRM strategies.

The quality of individual water resources will influence their potential uses. Both allocation strategies and river water quality objectives are influenced by the need to match quality with purpose.

When allocating water resources a *water use classification scheme* is helpful. Such a classification may vary from one country or region to another depending upon location-specific factors, but a typical general use classification, in decreasing order of water quality requirements, would be:

1. public water supply
2. fishing
3. industrial water supply
4. irrigation
5. recreation and amenity
6. navigation and power generation
7. wastewater disposal

The ranking of importance of individual uses will change with circumstances, but public water supply is usually seen as the most demanding in quality. This is not because highly polluted waters cannot be treated to provide a potable supply, but rather to emphasize the value of providing multiple barriers between potential contaminants of a water source and its use for potable supply. Abstraction of highly polluted water for potable supply will necessitate complex and costly treatment processes which could fail and allow contaminated water into the distribution system.

DFID/C J Oxlee

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Irrigation, the prime area for water savings, is also a matter for national governments to address. Food imports and bulk storage provision are seen as a favourable alternative to reliance on local production in high water-loss irrigation systems.

2.4

In developing countries, agriculture is by far the biggest water consumer, accounting for as much as 90 per cent of total consumptive use. The rest is about equally divided between industrial and domestic consumers. The total consumption of all three elements is increasing. While it may be appealing to WS&S proponents to say that the greatest potential for savings is in the irrigation sector, the fact remains that inefficient water use, wastage, and pollution have to be tackled by each sector. No-one disputes that water for human consumption has to be the top priority in allocating resources, but that does not remove the need to manage it efficiently and avoid waste.

The allocation priority of a water supply is crucial for WS&S programmes in situations where water shortages occur at some time of the year. Increasingly, the growing demand for domestic water supply will necessitate reducing existing allocations of high quality water to irrigation systems where it has a relatively low economic value per cubic metre. The relative amounts involved are illustrated by the fact that a flow of 1 litre/second is needed to irrigate just one hectare of land, but sufficient to provide domestic water supply for 1000 people. There are strong vested interests in existing irrigation systems, however, and these will need careful political handling (government departments, commercial farmers and businesses, and large numbers of small farmers who rely on irrigation). Food security is a high political priority in many countries, but there is a growing belief that where water is scarce, security is best achieved through food imports and storage facilities (the term ‘virtual water imports’ is being used for this alternative to heavily subsidized irrigation).

In relation to specific community WS&S systems, the critical point is that the community or the water utility has the right to abstract the required amount of water, which should be recognized in the overall planning and management of water resources. The amount may be small, but it is a priority and must be protected.

Governments and utilities can promote community efficiencies with appropriate charging systems.

Governments in turn may promote utility attention to leakage prevention and other aspects of water saving by appropriate charging for bulk abstractions.

Water pricing issues arise in water allocation and also in demand management. Demand management plays an important role in reducing inefficient consumption of water (for example leakage from pipes and excessive use by some consumers) and encouraging water conservation. There are also very good reasons why water utilities need to demonstrate efficient use of potable water, including the need to recover costs from consumers. Note however that WS&S programmes should generally be trying to *increase* water consumption by the poor, for the important health reasons described in Section 2.3.

Water availability

The water resources which provide supplies for all the uses given in the previous section may be summarized as:

- surface waters in streams and rivers, village ponds, lakes, and reservoirs
- groundwater in aquifers and rocks, and emerging to the surface in springs
- rainwater, recharging both surface water and groundwater, but also a resource itself in roof catchment and water harvesting systems

There is clear evidence that the dwindling availability of renewable water per head of population is bringing an increasing number of countries into conditions of such scarcity as to limit their potential for economic development. Better allocation and increased attention to efficiency in all sectors is vital; it is also essential that, whatever the pressures, the priority given to public water supply is maintained so that the extension of water supplies to the poor is not hindered.

These resources are not uniform or static. They vary in quantity and quality over the annual cycle and from place to place. Quantity also varies from year to year and over longer time periods, and climatic change is predicted to increase variability and uncertainty.
A rough measure of water scarcity in a country is the total amount of renewable freshwater per person per year. Hydrologists say that water stress starts to occur when the average is below 2,000m^3 per person per year (about the UK figure). Scarcity becomes evident at 1,000m^3 per person per year, which is the figure in a growing number of countries in sub-Saharan Africa.

As the stress gets more intense, so does the competition for water and the need to use it efficiently and protect it from contamination. The stress is growing all the time. In the 1997 *Comprehensive Assessment of the Freshwater Resources of the World*, the UN Secretary-General summarized the position as follows:

> 'There is clear and convincing evidence that the world faces a worsening series of local and regional water quantity and quality problems, largely as a result of poor water allocation, wasteful use of the resource, and lack of adequate management action. Water resources constraints and water degradation are weakening one of the resource bases on which human society is built.
>
> Water use has been growing at more than twice the rate of the population increase during this century, and already a number of regions are chronically water short. About one-third of the world's population lives in countries that are experiencing moderate to high water stress partly resulting from increasing demands from a growing population and human activities. By 2025, as much as two-thirds of the world population will be under stress conditions.
>
> Water shortages and pollution are causing widespread public health problems, limiting economic and agricultural development, and harming a wide range of ecosystems.'

In the end economic development depends on increasing industrialization. Developed countries have learned that this puts a double strain on water resources: rising demands for process water and more discharge of polluting wastewater. The adverse impacts of these trends, falling aquifer levels and dried river beds amongst them, have become evident and are belatedly being addressed. For these reasons water re-use and recycling practices have progressed rapidly in the industrialized world. There is a need for similar approaches as part of demand management and water conservation in the developing countries.

The long-term growth in water consumption has arisen from irrigation development, industrialization, urbanization, tourist development, population growth, and increased per capita demand. Associated wastes also pollute water resources, reducing the quality and hence the quantity of freshwater available for WS&S.

Groundwater abstractions which are greater than the natural recharge inevitably cause a continuing fall in groundwater levels. Surface water abstractions which are greater than the natural flow cause dry river beds downstream, but disturbance to natural ecosystems, including fisheries and wetlands, will occur long before the withdrawals become so large. These are examples of non-sustainable use of water, and are like the mining of any non-renewable resource. At a time of climate change it is difficult to estimate long-term replenishments with confidence, and a factor of safety needs to be applied in critical

Groundwater sources are to be preferred for water supply; compared to surface sources they are cleaner, and in some cases may be useable without treatment. If the community is encouraged to protect the borehole or well catchment zone from pollution the source will remain clean.

The safe disposal of waste on the household plot prevents the pollution of adjacent areas and streams.

Saline intrusion

Saline intrusion can occur in aquifers which outcrop into a body of saline water (usually the sea, but possibly a saline lake). An interface is formed in the aquifer between freshwater and salt water. The position of the interface depends on the water table depth, and pumping at a higher rate than the aquifer is recharged at will lower the water table, forming a hydraulic gradient which moves the salt water interface inland. This can lead to wells becoming saline and unusable.

Therefore it is particularly important in coastal areas to monitor abstractions, groundwater tables, and water quality (electrical conductivity).

circumstances such as where over-abstraction would cause saline intrusion to an aquifer.

WS&S water management

Any WS&S system needs to have a sustainable supply of clean water, and a safe means of disposing of wastes. For WS&S projects in rural communities, local groundwater is the most widely used source of clean water supply, often replacing traditional surface water sources. Wastes are disposed of on the household plot (e.g. in latrines), replacing traditional use of nearby fields or streams.

As Section 2.7 makes clear, these are likely to remain the most cost-effective solutions for poor people, so it is important to ensure that they are also environmentally sustainable, by taking care to prevent pollution of the groundwater resource. A major factor favouring groundwater as a source for drinking water is that in its natural state it is more protected than surface water and it can generally be used without treatment.

WS&S services for the urban poor may follow the same pattern as for rural communities, especially in peri-urban areas and small towns. In many cases however (e.g. inner-city slums) water may need to be supplied from a city-wide utility which abstracts large quantities of water from major surface water or groundwater sources. Similarly, wastes may be removed by drains and sewers connecting to major systems and discharged to surface water bodies with or without treatment.

Most of the water abstracted for WS&S will be returned, although with some deterioration in quality and not necessarily to the same basin.

One other key experience is that conventional water-borne sewerage is expensive, in both money and water. It may be an enforced option for WS&S projects in inner-city areas, but in rural locations and wherever possible elsewhere, on-plot sanitation is the favoured cost-effective choice.

Using water to carry human and industrial waste discharges through sewerage systems places heavy demands on water resources. Its almost universal use in developed countries does not mean that it should be an automatic choice in all situations, and it will rarely be a cost-effective solution for the poor.

Water and wastewater treatment processes are themselves heavy water users, and this needs to be taken into account. So does the potential for leakage in water distribution networks. A water treatment plant may use up to 10 percent of its throughflow in process operations, and leakage from large distribution networks in developing countries

Conventional sewerage and sewage disposal

The conventional industrialized-country approach to sanitation is to provide conventional sewerage and off-site treatment. This has several disadvantages:

- It uses potable, treated water in large quantities for a use where it is not required.
- By using water as a carriage medium away from the source of defecation it changes the fundamental nature of sanitation from what can be a localized, dry-disposal problem to a remote and very much larger one.
- Conventional remote treatment does not use the resource potential of the sewage — rather than seeing the nutrients and water as a resource, it treats them as a problem.
- It is expensive.

There are a lot of advantages of on-site sanitation. From a health perspective the important aspect is to have any form of usable and reliable sanitation facility to separate humans from excreta. From an environmental perspective, the implications of a malfunctioning or inoperative centralized system are worse than the implications of on-site sanitation.

However, there will be situations where on-site sanitation is not possible or desirable. Alternative sewerage systems which optimize water conservation (such as small bore or shallow sewers), systems which use non-potable water (such as seawater) as the carriage medium, and which optimize recycling and re-use, are available and should be considered. See Section 2.7.22.

may be as high as 50 per cent of input (though this should be seen as a signal for action, not a basis for design!).

Planning: Integrated Water Resource Management (IWRM)

Catchment zone protection is an integral part of river basin management generally and, in turn, of Integrated Water Resource Management (IWRM). WS&S user groups must be engaged in the local implementation of plans, but effective IWRM demands a powerful organization capable of ensuring equity in abstraction allocations, enforcing anti-pollution measures, and devising and implementing strategies that prevent waste and guarantee the primary objective of water sustainability.

The complex interactions between the uses of land and water in a river basin are often difficult to specify with precision, but without a proper understanding of these interactions it is almost impossible to manage the basin's water resources effectively. In areas where water resources are ample the need for their positive management may not be obvious, but with growing demands some form of management will become inevitable in most river basins.

The effective management of water resources requires a powerful and properly funded impartial organization which is able to assess the available resources and balance the various demands on them using a rational and open policy. All abstractors need to be licensed and regularly inspected to ensure that over abstractions are not taking place. In the absence of such arrangements water shortages and conflicts between users are likely. It is important that all abstractors are subject to some degree of demand management so that excessive and/or wasteful uses can be curbed. The practice of IWRM is discussed later in this section.

2.4.2 Water quality and pollution

Pollution is a major environmental concern, and needs to be approached from a wider perspective than just WS&S. Industrial wastewater discharges, for example, have a major impact on the quality of rivers passing through cities. In some instances, pollution

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from one city's factories may contaminate the water to such an extent that it cannot be used as a resource downstream.

In this manual we confine our attention to the two water quality areas which are important for WS&S programmes:

- the protection of water supply sources from pollution; and
- controlling pollution from sanitation systems.

Before addressing these issues, it is instructive to look at common types of pollution, and the sources.

Types of pollution and their effects

The effects of pollution can be detrimental both to human health and to the natural living environment. Often, in developing countries, the major concern will be with protection of human health. Section 2.3 highlights two aspects:

- Poor sanitation combined with a lack of safe water and poor personal hygiene leads to the transmission of pathogenic organisms. These are the cause of immense disease and suffering throughout developing countries.
- Water which is contaminated with chemical pollution may be unsuitable for domestic water supply due to a direct threat to health (e.g. from heavy metals and organic substances from industrial processes and agro-chemicals) or to its unacceptability to users (because of taste, staining, hardness).

As part of WS&S programmes users can be educated and encouraged to protect the aquatic environment. They have a direct interest in doing so and they also have direct control over pollution from their own activities. It is beyond their control to stem pollution from outside the immediate locality, for example, in a river polluted by wastes from upstream.

Although the main worry in many situations will be human health, increasingly environmental pollution is of concern as the holistic nature of environmental issues means that the implications of a poor quality of any aspect of the environment can have serious widespread and/or long-term effects.

Many low- and middle-income communities depend on fragile ecosystems and marginal lands. Any pollution or degradation of these environmental resources can have serious consequences on the livelihoods of local inhabitants. It is also important to consider the environmental effects of development on long-term issues such as the maintenance of global biodiversity.

Table 2.4.1. offers a classification of the more common types of pollution. This is a big subject in itself and the table is only a summary guide to the main issues, which are covered in depth in textbooks on pollution control, such as Rhoades (1997) or Tebbutt (1998).

A natural watercourse in an unpolluted state has a balanced chemical composition and usually supports a wide variety of living organisms. This balance is largely dependent on the presence of sufficient dissolved oxygen, which is essential for most of the aquatic life.

Pollutants in water behave differently in different circumstances and this must be taken into account when formulating control measures.

Environmental protection in coastal areas

Many coastal areas are associated with fragile ecosystems, such as coral reefs or mangroves. Protection of these resources is important for several reasons. Such ecosystems contribute to development and poverty alleviation through their role as a tourist attraction (and hence employment creation) and also as an important fishing area. They also play a vital environmental role by naturally protecting coastal communities from the ravages of the sea.

The need to protect such important habitats means that pollution-control indicators other than those associated directly with human health are important. For example control of phosphorous is vital, as an excess will lead to eutrophication which could mask the penetration of sunlight on to corals, and hence lead to die-off.

This may present a problem in low-income communities, as the protection of resources from pollutants which are more difficult to control and which cause damage in small quantities is a costly process. Standards and controls which are stricter than the basis required for human health protection may be required. Local economies may have difficulty affording such a level of protection, although from an environmental point of view it may well be needed. Without it, the fishing and tourism industries may be affected, and people's livelihoods threatened.

The dilemma is who should pay for the control and protection?

Table 2.4.1 Common types of pollution

Type of pollution	Reason for importance	Typical identifier
Pathogenic material	Health problems for those in contact with the polluted water (often severe)	Indicator organisms such as faecal coliforms
Readily biodegradable organic matter	Oxygen depletion in water course — resulting in die-off of aquatic life and loss of natural recuperation capacity of a water body	Dissolved oxygen level. Indicator of organic load (such as Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) or Permanganate Value (PV)
Solid material	Several problems: harmful to aquatic life; often pathogenic material will attach to solid material; turbidity problems; aesthetic problems	Suspended solids concentration
Nutrients	Algal growth (eutrophication) — leading to taste and odour problems and problems with operation of water abstraction and treatment facilities	Nitrogen and phosphorous are the main nutrients of concern
Toxic material	Inhibit or totally destroy aquatic biological life. Can have serious accumulative effects in the food chain	Heavy metals and complex organics are often thought of as typical examples, but ammonia is also very toxic to fish life
Dissolved salts	Colour, taste, health problems (see *WHO Drinking Water Guidelines* for recommended acceptable levels in potable supplies)	Salts of particular chemicals produce particular problems, e.g. fluoride affects teeth and bone structure; iron affects colour and taste of water supplies, etc.

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Provided the pollution is not excessive, most organic substances, including micro-organisms, and some inorganic substances are degraded by the natural self-purification processes which occur in a healthy watercourse. The implication of this for water supply abstractions from rivers is that water quality may vary considerably along the length of a river depending on pollution inflows and self-purification, so water supply intakes should be located accordingly. Biochemical Oxygen Demand (BOD) and dissolved oxygen (DO) measurements should be taken at possible sites as a simple indicator of the pollution load, bearing in mind that the situation may change seasonally, especially if agricultural runoff adds fertilizers and pesticides in the irrigation seasons.

Heavy metals and many other inorganic substances are relatively stable in solution and are not affected by self-purification processes, so the amount of material in the receiving water does not change with time. Most are also unaffected by conventional water and wastewater treatment processes. The concentration in a watercourse or aquifer will only be reduced if uncontaminated dilution water is added, from an unpolluted source for example.

In developed countries much of the concern about pollution is related to its effects on dissolved oxygen levels or to the possible toxic effects of pollutants on aquatic life. There is, however, growing concern about the presence of low concentrations of complex organic substances in water sources which may not be readily removed by conventional water treatment processes.

Where abstracted water receives only limited treatment, the primary concern in relation to pollution must be with the potential hazards arising from the presence of pathogenic micro-organisms in the water and the consequent risks of outbreaks of water-borne disease. In such circumstances concerns about possible long-term health hazards which may arise from the presence of minute concentrations of potential carcinogens in drinking water are not justifiable.

In both rural and urban areas of developing countries it should be borne in mind that pathogens are likely to remain as by far the most dangerous threat from water pollution. Properly used on-site sanitation prevents this form of pollution.

Sources of pollution

Pollution may be from *human activities or from natural processes.* Sanitation systems may pollute the environment if not properly designed and maintained. Lack of sanitation is a primary cause of river water pollution. In many situations in developing countries, sanitation systems may be based on off-site collection systems (sewerage, typically), but without subsequent proper treatment or disposal of the collected wastes. The generally accepted estimate is that less than 2 per cent of the domestic and industrial wastewater generated in developing countries receives any kind of treatment before being discharged to the surrounding land or water. This has resulted in serious degradation which environmental programmes need to address.

Communities are also vulnerable to industrial pollution and to pollution from diffuse off-site sources such as agriculture, or storm runoff from highways or contaminated land.

On-site sanitation systems which are used and maintained can make a major contribution to pollution alleviation.

Point and non-point sources of pollution

Point or local sources of pollution such as pipes, channels, and overflows are usually seen as the primary causes of contamination, and most control measures have in the past been directed towards such sources. This is normally justifiable in relation to potentially heavy pollution but increasing concerns about trace contaminants in the aquatic environment mean that non-point or diffuse sources are growing in importance. Non-point sources of water pollution include runoff from agricultural land and urban areas, and can include aerial contamination, such as from acid rain.

Typical point sources of pollution include discharges from:

- sewage treatment plants;
- rural sewerage;
- industrial wastewater treatment plants;
- farms and agricultural activities;
- solid-waste disposal sites;
- storm water overflows on combined sewers;
- surface water drains in urban areas from roads and paved areas, industrial premises, and transportation facilities; and
- power generation stations and cooling water equipment.

Non-point sources of pollution are more difficult to identify but include:

- surface water runoff from agricultural land;
- land drainage from agricultural land;
- surface water runoff from contaminated land; and
- surface water runoff from roads and paved areas.

Industrial processes are a significant source of pollution, particularly for chemical pollution (dissolved salts, heavy metals, and complex organics).

Pollution may be also classed as point or non-point, as described in the box above.

Community-level measures that can be taken to protect surface sources include:

- preventing access by users or animals;
- guarding against inflows from polluted spillages (good intake design and construction helps);
- avoiding upstream bathing, clothes washing, animal watering, and defecation; and
- abstracting from an adjacent well or borehole rather than direct from the river or lake.

Protecting sources from pollution

Water supply systems for small communities generally use groundwater from wells, boreholes, or springs, or surface water from small streams or reservoirs. The most important safeguard for the future quality of this water is to protect the source itself from contamination by keeping users, animals, and dirty buckets out of the water source, and to prevent spilled water draining from the surrounds into the source. This requires good design and construction of the abstraction facilities, combined with hygiene promotion and community action to maintain good practice.

Then pollution inflows to the source water need to be controlled. With surface water, the main risk is faecal-oral contamination (and in some areas guinea-worm). It must generally be assumed that surface water is faecally polluted. Though people who drink the water may develop resistance, babies and children are still vulnerable. Surface water treatment requirements can be reduced by minimizing the pollution. Again the community can establish good practice and maintain a clean area upstream in which people do not bathe, defecate, or water animals. In some situations abstraction facilities from surface water can be designed to provide some safeguards against pollution — for example by abstracting from a well or borehole beside a reservoir or river rather than directly from the open water source, in order to benefit from the cleansing due to filtration and travel time.

Groundwater sources are much less vulnerable and can have their quality protected by:

- filling in or covering disused wells that could give a direct pollution route through the protective unsaturated zone above the water table;
- siting landfills and soakaways well away from the borehole and in a location that takes downward percolation away from the well; and
- prohibiting any polluting activities in a 10m zone around the well.

The soil above an aquifer provides a natural physical and biological filter to keep groundwater protected. That is why groundwater supplies rarely require treatment. Normal surface activities are not a threat to groundwater; the danger comes either from concentrated pollution loads, or from short-circuiting the natural filtration by contaminating the area around a borehole or dug well.

Although it has natural protection, most groundwater has little capacity for self-purification if it does become polluted. This is because of its inability to replenish oxygen by re-aeration. As a result even relatively small amounts of organic matter reaching the groundwater can produce anaerobic conditions, leading to unstable end products like methane and hydrogen sulphide, which may render the water unacceptable for potable supply purposes.

Hence, it is important to take appropriate steps to protect existing groundwater sources (and those which may be used in the future) from pollution. A simple example at a local level is to cover (or fill) disused open wells to prevent them from becoming filled with rubbish and a direct pollution route into the aquifer.

The implication for WS&S programmes is that water resources used for potable supplies (now or potentially in the future) need to be protected against future degradation by an effective control system for hazardous pollutants.

Pollution from sanitation systems

Sanitation systems may themselves pollute the local environment, the underlying aquifers, or the surface water bodies, estuaries, or coastal waters into which they discharge.

Maintaining a clean living environment is important from the health point of view, and environmental sustainability is a development goal. Hence the need to adopt design and maintenance measures which prevent pollution risks.

Aquifers can be contaminated by downward percolation, drainage soakaways, solid waste landfill, and miscellaneous wastes such as engine oil. In most soil conditions the filtration effect and long travel time before the percolating water enters the aquifer will be sufficient to remove the pollutant. The best safeguard is the appropriate siting of landfills and other waste disposal facilities, with registered facilities for disposing of hazardous wastes. Particular attention is needed to protect both vulnerable and key aquifers for potable water supply. The risk of groundwater pollution by on-site sanitation is generally low and should not prevent sensible low-cost sanitation projects. See for example, the literature review by Lewis, Foster, and Drasor, (1980). Minimum distance rules (for example 10m) can protect

Aquifer vulnerability

The vulnerability of an aquifer to contamination can be assessed from the

- composition of overlying deposits;
- nature and thickness of the unsaturated zone; and
- speed with which water flows through the zone.

A thick layer of clay and a deep water table indicates a well protected aquifer. An example of a very vulnerable aquifer would be a fractured limestone with a thin soil cover and a shallow water table.

Downing, 1998

Appropriate effluent discharge standards

Often one of the first measures in controlling pollution is to set effluent discharge standards. In many developing countries, there will be no history of such standards, and so they are often based on practice in industrialized countries.

The problems in the developing world, however, are very different from the industrialized situation, as:

- differences in climate mean that the impact of pollutants is different (e.g. rivers can re-aerate themselves more quickly);
- there will be different priorities in terms of control of pollution parameters (e.g. pathogenic material is the major concern in developing countries, but in industrialized countries the main concern has been with biodegradable organic pollution); and
- monitoring and enforcement capabilities are often poor in developing countries

There is a need to be realistic, and to:

- base standards on real local problems;
- implement standards incrementally (start small); and
- ensure standards are realistic and attainable, and enforceable — otherwise they are virtually worthless.

Parr and Horan, 1994; Johnstone, 1994.

Just as WS&S improvements must be protected against 'external' environmental impacts so must they make no adverse impacts on their surroundings. In particular discharges resulting from sanitation improvements must comply with relevant standards.

It may be necessary to go further if a discharge complies with set standards but leaves the receiving water in a state that impacts on potential downstream uses. This is more likely if standards are of the 'fixed emission' or 'end of pipe' type. The preferable alternative, based on water quality objectives, generally obviates this risk.

groundwater sources from latrines. In case of conflicting demands, off-site water supply is a much more cost-effective solution than off-site sanitation.

Control of pollution

Again, text books such as Rhoades (1997) or Tebbutt (1998) are the source of detailed information about specific pollution control measures. Only the main features are highlighted here.

Setting standards

It is important that new WS&S programmes support improvements rather than worsen the situation. New sewerage and treatment systems need to comply with national water quality standards and to consider the impacts on downstream users and ecosystems. If there are no national standards, assistance might be provided in developing these in a wider environmental or water resources framework.

There are two types of water quality standard in relation to pollution:

- Ambient water quality objectives for the river or lake, set in relation to the intended uses and the protection of the freshwater ecosystem. Such standards take into account the dilution and dispersion capabilities of a water body.
- Requirements for effluent discharges may take the form of fixed emission standards (in which the quality standards for discharges are not related to the location of the discharge or to the dilution available) or more flexible effluent discharge permits, based on what is necessary to maintain the ambient water quality objectives.

Fixed emission standards are easy to apply but they make no allowance for the environmental conditions at the discharge and the usage of the receiving water. As a result they tend to be economically and technically inefficient.

Effluent discharge permits based on ambient water quality objectives are more flexible in approach but require more work to determine on a case-by-case basis. Such an approach can result in a more cost-effective use of resources, but problems can arise later if additional discharges are made to the water. Water quality objectives may exist in the form of advisory information used for management purposes, or they may have legislative backing in the form of statutory standards.

Sullage drains should have no problem meeting discharge requirements, and any resulting pollution should be removed by the self-purification process. For sewage, however, treatment may be necessary to meet the standards, and various options are available (preliminary, primary, secondary, or tertiary levels of treatment, using a range of technologies). These provide different degrees of removal of pollutants. Normally the cheapest option which will provide effective and sustainable compliance with national water standards (considering both capital and recurrent costs) should be adopted. Appraisal of any proposed further treatment will need to include economic analysis of costs and benefits.

2.4.3 Environmental impact

The *Manual of Environmental Appraisal* (ODA, 1996b) provides guidance on procedures to be followed when analysing impacts. A project may need to include additional components to mitigate against these, possibly including, for example, improvements to a water supply system downstream to protect it against pollution from the project. Environmental Impact Assessment (EIA) and Environmental Auditing are standard practices which are explained in specialist literature.

To prove sustainability the impact of all WS&S interventions must be measureable and monitored. Monitoring is expensive; it must therefore be selective, with a focus on important parameters such as faecal coliform counts in drinking water supplies or dissolved oxygen levels in receiving waters.

Monitoring requirements

If WS&S projects are to be sustainable, then their environmental impact needs to be monitored. There is a need to *measure* and *monitor* — only then can problems be identified, and preventive or remedial action taken. Analyses need to be made and records need to be kept of water and environmental quality. While some analytical procedures are easier and cheaper than others (and visual sanitary surveys can convey much information) monitoring requires resources. It is important that resources are optimized to achieve the best results. It will not be possible to analyse for all parameters, for example, so efforts should concentrate on highlighting the parameters of main concern (such as faecal coliform counts in potable water supplies, or dissolved oxygen levels in surface water courses, or indicators of chemical pollution where there is known to be a problem). It is beyond the scope of this section to go into detail of how a monitoring programme should be undertaken, but see Canter (1996) or Gilpin (1995) for guidance.

Sustainable management of the natural water environment is conveniently based on the river basin as a unit. Integrated river basin management has as its primary objective the balancing of ground and surface water resources in the catchment with the competing demands made upon them.

To meet this aim the river basin management authority must have influence in pollution control matters and be aware of agricultural, commercial, and industrial activities in the basin.

An effective authority will be independent of but consult fully with all parties in the formulation of a basin strategy that has medium- and longer term perspectives and embraces environmental, social, and economic concerns.

Interested parties are not limited to abstractors. Valid interests include other sectors such as leisure and wildlife groups.

Practice

2.4.4 Implementing integrated river basin management

The river basin provides an obvious management unit for water resources for small rivers but with larger systems it may be more appropriate to establish a hierarchical management structure with overall policies for the whole basin supplemented by more detailed policies at sub-basin level.

Roles and responsibilities — China

Co-ordination between sectors and government departments at all levels remains central to the planning process in China. The Water Law (1988), defines responsibilities and mandates of ministerial and government departments, including specifying lead and co-operative agencies. This aims to prevent over-lapping responsibilities and duplication of effort.

The primary function of the Ministry of Water Resources is to organize and enforce implementation of the Water Law, Soil Conservation Law, and other water-related laws and regulations on behalf of the State Council. The ministry has a wide range of responsibilities ranging from policy formulation, strategic planning, economic regulation measures, and implementation of the water permit system, as well as arbitration in water-related disputes and conflicts.

River Basin Conservancy Commissions are responsible for planning and management along the main river courses, but Provincial Water Resource Bureaux take responsibility for development along the tributaries. Co-ordination between the Conservancy Commissions and Provincial Water Resource Bureaux is therefore critical.

Planning for water pollution prevention and wastewater discharge sites is undertaken in close collaboration between the Environmental Protection Bureaux and the Provincial Water Resource Bureaux and, if necessary, the River Basin Conservancy Commission.

Although there are clearly defined roles and responsibilities, a critical factor remains one of co-ordination of the large number of authorities involved at the national, river basin, provincial, and local levels. In addition, lack of financial support can also hamper the effective implementation of key responsibilities within the various authorities.

DFID (1998b) Water Resources Occasional Paper No.5

Development of water policies and strategies

In Pernambuco, North-eastern Brazil, DFID is helping the State Environmental Agency and municipal institutions to collaborate in the production and implementation of a Sustainable Development Plan for the Pirapama catchment area. This Plan will define those measures and decision-making criteria needed in order to ensure the sustainable supply of freshwater from the Pirapama catchment area. This involves a multi-disciplinary approach to balance the different, and potentially conflicting, objectives related to economic growth, environmental management, and social development.

Use of groundwater for irrigation and water supply in South Asia

Both the public and private installation of boreholes for irrigation has facilitated a major expansion of wheat and rice production in the alluvial plains of South Asia since the 1970s. As a result, water table levels drop much lower than previously in the dry season, recovering in the wet season. Shallow handpumps for water supply may then need to be replaced in some areas with deeper boreholes and handpump models suitable for the deeper water tables. If this is done, a new, sustainable, and effective development of the water resource has been achieved, but note the severe inequity if pumps are not replaced.

A more local problem occurs when a powerful farmer installs a private motorized pump close to a village borehole, drawing the water table down in its vicinity so that the handpump can no longer deliver water.

Integrated river basin management requires a full appreciation of the natural characteristics of the system and of the interactions between the system and the various users. This should enable the establishment of both a water budget and an allocation and regulation policy to ensure that uses and demands are prioritized and that appropriate measures can be taken to augment resources if necessary. Because of the vital importance of water to many users it is essential to involve all interested parties in the formulation of river basin management strategies and to ensure that an agreed conflict resolution mechanism is in existence.

A basin management strategy focuses on a river and its associated corridor to analyse the issues which affect the river basin and to suggest solutions to resolve problems and conflicts. Many of the issues can only be addressed with the co-operation and assistance of other bodies, organizations, or industries, but it is essential that the organization responsible for river basin management has the necessary resources and powers to operate in an independent manner.

The purpose of a river basin management plan is to produce a vision for a healthy and diverse water environment managed in an environmentally sustainable way, balancing the needs of all users of water. Sustainable development of water systems must embrace environmental, social, and economic concerns for it to be a workable concept. Integrated river basin management planning should:

Basin management plans are the building blocks underpinning national IWRM strategies, a concept which the UN Commission for Sustainable Development recommended to all national governments following the advice of the 1998 Harare meeting of the Expert Group on Strategic Approaches to Freshwater Management.

- focus attention on the water environment of a specific river basin;
- involve all interested parties in planning for the future well-being of the basin;
- balance the competing requirements and interests of all users;
- agree a vision for the basin which helps to guide activities over the next 10 to 20 years; and
- establish an integrated strategy and plan of action for managing and improving the river basin in the future.

Effective enforcement arrangements are needed, taking account of any possibility that these may be subverted by corruption.

National IWRM strategies

The Expert Group Meeting on Strategic Approaches to Freshwater Management in Harare in 1998 recommended that each country prepare a comprehensive national water policy to ensure efficient and equitable allocation of water resources, and to protect freshwater ecosystems, water quality, and human health. That recommendation has been transmitted to all governments by the UN Commission on Sustainable Development (CSD). A Harare Working Group made detailed recommendations on the elements of any such policy:

1. Research, monitoring, and information management programmes for understanding the quantity and quality of the resource base and its variability in time and space, and the social and economic forces affecting them.
2. The principles for allocation of the resource, taking into account the principle that access to safe drinking water and sanitation is essential for satisfying basic human requirements, and that other allocations should be based upon consideration of economic efficiency and equity, and that allocations should be based on both the sustainability of the resource base and on ecosystem and environmental protection.
3. Incorporation of health concerns into the freshwater management process through the adoption of explicit health objectives in planning, the use of health indicators in routine monitoring, and the assessment of health outcomes in evaluation.
4. Protection of the aquatic environment, including wetlands, from local and diffuse pollution sources and from threats posed by exotic influences to maintain physical and chemical balances and biological integrity.
5. Management of demand should be a key part of the policy, focusing on water conservation through recycling and re-use and, where appropriate, driven by pricing policies and by adopting best practices and appropriate technologies.
6. Management of water supply to deal with annual and inter-annual variations, to support food security and other purposes.

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2.4

Integrated management of catchments and water resources

As part of a regional environmental management project in Region II in Chile, an assessment of the water supply and demand showed that the existing use was unsustainable and was seriously contaminating ground- and surface water resources. The project enabled the regional institutions to integrate water resources management into their planning processes, identify environmental improvements and investment priorities, and raise the awareness of the other institutions, communities, and industries.

7. Providing appropriate mechanisms for the management of land and water resources on an integrated basis within natural hydrological and hydrogeological units (river basins and aquifers), and providing for necessary interaction with administrative organizations where provincial, municipal and district boundaries do not coincide with basin or aquifer boundaries.
8. Provision for coping with hydrological extreme events and disturbances, particularly droughts, floods, and erosion, through the implementation of programmes of drought preparedness, flood protection, and mitigation including adequate monitoring and early warning systems.
9. Substantive co-operation with neighbouring countries in the integrated management of shared surface and groundwater resources within river basin or aquifer system frameworks
10. Development and sustenance of appropriate institutions, including cross-sectoral water councils, and recognizing needs for capacity building, public information, and education.

2.4.5 Pollution and water quality

Sound engineering practice based on holistic approach

As discussed earlier, good design and construction of water-points and sanitation systems is important to safeguard against the direct pollution of water sources. A sustainable system means that it will have addressed all the elements of infrastructure intervention as described in this manual.

A common approach may be suggested for preventing pollution from WS&S interventions (Parr and Horan, 1994):

- Define the problem: identify sources of pollution (point and non-point), and their characteristics (volume, quality, and frequency).
- Identify areas at risk (environmental and health risks).
- Establish what type and how much pollution one is trying to remove, and *why.*
- Identify the constraints on the development of a pollution-control

strategy (e.g. what are the resources available, and what is the ability to pay for services, or to operate and maintain them).

- Set monitoring and control procedures (which are attainable, realistic, and enforceable).
- Select the control options which meet the requirements.

Making the polluter pay is an important principle of pollution control. It is a concept of the developed world, typically applied to piped sewage or industrial effluent discharges. Sewerage systems are high users of water and money; they are rarely the best sanitation option for the world's poor. Requiring the better-off to pay the full cost of pipe-borne pollution therefore serves the poor well.

The *polluter pays principle* places the cost of remedial action on the producer of the pollution. This is an important principle to establish and uphold, for sewage as well as for industrial effluent. The costs of sewerage and treatment should be passed back to the households producing the wastes. In general the poor will not be connected to such systems, and any subsidy will in effect reduce the resources of the utility to provide services to other consumers, including the poor.

The high financial and environmental cost of sewerage systems reinforces the point that sewerage cannot make much contribution in the near future to providing for the three billion people who lack adequate sanitation.

In current thinking the principle is carried further into 'pollution prevention pays' — it is better for an entity to save costs by cutting its polluting output; by the same token society in general benefits from less pollution in the environment.

Increasingly, there is a realization that much can be done to prevent water pollution in the first place. There is a move away from the concept that the polluter pays for the pollution caused, to one which states that *pollution prevention pays.* This means that control of pollution in the first place (by industry for example) will reap benefits — for the industry in terms of lower penalties for the cost of pollution and increased process efficiencies, and for society as a whole in terms of reduced polluting loads in the natural environment.

Associated with this is what is sometimes termed the '4Rs' principle:

- Reduce
- Recycle
- Recover
- Re-use

Industrial pollution control in China

An electroplating enterprise in a village near Beijing in China discharged dangerous industrial wastewaters without treatment, polluting groundwater over an area of approximately 50km². Most of the working areas were unpaved, and liquids drained both into the ground and into a nearby river bed. Water use was wasteful, with no attempt made to limit the volumes of water used. A village downstream from the electroplating enterprise, where the groundwater was very acid and contained dangerous concentrations of chromium, was forced to find an alternative source of water.

The local Environmental Protection Bureau began fining the enterprise for causing pollution. The regular fines were substantial, and the polluter was made, reluctantly, to pay for the pollution caused, although not for any remedial work. Economic pressure caused the owners to consider provision of wastewater treatment.

The enterprise received advice on wastewater management, and financial assistance to buy treatment equipment, under a DFID project. Water consumption was reduced, working areas were paved, and treatment facilities were installed. As a result, the wastewater discharges were contained and treated prior to discharge.

WEDC/Michael Smith

Effective management of sanitation facilities should encompass the '4 R's' to ensure that effective use is made of increasingly precious finite resources.

On a wider scale, UNICEF (1998) points out the importance of monitoring groundwater conditions, developing capacity for long-term management, and focusing efforts in areas where serious problems are emerging. The following instruments are recommended:

- **Comprehensive information systems** about the resource base.
- **Setting of water quality standards** Standards should reflect national priorities and technical capabilities. The strict adoption of standards set in the industrialized world may not be attainable, enforceable, or in some cases even desirable in developing countries.
- **Establishment of protected areas** Rather than attempting an immense task — to protect at once all groundwater resources — it is better to focus on the creation of protected areas for key aquifers. In cases of critical water supplies, water systems above and below the surface need to be efficiently protected and monitored.
- **Integrated management of groundwater resources** In Colombia, DFID is working with research institutions and regional authorities to establish pilot systems for the control, mitigation, and protection of groundwater resources. Working in two pilot catchment areas, the objectives are to develop and implement groundwater protection measures that can be replicated at a regional level throughout Colombia.
- **Pollution control** Pollution sources, especially in groundwater protected areas, should be carefully identified and removed.
- **Extraction control** Based on the average recharge of a given aquifer, it may be necessary to set legal limits on pumping or to motivate more efficient use of groundwater by charging extraction fees.
- **Control of subsurface waste disposal** Limitations or a complete restriction also need to be placed on the location of underground waste disposal and on the quantity and content of waste material, both liquid and solid.
- **Land-use regulation** The use of certain toxic materials may be prohibited or restricted. Controls may be placed on the pollution of the ground from landfills, sewage treatment plants, and underground storage tanks. Other helpful regulations might include controls on housing density, use of chemical fertilizers and

Integrated management of groundwater resources

In Colombia, DFID is working with research institutions and regional authorities to establish pilot systems for the control, mitigation, and protection of groundwater resources. Working in two pilot catchment areas, the objectives are to develop and implement groundwater protection measures that can be replicated at a regional level throughout Colombia.

pesticides, and limitations on clearing vegetation in groundwater protection areas.

Environmental sustainability is a multi-faceted problem and involves the integration of many aspects of 'development', including potentially conflicting stakeholders and users. Institutional responsibility is often not clear and is usually shared between many agencies. The need for a rational co-ordinated response is vital. The tools and principles of Integrated Water Resources Management and integrated environmental pollution control are important contributions to a more sustainable environmental future.

In some specific regions of the developing world where there is great need for WS&S interventions there are compelling reasons for caution in the uncontrolled extension of water availability. These are the arid and semi-arid areas populated by wandering herdsmen.

Culture inclines these groups to give livestock the priority over household use of scarce water supplies. More water could mean more stock, overgrazing, local erosion, and possible terminal degradation of a fragile environment already under severe water stress.

WS&S must in such cases be integrated with and give precedence to other forms of intervention. Sustainable livelihood improvement must be the objective. It might be achieved by educating to give an understanding of the dangers of immediate water supply improvements. Earlier steps might include improvements in animal welfare or hygiene and sanitation promotion.

2.4.6 A Sustainable Rural Livelihoods Approach for arid and semi-arid areas

A high proportion of people living in arid and semi-arid lands (ASAL) have pastoral livelihoods. They frequently give a higher priority to the water demands and health of their livestock in comparison to themselves. The fragile nature of their environment also needs to be borne in mind; for example, the provision of a new, plentiful water source could result in extensive overgrazing and erosion around that new source. Hence the provision of water and sanitation services, in such areas has to be placed in a wider integrated framework.

The interrelated nature of these problems would suggest that a 'Sustainable Rural Livelihoods Approach' would be appropriate. The approach is inherently responsive to people's own priorities for their livelihoods, without compromising the fragile environment. The purpose of such a project could be to:

- Contribute to sustainable improvements in the livelihoods of pastoralists and communities in the selected district.

A framework for project development could include:

a) A participatory analysis of livelihoods, stakeholders, the environment and the effectiveness of potential project options.

b) Help for those concerned with supporting Sustainable Rural Livelihoods to understand and manage the complexities of livelihoods in arid and semi-arid areas, enabling the complementarity of interventions and the trade-offs between outcomes to be assessed.

c) Support for community organizations and other implementing organizations (including NGOs, the private sector, and local government) in developing and implementing integrated project proposals, using piloting as appropriate.

d) Water supply could be used as an entry point, but interrelated interventions to be considered based on community priorities could include:

- improved access to water supplies;
- animal health services;
- marketing of livestock products and livestock management;
- hygiene and sanitation promotion;
- environmental assessment and management;
- supporting income-generating opportunities;
- capacity building; and
- support to the development policies and legislation for ASAL areas.

An area-based approach in a limited area may be appropriate to enable a good understanding to develop between stakeholders.

Water and sanitation in semi-arid areas in Kenya

Arid and semi-arid lands (ASALs) comprise over 80 per cent of Kenya's land area, sustain 20 per cent of the population and 60 per cent of the livestock. These are water-stressed areas with large disparities between seasons as well as within the region. Over 70 per cent of the population in ASALs do not have access to safe water and in many of these districts more than 70 per cent of households do not have access to safe sanitation. In most ASAL districts people take an average time of more than 15 minutes to collect water in the dry season. In some districts, more than 50 per cent of households take, on average, more than one-and-a-half hours to walk to the nearest source.

The districts with the highest percentage of people suffering 'hard-core poverty' are mainly ASAL districts, ranging from 30 to 60 per cent. There is also reported to be a higher level of willingness-to-pay in these areas compared to other parts of Kenya, although this would need to be confirmed.

Advantages of the Sustainable Rural Livelihoods Approach (Strengths and Opportunities):
- It conforms to DFID's poverty focus.
- ASAL communities are reported to have a high need and demand for water and other services.
- An integrated approach reduces the risk of making the situation worse in a fragile ASAL environment.

Disadvantages (Weaknesses and Threats):
- The areas are generally sparsely populated resulting in interventions being generally more expensive.
- There are security problems in many of the ASAL districts, so if the situation deteriorates, project achievements could be lost and plans abandoned.
- It can be difficult to get well-qualified outside people to work in these areas.
- The complexity of having a number of different interrelated project components can result in slow progress.

Further reading

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This book provides useful checklists for assessment of different types of projects and also case studies from an international perspective.

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A good general book on the principles of groundwater — easy to read, not too technical or detailed; good for those who know little about the subject and want to find out more.

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World Bank (1991) *Operational Directive OD4.01 Environmental Assessment*, World Bank, Washington DC.

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These books provide detail on methodology for assessment in general, and on different types of methodology specifically.

World Bank (1993) *Water Resources Management*, World Bank, Washington DC.

A useful overview of water resources management issues and World Bank perspectives.

2.5 Economic and financial perspectives

Introduction

This section looks at the economic and financial principles that should underpin domestic water supply and sanitation policy, programmes, and projects; the role of economic and financial appraisal throughout the programme and project cycle; and recommended analytical approaches and techniques.

Economic and financial analyses have an important role to play in informing decisions at the *policy stage* of the cycle, at national or utility level. Key areas for analysis are the demand for different levels of service, the use and targeting of public subsidies, and how to reform tariffs and improve utility finances (e.g. in the context of a privatization programme).

Economic and financial analysis can inform decisions at the *project identification and preparation* stages by contributing to strategic choices for offering specific levels of service. At the *appraisal* stage the economic justification for water projects is typically based on cost-benefit analysis. In contrast it is usually much more difficult to quantify the benefits of sanitation projects, and the economic justification is more usually based on cost-effectiveness analysis. The financial appraisal should define financial viability, and hence project or programme financial sustainability. Both economic and financial appraisal are vital parts of project *monitoring and evaluation.*

Principles

2.5.1 The water sector

At the many international conferences, regional workshops, and other gatherings of water specialists in recent years there has been a growing consensus on the economic and financial principles that should underlie the formulation of a national water policy:

WS&S is a basic need Many people still lack access to safe drinking water and sanitation. The cost of under-provision is revealed in disease and in the human and financial costs of people making their own alternative arrangements. Enabling the unserved to obtain access to a basic water supply and safe sanitation should be the first priority of any country's water policy. As we saw in Section 2.4, domestic water use accounts for less than five per cent of total water consumption in developing countries, compared with agricultural consumption of around 90 per cent.

Past failure to attach a true value to water as an economic good or to implement cost-based charging policies for water and sanitation services has been a major factor in downgrading the financial viability of public service providers and discouraging private sector investment.

Water is an economic good In a large and growing number of countries, water is becoming scarce, in the sense that *at its prevailing price* demand is fast approaching supply. Scarce commodities and services have economic value. An appreciation of the economic value of water is essential to reduce waste and loss, encourage conservation, and move consumption towards higher value uses.

Correcting these failures by robust financial and economic analysis and monitoring at all appropriate stages of WS&S improvement programmes can contribute significantly to better progress in extending service coverage.

A crucial corollary to these failures, impacting adversely on sustainabilty, is an unnecessary boost to demand — water is seen as cheap and there is no incentive to cut waste.

Programme planners should be aware that:

- The poor will not necessarily make use of newly installed facilities, for a range of reasons quite unconnected with their ability to pay for them.
- Householders commonly have more than one existing option or water source and will not automatically switch to a newly installed cheaper supply.

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2.5

Financial self-sufficiency Shortages of funds because of poor cost recovery are widespread in all kinds of water systems, at every scale. This is due to a combination of reluctance to charge fully for water, inefficiency in collecting amounts due, failure to control water losses and wasteful use, and a continuous growth in the demand for services. Financial viability is vital for system efficiency.

Sustainability This has technical, environmental, financial, social, and economic dimensions. *Economic* sustainability requires that users pay the full cost of their actions, including environmental costs and the full cost of replacing supplies in future. *Financial* sustainability requires that the system is able to meet its capital, operating, and maintenance costs.

2.5.2 Demand for improved water and sanitation services

No community can exist without a source of water. In rural and peri-urban areas households often have a variety of water sources available to them, each with different characteristics. Different sources may be selected for different domestic uses (e.g. drinking, cooking, bathing, and clothes washing), and they may vary seasonally. The demand curve for water is therefore an aggregation of individual demand curves for different purposes, which is considerably more complex than in developed countries.

A new water supply project is never the only water supply available. It simply changes the range of options available. Such an intervention may increase the quantity of water available to a community, the reliability, the convenience of the service provided, and/or the quality of water available. These changes in *quantity, reliability, convenience, and quality* may range from significant to modest. The economic value of a water supply project depends largely on the magnitude of these changes.

People can have very strong views on what *standard* of improved service they want, and are willing to pay for, and will use in preference to existing water sources (and sanitation facilities). It cannot be assumed that households will switch to a new water or sanitation system. This will depend on the combined effects of three

Why willingness-to-pay (WTP) for rural water supplies varies

- Poor households without good alternative supplies are often willing to pay much more for improved water supplies, in both absolute and relative terms, than richer families pay for their existing supplies.
- Time and monetary costs of obtaining water from alternative sources is a key influence on WTP for 'improved supplies'.
- Family characteristics, such as level of education and family size — thought to be related to the opportunity cost of time — will also influence the perceived attractiveness of improved supplies and affect WTP for different standards of service.
- Where people believe government should provide free water, WTP is very low.

- Poor householder willingness and ability to pay for service improvements is *not*, as often assumed, limited to the 3 per cent to 5 per cent range of income. In some circumstances WTP is effectively zero; where the service is closely associated to demand WTP can be over 10 per cent of income.

Poor householders without good alternative supplies are often willing to pay much more, in relative and absolute terms, than richer householders currently do for the good quality services they enjoy.

The best take up and use of new facilities is achieved if provision corresponds to what households want after consultation on a range of cost-related options. The principal factors influencing demand for water improvements, particularly in rural settings, are the perceived cost or time savings.

Since health benefits are frequently not understood there is typically a lower demand for sanitation than for water supply. Initial subsidies are one route to promoting a change in thinking and realizing benefits for the individual and the wider community.

Variations in willingness-to-pay (WTP)

- In Chihota District in Zimbabwe, where water is relatively easily available from traditional wells, WTP is very low (0.5 per cent of income).
- In Newala District in Tanzania, where water is far away in the dry season, WTP is quite high (8 per cent of income).
- In Ukunda, a small market town in Kenya, most households prefer to spend over 10 per cent of their income buying water from vendors rather than fetching free water from a well, because of the high value they attach to their time.
- In rural Thailand, villagers were willing to pay 8-9 per cent of their income for yardtaps, but were unwilling to pay small amounts for maintenance of communal supplies.

sets of factors: characteristics of the supply, socio-economic characteristics, and attitudes to government policy (see box on previous page).

Nor can it be assumed that householders will automatically switch to a cheaper source of supply. There may be (a) reluctance to make a firm commitment to pay a water utility (or users' committee) a fixed sum every month, especially where demand will fluctuate seasonally; (b) mistrust of government's ability to provide a *reliable* supply; and (c) unwillingness to upgrade a rented property. It may also be that the level of service offered may not meet the aspirations of the intended users.

Income is therefore not the only determinant of willingness-to-pay (WTP). Poor householders without good alternative water supplies are often willing to pay much more, in absolute and relative terms, than richer households currently do for the good quality services they enjoy. The widely used rule of thumb that a household's *ability* to pay for water is some 3-5 per cent of income is simplistic and inaccurate (see box above).

Where the standard of service provided is not what people want, they soon abandon new facilities. The implication is that successful projects depend on *matching supply to demand.* Crucially, people should be given a *choice* over the type and standard of services offered. Water and sanitation systems should allow for a *range of facilities* to be made available, such as public standpipes, private house connections, different types of toilet, and sewage disposal facilities.

Demand for water reflects *perceived* benefits. These are primarily cost or time savings. People typically do not perceive health benefits. Improved sanitation is therefore often low on the list of rural peoples' priorities (it may be higher in crowded urban areas, where dignity and status are important criteria). Initially, to create demand, it may be necessary to subsidize sanitation services and/or facilities (but see also Section 2.5.15). In addition to meeting individuals' needs, domestic water and sanitation may also have public health benefits for the population as a whole.

Assessing demand by gauging willingness and ability to pay helps the poor by eliminating assumptions and misconceptions in these areas. Reliable assessment provides a sound basis for installing an affordable service that aims for cost recovery and thereby service sustainability.

2.5.3 Role of demand assessment

The importance of adopting a demand-responsive approach to water and sanitation projects has been demonstrated in the previous section. At the centre of a demand-responsive approach to the WS&S sector is the process of demand assessment, used to ascertain what levels of service users are willing and able to pay for. As we saw in Section 2.5.2, this varies much more widely than has been traditionally assumed. Demand assessment is important to inform decisions at both the policy stage of the programme and project cycle, and at the project identification, preparation, and appraisal stages. Detailed guidance on how to carry out demand assessment studies is provided in the 'Guidance Notes for DFID Economists on Demand Assessment in the Water and Sanitation Sector' (see DFID 1998 in Further Reading).

2.5.4 Demand assessment and poverty

Despite the focus of most demand assessment work on WTP (by which economists mean willingness *and ability* to pay), demand assessment studies can help with poverty reduction in several ways. Firstly, it cannot be assumed that all poor people are unwilling and unable to pay for private connections (see box below), and the strategy of providing *communal* water facilities and latrines ('some for all not all for some') may benefit the poor less than providing them with the level of service that they want. Evidence shows that unless people see the new facilities as providing on balance a more attractive service than the present one, they will not switch to them.

Secondly, cost recovery based on demand assessment can help to improve the financial, and thus the technical, sustainability of water supply systems. Where existing public systems offer a poor standard of service, characterized by low water pressure or irregular and unreliable supplies, it is usually the poor who are most adversely affected.

Targeting the poor

Lessons learned from the DFID evaluation 'Synthesis study of rural water and sanitation projects':

- At the appraisal stage of the Aguthi rural water supply project in Kenya, Danida found that demand for private connections was high but, to protect the poor, chose to supply a mix of water kiosks and private connections. Their ex-post evaluation found that all the kiosks had gone out of use, and more than 90 per cent of households had private connections.
- At the appraisal stage of the Sri Lanka rural water supply programme, Danida forecast demand on the basis of assumed *ability* to pay. At evaluation it was found that people were unwilling to pay their share of O&M costs for communal waterpoints. Many poor consumers had acquired house connections, independent of the project, and were limiting their consumption to within the level of the lowest tariff, so making it affordable.
- UNICEF reviewed 54 sanitation projects and concluded that success is determined principally by consumer demand, and that it cannot be assumed that demand will universally be for *low cost* sanitation.

White, 1997


WEDC/Sarah Parry-Jones

Water vending

Interventions to improve water supplies for the urban poor need to take particular note of the role of water vernding, as summarized below:

- Probably 25 per cent of the population of most Third World cities buy water from vendors.
- They spend typically 10 to 20 per cent of their income on water, and this money comes out of their food budget.
- The income elasticity and price elasticity of demand are very low, with the result that the poor pay the highest proportion of their income for water, and the price is very sensitive to change in supply.
- Vendors charge high prices, but rarely get rich; their prices reflect the high cost of their means of transporting water.

In this situation, any interventions which reduce the cost of water to the poor are likely to improve their nutrition and hence their health. These include:

- more accessible piped water for the poor (standposts);
- reduced queuing time for vendors when filling up; and
- credit schemes to help more vendors to enter the market.

Cairncross and Kinnear, 1988

Tariff structures and subsidy policy are formulated on demand assessment information, ideally allowing incorporation of appropriate payment mechanisms for the poor which may include cross subsidies from better-off households.

Cost recovery policies informed by demand assessment studies can also be structured to provide cross subsidy to low-income or low-volume consumers.

Thirdly, demand assessment studies can help in the design of payment mechanisms that are appropriate for poor people by identifying, for example, their preferences for weekly as against monthly payments, or for credit arrangements to spread over time the capital costs of connection fees. They can also indicate the WTP of better-off households to pay the full costs of metered private connections. Allowing such households to on-sell water may improve the access to water of poor people who would otherwise have to buy water from vendors or from public taps. And by demonstrating people's WTP for different levels and types of water and sanitation services, demand assessment studies can help to obtain political endorsement for pricing reform and greater cost recovery. This can facilitate improved services for the poor, as described above, and attract new investment.

2.5.5 Household benefits from water and sanitation

Householders can benefit from WS&S improvements by, amongst other things, saving time and/or money, and enjoying better health and a more convenient service.

The main benefits to households from improved water and sanitation are:

Financial savings Households can spend less money on water supply (e.g. from vendors) or on storage tanks.
Time savings Households spend less time collecting or queuing for water.
Convenience Water supplies are more reliable and accessible, and sanitation arrangements provide adequate privacy.
Health benefits Increasing the quantity of water used, and combining better water access with sanitation and hygiene

promotion is usually more important than improving water quality. We saw in Section 2.3.7 that unless the return-trip time to fetch water is less than three minutes or more than 30 minutes, the quantity of water used (and hence the health benefits felt) varies little. Some potential health benefits are unperceived by households, and some are external in the sense that they depend on others' actions too.

Consumer surplus Benefits may arise when households consume more water because it is available much more cheaply from the improved supply than previously.

2

2.5.6 Economic appraisal of water and sanitation projects

Health

[1] The exception to the rule is guinea-worm, for which reasonable estimates exist for the reduction in incidence which improved water supplies can offer, and for the economic value of such disease reduction.

Health is the benefit most commonly used to justify drinking water and sanitation projects. But there are serious practical and theoretical difficulties in measuring the health benefits that may arise from an individual project,[1] although health impact studies, taken as a *whole*, provide firm evidence of a link (see Section 2.3). The key policy implication is that expected health impacts are not an operational tool for the 'fine tuning' of interventions, or for ex-post evaluations. Results from individual studies are too unpredictable.

2.5

Economic justification for projects is commonly based on health benefits. They are difficult to quantify. For rural water projects an indirect assessment can be made by allotting a monetary value to the time saved in water carrying, for example, when a source is provided closer to dwellings.

An alternative approach is to try to maximize health benefits, without attempting to quantify them. Broad patterns of disease, and their associated economic and social costs, should help guide the overall strategy. Health benefits can be expected to be maximized where existing water sources are furthest away and water consumption is lowest, and people are most likely to feel a need for improved (that is more convenient) water. Those who would benefit most in terms of convenience — that is where time savings are greatest — are the most likely to switch to the improved water supplies, with potential health benefits. Typically, the economic value of time savings in these cases is high enough to justify the cost of rural water schemes, and give a positive economic rate of return. (See Briscoe & de Ferranti, 1988 and Churchill et al., 1987).

The difficulty of measuring health benefits from improved water and sanitation has led to the development of proxy indicators, for use in monitoring and evaluation (see WHO, 1983). As Section 2.3 makes very clear, the likelihood of health benefits occurring is significantly diminished where there is no reason to believe hygiene behaviour will change.

Cost-benefit or cost-effectiveness analysis

Assessments for water projects in general are preferably derived from cost benefit analysis.

The preferred method for assessing economic justification for a water project is cost-benefit analysis. Demand assessment surveys using Contingent Valuation (CVM) and/or Revealed Preference (RP) methods should form the basis for benefits estimation for most water projects. Table 2.1.2 compares these with other assessment methods. The basic steps in using CVM and RP surveys are outlined in the

'Guidance Notes for DFID Economists in the Water and Sanitation Sector' (DFID, 1998). Traditionally, tariffs have been used to value water benefits for urban piped water schemes, but typically these seriously underestimate benefits. For rural water supply projects, estimated time savings, converted to a monetary value based on the assumed economic and social value of time, can be used as a measure of benefits. For both urban and rural schemes, financial cost savings may also be an important additional component of project benefits.

The costs and benefits that should be included are not only the capital and running costs of the project and the direct benefits, but also those which are external to the project (see the following sections on Water pricing for economic efficiency and on use of public subsidies).

Sanitation projects, where economic benefits are hard to measure, more usually depend on cost-effectiveness analysis. The same technique is used for water and sanitation projects where there is no demand assessment study.

Cost-effectiveness analysis is an alternative approach where benefits cannot be estimated. It involves comparing the costs of meeting the assumed demand for water or sanitation and identifying the 'least cost' option. Conventionally, sanitation projects have been justified in economic terms by cost-effectiveness analysis, because of the lack of satisfactory measures of the economic benefits of improved sanitation. This method is still recommended for both water and sanitation projects where demand assessment studies are not justified.

2.5.7 Water pricing for economic efficiency

Leaving aside for the moment questions of income distribution and poverty, economic theory argues that setting the price of water to reflect its full cost will give incentives to use water in the most efficient way for the economy. The full cost should be estimated in economic prices (reflecting the impact on the economy as a whole) rather than in financial prices (which may not be the same, for instance because of tax and subsidy arrangements).

The full cost of water has three components:

There are several very good reasons for basing water pricing on full costs. The results of under pricing are that:

- public utility service providers are left short of funds;
- the private sector will not invest;
- users take and waste more
- there is a lack of incentive to prioritize water allocations to the higher value uses.

(i) **Long-run marginal costs of supply** They are 'long-run' because they include capital as well as running costs. They are 'marginal' because they are based on the cost of expanding the supply.

(ii) **External costs** These are 'external' to the water users' main concern. The main components are:

Economic externalities These are where water use has an impact on others 'upstream' or 'downstream'. Examples are the cost of disposing of wastewater (where pollution of other water sources leads to higher costs for downstream producers), or the cost of over-extraction from an aquifer or lake (which may raise the water salinity levels, and costs, of downstream water supplies). Externalities may be positive too (for example where irrigation leads to the recharge of an aquifer and reduces salinity).
Public health externalities These are health costs imposed on others because of polluted wastewater.
Environmental externalities These are costs imposed on ecosystem health.

(iii) **Opportunity costs** These are the costs to the economy when scarce water used in one way pre-empts its use for a higher value purpose elsewhere. Typically domestic water has a high value relative to other uses, so the opportunity cost to be applied in calculating the cost of domestic water is zero. (The opportunity cost concept can be very important, however, for policy discussions about intersectoral allocation of water. The opportunity cost of water used in agriculture can be high when this pre-empts domestic use.)

Pricing must encourage the most efficient use of the resource for the national economy as a whole. Prices must reflect true economic cost, accounting for both the external impacts and opportunity costs of specific uses as well as the current capital and operating costs and those needed to expand the supply system.

Where water is under-priced, public sector agencies responsible for the operation and maintenance of water supplies will typically be short of funds, and the private sector will be discouraged from investing in water utilities. The likely result will be a decline in the quality and reliability of water supplies.

In addition, where water is under-priced, little incentive is created for users to avoid excessive use and wastage of water, which may lead to over-investment, as new projects are brought forward to prevent demand outstripping supply. Finally, under-pricing will not encourage the allocation of water to more essential and valuable purposes, such as domestic use.

2.5.8 Use of public subsidies

International recognition of the realities of the growing scale of WS&S needs means a move to cost recovery and away from the heavy subsidy policies currently built into charging systems.

Subsidies may still be necessary to aid the poor, rectify price inequities, and encourage service expansion. A justifiable case for subsidy can be made where individual and community health benefits are not apparent to householders but are apparent to those competent to make judgements from a wider perspective.

Public subsidies are used extensively to meet both the capital and the running costs of water and sanitation schemes. In practice, subsidies have often been allocated primarily to reflect political objectives. From the economic viewpoint the main justifications for using subsidies are on income distribution grounds, that is to reduce poverty, and where significant external benefits are expected.

For *water supply* schemes, any proposed subsidies should normally be justified on income redistribution grounds, not on direct health benefits, because the link with water investment is very complex. Subsidies can be used to provide water at a lower cost, either by charging a lower tariff or by providing a water source which is closer to home, or more reliable.

For *sanitation schemes*, subsidies may be needed to correct for ‘market failure’ which arises because inherent demand (the market) does not to lead to the level of investment in and use of sanitation services which would be most efficient for the economy and society. Market failure occurs because people do not know that their own health and welfare could be improved by better sanitation facilities and hygiene practices (and potential providers of products and services do not know that there is market potential in this sector); and because improved sanitation and hygiene practices in individual households can contribute to improved health in the wider community.

Typically, public financial resources for the water and sanitation sector are scarce compared to need, so a higher level of subsidy per capita is possible only at the cost of subsidizing fewer people. This

It is essential that subsidies built into any pricing strategy are transparent and have clear objectives and targets. They must be sustainable by being covered through other elements of the charging structure.

highlights the importance of a *transparent* subsidy policy so that there is clarity about the *objectives* of the use of the subsidy; the *targets* for cost recovery and/or financial performance of the utility; the *criteria* for deciding where and how much subsidy will be allocated and for what purpose; including definition of the target group of consumers; and the *procedures* to ensure accountability on the use of the subsidy.

Scarcity of public financial resources also emphasizes the need to avoid subsidizing consumers who are willing to pay the full costs of the service proposed, and where there is no compelling social reason for subsidy. Lastly, it argues for action to attract more private sector investment into the water and sanitation sector, and to aim for higher cost recovery from users who are willing and able to pay for the services provided.

It is important that subsidies are sustainable, for example covered by surpluses generated elsewhere by the utility, or funded from earmarked revenue sources. See also Sections 2.5.12 and 2.5.13.

Practice

2.5.9 Demand assessment

The importance of making WS&S interventions effective by associating them closely to user demands and preferences is a central theme of this manual. There are established and recognized methodologies for assessing demand, of which the two most recommended are *Revealed Preference* and *Contingent Valuation* (CVM). Between these two the latter has some major advantages but it has the serious disadvantage that, unless an experienced CVM expert is involved in the design, implementation, and analysis of the study, the outputs can be biased and misleading. Two approaches *not recommended* are the *benefit transfer* and *affordability rule of thumb* methods.

Advantages and disadvantages of different methodologies

Two common approaches to demand assessment which are *not* recommended are:

- **An affordability rule of thumb,** which is the widely used assumption that people will be willing to pay three to five per cent of their income on water has been shown to be a poor guide to WTP for service improvements. One of the key findings of demand assessment studies to date (undertaken by the World Bank Water Demand Research Team) is that income is only one among several determinants of WTP for improved water (see box 'Why WTP for rural water supplies varies' in Section 2.5.2). Differences in characteristics (quality, cost, reliability, etc.) between the improved and alternative sources of supply are very important, as are socio-economic characteristics of the household and attitudes to government policy. Households' WTP as a proportion of cash income consequently varies widely, from effectively zero to over 10 per cent.
- **Benefit transfer,** under which results in one location are used to estimate benefits in a 'similar' location. This can lead to seriously erroneous conclusions as WTP varies considerably even between apparently very similar locations. The conditions under which benefit transfer is valid are rigorous, and rarely met.

Demand assessment is best undertaken by:

- **Revealed Preference** methods, which measure demand indirectly by examining current behaviour, for example the price paid to water vendors, other expenditure on water services such as private pumps, storage tanks, or boiling water, and time taken fetching water.

- **Contingent Valuation** methods (CVM), in which people are asked directly what they would be willing to pay for different water and sanitation services specified in a carefully designed and realistic 'hypothetical scenario'.

Choice of method depends on project-specific criteria. In some instances different approaches may be preferable at different stages of a programme. Criteria affecting choice of method are summarized in the boxes on pages 110 and 111.

Either method can be used for focus group discussions, for small, non-random surveys, and for large surveys on randomly selected samples. CVM has two big advantages over Revealed Preference. Firstly, it can assess demand for a variety of possible improvements (i.e. different standards) to water and sanitation services, for example, individual yardtaps versus public standpipes, pit latrines versus indoor toilets, as well as demand for improved reliability to existing water supplies. Secondly, it can accurately estimate what proportion of households are likely to switch to improved service levels at given tariff levels.

A serious disadvantage of CVM is that unless an experienced CVM expert is involved in the design, implementation, and analysis of the study, the results are likely to be biased and misleading. Using CVM adds significantly to the cost of (and time needed for) focus group or small survey demand assessment studies, but the incremental costs of a CVM approach will be relatively modest if a large random sample survey is to be undertaken in any case. CVM household surveys may not give a full picture of demand where money decisions are taken by men, but the views of women are important, as women bear the time costs of water collection and have gender-specific needs or views in relation to sanitation. CVM may need to be complemented by other investigations, such as focus group discussions with women or men.

It is important that options presented under CVM hypothetical scenarios are based on sound engineering advice of what is technically

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Small rural water projects

Where there are few levels of service options and costs are low:

- The cost of a large survey and a CVM expert may not be justified for project-level decisions.
- Care still needs to be taken to ensure schemes respond to demand. Many rural schemes have been abandoned because their designers failed to do this. In villages where there is no water vending, and households spend little time, effort, or money on collecting or storing water, improved water services are not a high priority, and supply-driven water supply projects are likely to fall into disrepair through poor cost recovery. Providing water supply to these communities is likely to be a poor use of public funds.
- Full community participation is vital in the selection of technology and location; in determining arrangements for operation and maintenance; and in meeting O&M costs and at least a part of capital costs, in order to ensure that schemes match demand.
- Proxy measures for demand such as village size (population to be served), return trip time to existing water source(s), and price paid to vendor, may be useful to assess where demand is likely to be highest.

Urban or large rural water schemes

The case for using a CVM approach at some stage rather than just revealed preference studies is stronger where:

- there is a range of different, technically feasible 'levels of service' options which can be made available to consumers, for which there is likely to be some demand, even if charged at full cost, but which have significantly different implications for project design, e.g. whether to plan only for public standposts or for a growing proportion of private connections. The drainage infrastructure needs and therefore the costs of some level of service options are likely to be high, because of high density of housing and water demand (i.e. water volume supplied per hectare);
- the charges that users will be required to pay for some service-level options are likely to be high. In such cases, the financial viability of the utility and the economic justification for the project may be heavily dependent on how people respond to the options at the prices to be charged, for example, how many people opt for private connections and how much water all those with private connections will use;
- there are middle-income and commercial and industrial users with significantly higher WTP than poor people, and who might have the capacity to cross-subsidize the latter. Since poor people, particularly those served by standposts, use less water, this is likely to require only a marginal increase in the tariff for the larger consumers; and
- there is scope for providing private connections to households WTP full costs in areas where they are likely to sell water to poorer neighbours. This can be a useful component of a strategy to improve access to safe water among poor people.

feasible, and at what cost. In the case of water supply improvements the cost of associated drainage must also be taken into account. Indeed the capital cost of the latter can be as high as that for water supply, where water consumption per unit area is high.

2.5.10 Demand assessment: Water

An important factor to consider in all water demand assessment work is how far demand changes seasonally. In particular, it is important to identify all wet and dry season traditional water sources, since women often resort to wet season sources, when these are close, in preference to improved water supplies that are further away. Changing seasonal patterns of demand also influence households' willingness-to-pay on a regular basis for improved water supplies.

In the course of developing sector policy and then project identification and design, it may be appropriate to use more than one demand assessment approach. Which approach is most appropriate depends on circumstances. For policy-related studies to inform politically contentious decisions such as tariff structures and levels, cost-recovery levels, and the structure and targeting of subsidies, it is likely to be important to conduct a large randomly selected survey in order to produce results which are statistically robust. Results from a small survey or focus group discussion, though much cheaper, will carry much less weight. The factors that will influence the decision on the appropriate demand assessment approach at project level are summarized in the boxes on the previous two pages.

2.5.11 Demand assessment: Sanitation

As part of the formative research for a hygiene promotion and sanitation promotion programme (see Section 2.8), Revealed Preference approaches will be important to ascertain current expenditure and time spent on sanitation. But it will be useful to complement this with a CVM approach to assess preferences and WTP for new sanitation options which can be offered. CVM has been successfully used in this way, using descriptions of the characteristics of unfamiliar options (privacy, convenience, etc.) rather than of their technical design options (Altaf and Hughs, 1994). It should be noted, however, that using CVM to estimate WTP for sanitation is likely to understate the full economic benefit because of both public health externalities and respondents' misperceptions about the links between sanitation and family health.

Decisions on subsidy require a quite separate assessment and analysis and, given the financially weak state of many developing world utilities, are not infrequently tied into wider discussions covering essential tariff reforms and financial restructuring designed to give the company a viable, sustainable future.

2.5.12 Subsidy analysis

Subsidy analysis can inform policy dialogue, and lead to clearer subsidy objectives and criteria for use. The first issue to consider is the scale, purpose, and direction of fiscal subsidies. Here it is useful to distinguish between the source of the subsidy (domestic budget or donor financed), the end-user (utility, municipality, or other agency), and what is to be subsidized (capital and/or running costs). Secondly, who will benefit from the *financial subsidy*, and by how much? This requires comparing, for different classes of users, the financial cost of supply with how much they pay. Thirdly, what are the *economic subsidies*? This requires comparing the full cost of supply in economic prices for different classes of users with how much they pay.

Some key findings from experience in these areas are:

- Inadequate cost recovery breeds low standards and prevents system expansion.
- Recovery of O&M costs from users aids increased reliability of existing systems.
- Water coverage to the poor could be increased by using public subsidy for capital costs in conjunction with full cost recovery from existing users willing to meet them.
- Communal facilities make cost recovery difficult.

2.5.13 Water: Cost recovery, tariff reform, and use of subsidy

Weak cost recovery is the root cause of both low standards and low coverage of water systems. The reliability of existing systems is more likely to be increased if users meet operation and maintenance (O&M) costs. Greater coverage of safe water supply to many more poor people could be achieved if available public funds were used to subsidize capital costs, and if full costs (including capital costs) were recovered from existing users who were willing to meet them. Note, however, that cost recovery from consumers taking supplies from communal standposts is a more difficult or expensive, than cost-recovery from those with yardtaps or home connections. This is especially true in rural areas where weak local institutions may have no sanctions they can apply to non-payers.

For *small rural schemes* for water supply, simple cost-recovery targets may be appropriate, such as requiring communities to provide labour, materials, and a fixed cash sum as their contribution towards construction costs, and to meet O&M costs subsequently. These may

• In urban schemes variations in service levels and types of consumers introduce new possibilities and complexities into cost recovery.

or may not include occasional, major, maintenance costs, depending on public subsidy policy.

In *urban schemes*, especially where a range of water and sanitation services is provided to a variety of customer types, cost-recovery policy is more complex. Often many existing customers are middle- and upper-income households and commercial and industrial businesses who would be willing and able to meet the full cost of supply. Typically only a small proportion of system costs are recovered, and sometimes not even O&M costs, so the utility is financially weak, and the standard of service to existing consumers is very poor.

2

In summary poor households and communities are unlikely to benefit from an expansion of existing water systems where utilities are in need of the reforms described above; and those reforms must be accompanied by better billing and collection systems and more widespread metering of supplies.

In this situation poor people are unlikely to benefit from system expansion to cover (more) low-income areas, *unless steps are taken to tackle the financial and operational weaknesses of the utility as a whole*. Investment to improve the sustainable access of the poor to safe water must therefore be *complemented* by comprehensive reform of the utility to make it financially self-sustaining. The aim should be to meet all capital and O&M costs, except those met by transparent public subsidy (targeted, for example, on expanding the system to low-income settlements).

Improved cost recovery will usually require the setting of clear objectives for cost recovery and the use of subsidy; reforming of the tariff structure and levels to meet revenue objectives (and provide incentives for consumers to conserve water); greater attention to billing, collection, and enforcement; and more extensive metering of consumers.

2.5

The basis for tariff reform should be an analysis of the utility's financial costs and the economic costs of supply (and of necessary wastewater collection, treatment, and disposal), complemented by an analysis of consumers' WTP for water, and a financial analysis of existing and future subsidies. General guidance on public enterprise pricing and financial management is given in DFID's Technical Note No.5, (1992), and more detailed guidance on tariff systems and the accounts of water enterprises is contained in Appendix 3 of the *Manual for the Appraisal of Rural Water Supplies* (ODA, 1985). On-Lending Guidance is contained in DFID's Technical Note No.6 (1992). Revenue projections should be based on analysis derived from WTP studies which assess how existing users will respond to tariff rises and how many new consumers will connect to the system.

2.5.14 Meeting poverty objectives while restructuring utility cost recovery policy

Full cost recovery from all water consumers is not necessarily in conflict with reducing poverty. Many studies have found that poor people in some circumstances are willing to pay high prices and a significant proportion of their income for water supply. The full cost charges of the water supply from the utility may be less than they currently pay anyway, for example if they buy water from vendors.

When reforms are in hand policies can be tailored to accommodate the essential water needs of the poor and not necessarily by compromising the aim of cost recovery.
There are more complexities involved in justifying the need for sanitation projects than for water supply improvements, and also in justifying the need for and level of subsidies.
User demand for sanitation is less because, without understanding of health issues, the perceived benefits are less or even absent.

There may be good grounds for subsidized sanitation on public health grounds but special care must be taken with sewerage. Sewerage systems often serve the middle- and high-income sections of the community best able to pay the cost of the service. In addition, treatment works should not be subsidized for public health unless their contribution to this goal is clear; most sewage treatment is for environmental protection, not public health benefit.

Ways should be sought, however, to ensure that the poor have access to a minimum volume of water necessary to meet their basic needs at an affordable price. Possible approaches, ideally within the context of reform of a utility's cost-recovery policy, are shown in the box below.

However, 'lifeline tariffs' and 'rising block' tariff structures will work to the detriment of the poor in certain circumstances, as the following example from Accra in Ghana demonstrates. In Accra, most low-income households do not have private connections, so they do not benefit from the 'social tariff' (for consumption below 3000 gallons per month). They have to buy water from vendors or neighbours. The vendors charge high prices for water, not only because of scarcity, but because as wholesalers of large volumes of water, they have to pay high rates themselves under the 'rising block' system. As a result, households that purchase water from vendors pay between 2.5 and 6 times more for their water than those with private connections. (See also Section 2.6.17.)

2.5.15 Sanitation: Cost recovery and use of subsidy

For *sanitation* improvements, subsidy may be justified on the basis of significant external benefits, that is on public health grounds. Where to concentrate sanitation subsidy should be determined by examining the pattern of disease and hygiene practices, and assessing the likely benefits from sanitation and hygiene promotion programmes. Decisions on whether to subsidize sewerage schemes should take into account that every £1 spent on subsidy for sanitation is probably £1 less subsidy for water supply.

If a sanitation scheme is to be subsidized, it is better to subsidize the overheads of the project, particularly the promotion activity, rather than subsidizing the construction of facilities themselves. In that way

Meeting poverty objectives within utility full cost-recovery policy

Options include:

- cross-subsidy — charging better-off users more than the cost of supplying them;
- avoiding reverse cross-subsidy — ensuring poor people are not charged more for their water than better-off users;
- 'lifeline tariff' — charging a low (often a flat) rate for low-income, or low-volume, users. Low-income users may be classified by type of supply, e.g. shared rather than individual connection, or by location, e.g. township or slum location. To identify low-volume users requires metering. A typical ceiling for the lifeline tariff would be 6-8 litres per capita per day (0.9-1.2 cubic metres per month);
- 'rising block' tariff structure — charging higher rates for larger volume users; and
- easing the cost of individual connections for low-income households by subsidizing connection costs, or by allowing connection fees to be spread over a longer period, and included in monthly water bills.

the number of families who can benefit is not limited by the size of the subsidy budget.

Households can gain health benefits from following sound sanitation and hygiene practices themselves, regardless of what other households do (see Section 2.3.8). Sanitation has significant convenience benefits (for example privacy) which people are willing to pay for if suitable products and services are made available. It may be more appropriate and sustainable to subsidize the start-up costs of small businesses to provide products and services than to subsidize the products directly.

When considering *sewered systems* it is important to distinguish wastewater collection from its treatment. The economic benefits for these two stages may differ greatly, for instance when disposal or treatment is distant from population centres, so that public health risks from non-treatment are low. Treatment may not be economically justified, even if collection is.

If there is a subsidy to the O&M costs of the water and sewerage utility, it will usually be inequitable for this to go to the sewered customers, who typically are middle- and upper-income households and commercial and industrial users who can afford to pay full costs. If the sewerage network is being expanded, sewered customers should pay at least the long-run marginal cost of the network. The usual cost-recovery method is to add a sewerage surcharge to the water bill, rated on water consumption, which has the added benefit of discouraging excessive water use.

Further reading

Core references

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* Papers marked with an asterisk are available to DFID staff from the Development Economics Research and Enterprise Department. They include papers presented at a DFID seminar on the use of demand assessment in the water and sanitation sector held in London 15-16 December 1997.

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Reflects the state of the art before WTP studies. Argues that project success depends on giving people what they want and are willing to sustain, and that time savings provide insight into likely response of users to project.

Churchill, A. et al. (1987) *Rural Water Supply and Sanitation: Time for a change*, World Bank Discussion Paper No.18, World Bank, Washington DC.

Examines reasons why a high proportion of rural water supply projects failed to meet their objectives. Advocates economic appraisal of projects to be based on cost-benefit analysis which quantifies time savings, but not health benefits.

WHO (1983) *Minimum Evaluation Procedure (MEP) for Water Supply and Sanitation Projects*, WHO, Geneva.

Narayan, D. (1993) *Participatory Evaluation: Tools for managing change in water and sanitation,* World Bank Technical Paper No.207, World Bank, Washington DC.

Guidelines for evaluation using proxy indicators for health benefits based on community use of facilities and associated changes in hygiene behaviour.

Yining, L., and Warford, J. (Co-Chairmen) 'Natural resource pricing in China: Water supply, coal and timber', Working Group on Resource Accounting and Pricing Policy, China Council for International Cooperation on Environment and Development.

A detailed review of how to meet the multiple objectives of economic efficiency, social equity, and sustainability in policy reforms.

2

2.6

2.6 Institutional perspectives

The central lesson learned from too many WS&S interventions of the last twenty years is that simply *building* new facilities does little to help the poor. Projects that end with the construction phase inevitably fall into disrepair and disuse.

Experience has proved that benefits are only achieved when hardware installation is fully integrated with properly planned and implemented arrangements for the long-term operation, maintenance and financing of an improved *service*.

A successful programme, therefore, requires the active participation of a number of agencies from the public and probably the private sector, as well as professional input from a range of disciplines. Above all it requires that these many partners to a programme be properly co-ordinated, with clearly identified roles and responsibilities. Achieving this is difficult in a country where there is no strong institutional framework; deficiencies in this area are at the root of many past WS&S failures.

For rural projects a multi-layered, centrally-controlled management hierarchy is not helpful. Devolving management responsibility

Introduction

If we are to maximize the impact and the prospects for sustainability of WS&S programmes, institutional aspects need to be addressed comprehensively, as part of a collaborative approach with project partners. Key professionals working in the sector therefore need to understand institutional issues and their implications.

In this section we consider why support for institutional development is important, and look at the key issues and opportunities in the context of a poverty-focused approach and typical constraints in the sector. Under the heading of *Practices*, we examine what is entailed in Institutional and Sector Appraisals and Institutional Development, and learn how to support these. To put the discussion in context, we look briefly first at management options that are in use and worthy of further consideration in the rural and urban sectors.

A glossary follows this section with definitions of some common institutional terms.

2.6.1 Why support institutional development in the WS&S sector?

Rapid population growth and the inadequacy of water supply and sanitation services led to a strong emphasis in the 1980s and 90s on the construction of new facilities. Considerably less attention was paid to the sustainable management of services. Among examples of poorly managed services are the high percentage of handpumps that are not working in rural areas and the high leakage rates in urban water distribution systems. Host governments and donors usually advocate sustainability, but in practice they have often withdrawn support soon after the facilities have been constructed and then handed these facilities over to local institutions.

Poorly managed facilities lead to declining service levels. This in turn reduces the chances of good cost recovery in terms of both willingness-to-charge and willingness-to-pay. One consequence is that investment in the sector cannot keep pace with demand. It is clear that in many developing countries scarce resources such as water are allocated unfairly, with preference given to those who have power and influence, and the poor further marginalized.

Institutional Development (ID) work that leads to improved and more transparent management practices results in more effective and equitable use of resources, which is central to DFID's main aim of eliminating poverty in poorer countries.

2.6.2 Institutional options for rural WS&S

Management models for rural WS&S facilities vary from centralized government systems to localized community management, with several models between these extremes (see Figure 2.6.1). Some countries have central, state, district, and village administration involvement in the sector, amounting to four tiers. The activity-to the community via partnership arrangements with key agencies is more effective. It allows for appropriate skills inputs, particularly important for the up-front promotion programmes generally needed to engender demand for sanitation works.

responsibility matrix for South Africa's rural water sector (Table 2.6.1) demonstrates the overlapping or fragmentation of responsibilities, which is also common elsewhere.

Centralized management often contributes to operation and maintenance (O&M) failure because of:

- over-dependence on limited government resources;
- user expectations that government provides everything;
- user non-payment of water charges; and
- a lack of user involvement in decisions concerning their water supplies and sanitation.

(Davis and Brikke, 1995)

Under such circumstances, adapting centralized management by just incorporating community participation is unlikely to be successful.

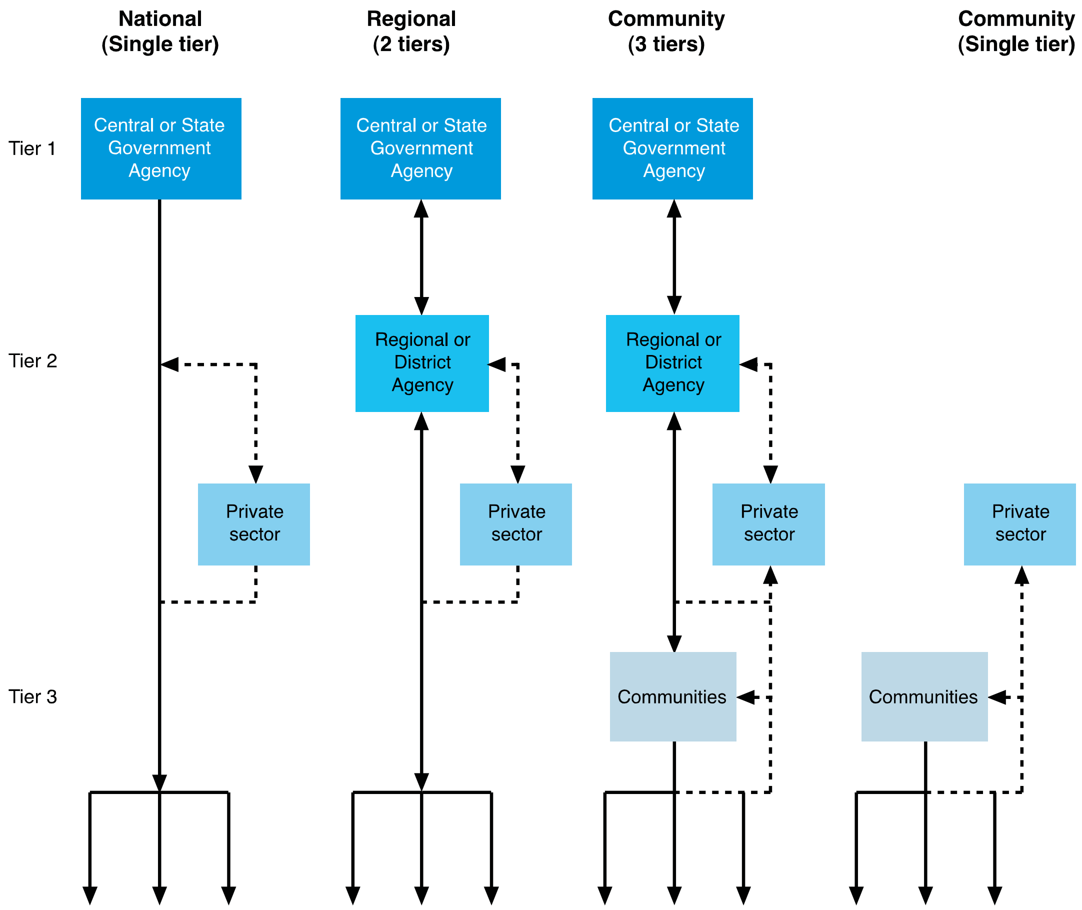

Figure 2.6.1. Rural operation and maintenance models and tiers of responsibility

A fundamental change towards community management using a partnership approach involving the community and the key agencies offers a more effective solution (see Section 2.6.7).

Rural sanitation

This sector presents a particular challenge because of the general lack of facilities, combined with limited initial demand for sanitation services, that is experienced in many areas. A comprehensive social marketing approach is advocated and explained in Section 2.8, as an effective means to promote sanitation and its use.

What are appropriate means of managing sanitation programmes from an institutional point of view? Collaboration between the various departments and stakeholders is possible for specific integrated projects, but long-term co-ordination is difficult to achieve.

Where such institutional problems exist, issues such as clarification or reallocation of responsibilities, options for an integrated approach, and HRD requirements should be addressed during the process of project development. A partnership approach involving NGOs and the private sector will also enable the introduction of much-needed skills to sanitation promotion and implementation.

The *devolving down* principle of management responsibility is equally applicable to urban programmes, as is the reduction of overlapping responsibilities to ensure accountability. The proviso is that the more complex nature of WS&S systems in large towns and cities, possibly including treatment works, and other major engineering elements, lends itself to and may benefit from an unbundling of management functions. Bulk supply of water and the associated river intakes and well fields may, for example, be regionally managed, while a municipality is responsible for the distribution network.

2.6.3 Institutional options for urban WS&S

Six basic management models of urban water supply are set out in Table 2.6.2. Models 1 and 2 can present problems associated with a lack of organizational autonomy, with substantial government involvement in matters that are often best left to competent managers. There are variations on these models in some developing countries. For example, in some states in India there is a combination of Model 1 and Model 2, where both municipal and state government are involved in the management of water supply and sanitation. Such overlapping responsibilities can often create problems of accountability. In South Africa there are combinations of Model 1 and Model 3, where municipal departments are partially corporatized or commercialized — this may offer a suitable route for development for other countries. Some countries ‘unbundle’ functions such as bulk supply and water distribution for reasons of economies of scale and to maximize the use of available expertise. Models 1 to 4 may also have varying levels of private sector participation as a means of introducing more incentives for effective service provision.

Models 5 and 6 include ownership by private shareholders and may raise concerns of equity where a high percentage of the population is poor. Model 4 — a public owned/public limited company with staff recruited from the private sector can offer an acceptably balanced arrangement — such models are used successfully in the Netherlands, the Philippines, and Chile.

One clear advantage of municipal management at the end-user level is the potential for integrating the expertise of other municipal departments, such as health or education, into the programme.

Municipal management

While the management of WS&S services by a municipality (Model 1) can present problems such as a lack of organizational autonomy for

Table 2.6.1 Indicative activity/responsibility matrix for the South African rural water sector (in a Transitional Policy Environment).

Legend: Responsibility (R) — Involvement (I)

Responsibility	Legislation & dispute resolution	Policy development & implementation	Sector Strategic Planning	Subsidy decisions • capital • recurrent	Financial Allocation	Budgets	Water Resource Allocation	Project Identification	Project Planning & Design	Project Implementation	Water Quality	Management of Community Involvement	Tarrif setting	Management of O&M	HRD	Training of community CBOs	Monitoring & Evaluation	Research
National Government																		
Parliament	R	I			R				I									
DWAF	I	R	R	R	I	R	R	R	R	I	R				R		R	I
DCD (MIP, EMIP & CMIP)		R	R	R	I			R										
Other financiers[1]		R	I	R	R			R	I	I								I
(National public water utility)**																		
(Natural Resources Court)																		
Water Research Commission			I															R
Provincial Government																		
DWAF[2]		I	R			I		R	I	I	R		I		I		I	
Local Government																		
District Councils		I	I			I	I	I	R	I			R	R	I		I	
TRCs[3]	I					R	I	R		R		I	R	R	I		I	
Private Sector																		
Water Boards							I			R	R		I	I				
Consulting Engineers			I				I	I	R	R	R		I					I
Contractors										I								
BoTT contractors								I	R	I			I	I		I		
Training institutions										I		I				R		
NGOs[4]	I	I						I		I		I				R		I
CBOs[5]																		
Project Steering Committees										I		R	I			I		
(Statutory Water Committees)																		
Community Water Committees		I								I		R	I	R		I		
Consumers	I									I		I						

** Proposed institutions in parenthesis [1] e.g. DBSA, IDT. international funders [2] Catchment Management Agencies [3] Transitional Rural Councils [4] Non-Government Organizations [5] Community-based Organizations

Table 2.6.2 Six basic management models of urban water supply organizations				
Organizational model	**Who owns the infrastructure?**	**Who operates infrastructure?**	**Legal status of operator**	**Who owns the shares?**
1. Direct public/ local (e.g. Kenya)	Local (municipal) government	Municipal administration	Municipal department	Not applicable
2. Direct public/ supra-local (e.g. India)	National or state government	National or state government administration	National or state government department	Not applicable
3. Corporatized utility (corporation/ authority/board) (e.g. Ghana)	Government or utility	Corporatized utility	Parastatal, usually defined by special law	Not applicable
4. Government-owned public limited company (PLC) (e.g. Netherlands)	Government or PLC	A PLC as permanent concessionaire	Public limited company	Local/provincial government
5. Delegated private (e.g. France)	Any combination of government agencies	Government and temporary concessionaire	Public limited company	private shareholders
6. Direct private (e.g. UK)	Private agents	Private company	Public limited company	Private shareholders

Source: adapted from EUREAU (1992)

effective management, it also offers a number of advantages. For example, local municipal management with potentially better accountability to consumers is a key reason for the growing trend of decentralization of powers to municipalities. If this is to lead to substantial improvements in service levels, however, it requires politicians and key staff to be prepared to make difficult decisions regarding aspects such as cost recovery and efficiency improvements.

Another advantage of municipal management of WS&S is the good potential for collaboration with other concerned departments in the same municipality, such as the Health, Public Works, Planning, and Slum Improvement Departments, where they exist. Unfortunately, such potential is not always exploited.

Close collaboration is particularly advantageous when considering sanitation improvement programmes. A box in Section 2.6.6 (page 128) discusses the management of sanitation programmes in urban local government as well as the 'strategic approach to sanitation'.

This approach differs from the existing supply-driven agenda through two underlying principles: it is demand based, and incentive driven (with appropriate rules, referees, and rewards). (See the box on the strategic sanitation approach in Section 1.5.)

The approach, as described in Cotton and Saywell (1998a), involves:

- **Wider choices concerning technologies and service levels** Comprehensive information about technologies must be made available, support provided in determining appropriate levels of service, and flexibility shown in applying appropriate technologies and service levels within the wider context of municipal sanitation programmes.
- **Step by step actions** Levels of service need to be disaggregated, or 'unbundled' both vertically and horizontally (see page 17). This implies that sector delivery systems are broken down into separate but technically integrated systems and the most efficient solutions are designed at the most appropriate level (household, community, city).
- **Financial sustainability** Key to the Strategic Sanitation Approach (SSA) is the full recovery of investment, operations, and maintenance costs, including financing and transaction costs.
- **Responsive institutional arrangements** Links between departments and institutions need to be developed to allow users to participate in the decision-making process and management of services within the context of the overall municipal sanitation programme.

Small towns

A general problem for rural and small town projects, and one which will test the strength of institutional links, is establishing sustainable mechanisms for drawing on the professional expertise which tends to be concentrated in regional and large municipal organizations. In many developing countries the full spectrum of necessary skills is not available at central government level or in lower level agencies.

WS&S for small towns can present its own particular problems. Often towns require more sophisticated forms of water supply systems than villages, including distribution networks, reservoir intakes, and treatment plants. Many small towns, however, do not have sufficient capacity to manage all aspects of such WS&S services. Larger towns and cities attract the more able management expertise in the sector, so the skills shortages become most apparent in small towns.

Some countries have a system of national or state water authorities — Models 2 and 3 in Table 2.6.2 — which serve some or all of the towns and cities in their defined region. These models are a means of maximizing the use of expertise in the sector. However, in resource-scarce countries, such national/state boards or authorities have often been unable to achieve the outreach to provide customer-orientated services, particularly to low-income groups. Fragmentation of responsibilities exacerbates this situation. Again, unbundling may offer a solution. Then the municipality (with support in capacity building) can manage the distribution system and collect charges itself or contract it out to the private sector. The bulk supply may then be managed by a regional water authority, or they too may seek private sector participation. Decisions need to be made where bulk supply costs are high, as to whether there will be cross subsidies or an average bulk supply cost applied across a region.

Principles

2.6.4 Constraints to effective service provision

Experiences vary both between and within countries, but WS&S institutions typically have to contend with a multitude of constraints which have varying degrees of severity, including:

2

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- fragmented and overlapping responsibilities between different organizations and stakeholders;
- a lack of clear direction and vision;
- poorly defined financial and physical objectives/indicators;
- a lack of capable trained staff at all levels and particularly in decentralized agencies taking on responsibility for WS&S operations;
- inadequate management information systems — a lack of transparency;
- no comprehensive O&M procedures;
- bureaucratic controls that inhibit effective management;
- ineffective staffing policy and job definition;
- lack of resources;
- political management and interferences and lack of willingness to charge higher water and sanitation tariffs; and
- a lack of incentives to make improvements.

Participatory approaches are undoubtedly vital in WS&S programme development and implementation. The problem is that they require new skills and experience. Few WS&S agencies have ready access to the social scientists and other specialists needed. In addition resource constraints are widespread and there is an ever-present risk of political interference to obstruct movement towards cost-reflective charging.

In the case of rural and peri-urban WS&S, many government institutions have not been able to provide adequate services to these widespread communities. Some form of community-based approach has been adopted in most developing countries with varying degrees of success. Problems arise when institutions have limited awareness and capacity to elicit people's real demand for service improvements, based on their willingness-to-pay, and then to support community management. The social mobilization and participatory approaches described in Section 2.2, the hygiene promotion recommended in Sections 2.3 and 2.8, and the willingness-to-pay studies outlined in Section 2.5 all require skilled staff with specialist knowledge. These people are rare in most developing countries. Even central government agencies have limited outreach and lack the capacity to implement programmes in distant communities.

2.6.5 Key institutional issues

Progression towards pricing structures that allow full cost recovery must be the central focus of institutional reform. The end objective of a sustainable water and sanitation service can come only within the framework of an integrated water resources management strategy in which tariff structures are formulated to cover the full costs of maintaining existing systems and financing planned expansions.

The institutional framework for WS&S has to meet major challenges in achieving both sustainable and equitable service provision. Central is the improvement of cost recovery to generate the resources for maintaining and improving services, to meet both existing and future demand. This requires a sustained effort and long-term commitment to addressing key issues that require greater emphasis, such as:

- water resources allocation and management;
- improved integration of water supply, sanitation and hygiene promotion;
- a commercial orientation including improved financial management, investment planning, and tariff setting;
- improved organizational autonomy, transparency, and accountability as well as decentralization and delegation to the lowest appropriate level;
- improved equity and gender perspectives through dialogue with low-income communities and well-targeted subsidies, seeking to minimize perverse subsidies;

Good finance and resource information is a basic necessity; establishing adequate management strengths in this area is an ideal starting point for reform. Subsequent capacity building should encompass moves towards the decentralization of decision-making and downward devolvement of management responsibilities. It should lead to an integrated institutional structure responsive to and focused on user demand.

- demand responsive approaches including participatory methods and the provision of appropriate marketing and customer services;
- private sector participation and regulation with appropriate incentives;
- management of operation and maintenance (O&M); and
- human resources development (HRD) and management development that supports improved capability in all these aspects.

An institutional set-up capable of addressing these issues in an integrated and comprehensive way improves the prospect for adequate and sustainable services. *Institutional Appraisal and Development* as described in the remainder of Section 2.6 provides a framework for assessing how such a set-up may be achieved.

WS&S institutions in developing countries are usually orientated towards constructing new infrastructure and the crisis management of existing facilities. They need support in developing their institutions to bring about improvements in the key aspects identified above. A common starting point is improving management information and transparency in the management of physical and financial resources.

WS&S strategies and interventions should seek to have a positive impact on policy in the host country.

In recent years, many countries have begun the process of decentralizing sector activities and some are making efforts to follow the principle of devolving management to the lowest appropriate level. This is a challenging process, particularly as it has to be combined with the other key principles of involving all stakeholders in decision-making processes and adopting an integrated approach to water resources management.

Opportunities for institutional development can exist at all levels in national management and organizational structures and should be sought around the starting point of a viable poverty-focused WS&S programme.

2.6.6 Opportunities and strategies

Past projects of DFID and other agencies offer lessons for developing new water sector programmes and projects, and reinforcing current policy guidelines. All strategies and interventions should seek to have a positive impact on policy in the host country. Opportunities and appropriate strategies for institutional development need to be placed in the context of potentially viable poverty-focused water and sanitation programmes. The elements of such programmes are:

At a very basic level sustainability of small community-managed projects can be impaired by the lack of a reliable system for obtaining spare parts or technical assistance for occasional repairs. The problem may be solved by developing links between community managers and relevant public or private

- **Integrated water supply, sanitation, and hygiene promotion programmes** aimed at maximizing health benefits at the local level, using a demand-responsive and a process approach (DFID Technical Note No. 4, 1992), and targeting poor communities in rural and peri-urban areas. All projects are likely to involve some form of institutional development, particularly in the areas of Human Resource Development (HRD), information systems, and improving linkages among stakeholder institutions.

- **Programmes in rural areas supporting management at the lowest appropriate level** will usually entail some form of community management. Even where Village Level Operation and Maintenance Management (VLOM) is achievable, the institutional responsibilities between community organizations, local

partner agencies.
At a quite different level appropriate specialist input might be used to strengthen national or regional resource management planning or to develop a water allocation policy.

government, and the private sector, will need to be agreed and the necessary support provided to achieve sustainable service provision. Ensuring the availability of spares is often a key issue, as is technical backup for major repairs. No less important is institutional backup to fragile new local institutions.

- **Addressing local water resource management (WRM) issues** offers substantial potential benefits, particularly in areas where there are water scarcity and water allocation problems between different users. Any significant improvements to WRM will involve some institutional development or strengthening. Support could be in terms of building policy frameworks, including assessment and modelling, legislation on water rights, and appropriate environmental standards (ODA, 1995d). Water allocation can be a sensitive issue and can generally only be addressed where there is a clear willingness to collaborate by the host government. Experience shows that properly informed communities will themselves become the best caretakers of local water resources, providing they are given the rights and the means to do so.

Cairo Wastewater: Support to deprived areas

DFID's support to the Cairo Wastewater project (since 1978) has primarily concentrated on the construction of trunk sewer tunnels and large pumping stations on the East Bank of the Nile. While the large investment in these works has clear benefits for the city drainage system as a whole, it is more difficult to identify targeted benefits particularly in relation to low-income groups in the city.

With the major part of the trunk infrastructure complete, the logical way of addressing this issue is to extend sewerage to deprived areas which fall within the catchment of the new trunk sewerage. The cost is marginal compared with the cost of the trunk infrastructure already provided.

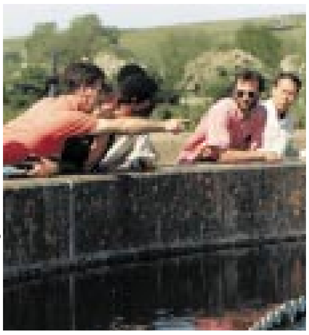
An additional project has subsequently been formulated which provides an opportunity to develop participatory planning of local improvements with communities, extending services to 60,000 people. The procurement and contracting process will be structured so that labour-intensive methods can be used for income generation within the local economy.

There are complementary projects offering institutional development support to the responsible city authority.

There are also lessons here about the timing and planning of investments in relation to trunk and local neighbourhood infrastructure.

Firstly, it is clear from the framework of the 1997 DFID White Paper that the potential benefits to the urban poor can and should be appraised at the outset, with clearly targeted interventions as opposed to 'trickle down' assumptions of benefits.

Secondly, such clearly targeted interventions cannot be made in isolation from the city-wide infrastructure context. The benefits of the Cairo deprived areas project are only realizable because the trunk infrastructure exists. In the effort to demonstrate the direct impact on the poor, it is important not to lose sight of the wider picture.


WEDC/Keith Pugh

Programmes with a primary focus on the urban poor can derive positive benefit from parallel institutional strengthening of the utility service provider. An improved or expanded service to target groups might, for instance, be better assured by improving the management of billing and charge collection and thereby the overall financial position of the utility.

Capacity building within the utility should concentrate on the human resource element rather than on financial aid which might be misdirected. Improved engineering expertise, for example, might save money by identifying areas for strategic infrastructure repairs as an alternative to major renewals.

Private sector management of urban systems has proved its worth but must be regulated to protect and ensure attention to the interests of poor communities.

Where WS&S improvements are only one element of an integrated poverty alleviation project a management system has to be developed around the municipality and CBOs. Technical support to strengthen WS&S institutions at the higher, policy formation, level must be well targeted and depends on a degree of

- **Working in poor areas allied with support to urban water utility management** offers the opportunity of a clear poverty focus together with collaboration on improving the effective and equitable management of water and sanitation services, without which the long-term service provision to the poor is threatened. By addressing service provision to poor areas as well as utility management, there is potential for synergy in terms of project effectiveness. For example, improved services to poor areas can be indicators of better utility management. Institutional development interventions need to be well targeted and enabling in nature, to avoid expensive overall development of the water supply organization (new offices, vehicles, computers, etc). The possibility of providing funding for the provision of strategic infrastructure to remove 'bottlenecks', as well as provision of support on leakage control, should be considered where appropriate. Projects that are dominated by the provision of substantial trunk infrastructure can create difficulties in achieving a poverty or sustainability focus, as has been experienced on DFID's Lucknow project in India (see box in Section 1.6). Provision of trunk infrastructure, however, can facilitate development of secondary and tertiary infrastructure for poorer areas, as the box on the DFID Cairo Wastewater project (left) illustrates.

- **Privatization** in its many forms raises special issues of concern in relation to services for the urban poor. Unless there is protective legislation or regulation, the commercial approach can mean that resources are focused on those who can afford to pay for high-cost services, at the expense of the poor. These issues are discussed later in Section 2.6.21 on Private sector participation.

- **Working with urban slum communities in developing integrated infrastructure provision,** including roads, community halls, lighting, etc., in addition to water and sanitation services, has been found to be successful in DFID urban poverty projects in India, where slum communities are able to express their relative demand for each type of infrastructure service. Close collaboration is required with municipalities and community organizations, particularly in developing appropriate institutional arrangements for operation and maintenance.

- **Institutional development of WS&S institutions** requires well-targeted technical assistance programmes such as the DFID projects in Swaziland (where a Corporate Planner and Finance Expert were provided). In South Africa DFID is supporting the development and implementation of new rural WS&S policies (see box in Section 2.6.13). Such programmes generally require good capacity and commitment to institutional issues within the host organization. The impact on equity or poverty needs to be demonstrated in each case. Institutional support seeks to foster the participatory approach and real involvement of stakeholders. The right gender perspective is also important. The increased current capacity and commitment to key institutional issues in the host organization.

Urban sanitation programmes for the poor can demand a singular management approach, working through local government bodies which are typically responsible for non-sewered sanitation while a specialist utility manages piped infrastructure services. Small local community projects may be led or supported by NGOs. Opportunities for institutional strengthening include capacity building in the local government organizations and in NGOs, and the development of stronger links between the two. Project sustainability is best achieved by establishing robust links between the community and local government.

involvement and influence of women in sector institutions is one of the key principles guiding the WS&S sector (see also Section 2.2.4).

- **Sanitation and hygiene promotion programmes or sub-programmes** offer the advantage of providing sufficient focus on sanitation issues without the preoccupation with water supply.

  However, sewerage programmes should only be considered where potential water supply problems will not adversely affect the operation of the sanitation facilities. Institutional considerations in such programmes include: optimizing subsidies and incentives in a demand-responsive approach, roles for formal and informal institutions, and capacity building as part of a Strategic Sanitation Approach (see box in Section 1.5).

- **Programmes led by international and local NGOs** that work with local communities also require institutional inputs in terms of encouraging local government collaboration, capacity building,

Sanitation programmes in urban local government

While large-scale urban water supplies, and to a lesser extent sewerage, are increasingly managed by specialized utilities, the provision of unsewered sanitation, which will cater for the majority of urban poor in the foreseeable future, is frequently the responsibility of urban local government. It requires a careful understanding of the role, functioning, and constraints of local government.

One of the most important institutional problems in urban sanitation is that there may be several different pro-poor sanitation programmes instigated at national, state/district, and city levels, and these may be channelled through different departments within local government. This leads to widespread confusion; the underlying question is who should be responsible for overall planning at the city level, and how can this be achieved?

While the strategic approach to sanitation (in Section 1.5) envisages ‘unbundling’ of responsibilities as a key issue, there may also exist situations in municipal government where the need is to set up an effective co-ordinating group of the various concerned line departments to promote convergence among the different sanitation programmes. The need for this is illustrated by the situation in Cochin, India.

The different skills for sanitation implementation are: health-related promotion and education; community development and negotiation; and technical issues around construction. In Cochin, India, these skills lie respectively in the Health Department, the Poverty Alleviation cell, and the Engineering Department. Different programmes of the state and central governments come through these departments. The problem is lack of communication between departments with a lack of convergence as different programmes are implemented in different ways.

DFID work on a strategic approach to urban sanitation is currently underway with the aim of developing an adaptable strategic macro-framework which sketches out the overall direction for sanitation service provision in a project area. It is clear that in small towns, it is necessary to put in place some directional role from the higher level state or district institutions, as well as internal co-ordination.

Encouraging host countries towards an institutional structure capable of supporting an expansion in WS&S provision for the poor can be effectively advanced by co-operation, collaboration, and dialogue. Learning is a two-way process.

Where major institutional reform is called for support may be directed towards one or more specific aspects of sector organizational policy such as mechanisms for private sector participation. A possible alternative, used in other sectors, is to support general development across the sector. It is an approach that is subject to some important pre-conditions and one that might not be applicable in the water sector.

and developing longer term support to community organizations. This form of project is particularly advantageous in developing approaches and systems for working with local communities, and tends to be more suitable for smaller projects. The development of NGO capacity should also be considered.

- **Demand-responsive projects working through government institutions** that maximize the use of local skills in government and in the private sector is the preferred approach for sustainability reasons, with support provided from NGOs and consultants as appropriate. Strategic technical assistance needs to be carefully planned and to begin sufficiently early in the project development cycle to influence the direction of the programme.
- **Collaboration with project partners to influence policies** needs to be carefully planned too, and to take advantage of opportunities as they arise. This can be done through such measures as: promoting DFID approaches to project development; developing national water, sanitation, and hygiene promotion policies and guidelines; encouraging governments to use development projects as pilots for replication elsewhere; introducing institutional development project components; promoting and supporting civil society institutions; supporting HRD institutions; holding policy review workshops; disseminating examples of best practice from elsewhere; arranging study tours, strategic consultancy inputs, and the well-designed dissemination of lessons, manuals, and successful systems; working with other donors; ensuring appropriate project conditions; and participating in an ongoing dialogue. Opportunities for collaboration on policy are often easier to develop with larger projects, where the donor is seen as a more important stakeholder. It has to be remembered too, that ‘influence’ is a sensitive topic and learning is a two-way process. DFID staff need to see themselves as supporters of national policies and programmes (the compatibility of such policies with the agreed principles will be established in the very early project phases).
- **Promotion of substantial institutional reform** may be appropriate in many cases and could include providing support to a variety of initiatives in the WS&S sector, such as:
  - decentralizing;
  - commercializing or corporatizing of institutions;
  - unbundling or rebundling of functions;
  - organizational restructuring;
  - changing roles of government from service provider to regulator and facilitator;
  - appropriate forms of public private sector partnerships; and
  - instituting agreeing targets performance between different organizations or levels of government.

Substantial reforms are usually led by the host governments and would often benefit from the support of the major donors in the sector. DFID’s involvement in such reforms needs to be carefully assessed in terms of the likely size of the DFID programme in the sector and the perceived risks.

- **The Sector-Wide Approach** (see Section 1.5) is a promising alternative way to support development in the sector that avoids the problem of a project being 'an island of success in a sea of failure'. The aim of this approach is to develop **Sector Investment Programmes (SIP)** that cover *all* sector expenditure, both recurrent and capital, as described in Section 1.5. An SIP has to be based on a clear sector strategy and policy framework, and local stakeholders such as government, direct beneficiaries, and private sector representatives have to be clearly in charge. All main donors must sign on to the approach and participate in its financing. There are specific macroeconomic pre-conditions for SIPs to be considered (Harrold and Associates, 1995). To date this approach has mainly been used in the health and roads sectors. Opportunities should be explored in the WS&S sector, although where there is a high degree of decentralization or significant institutional complexity, it may prove difficult.

2.6.7 Partnership approach: Sharing responsibilities

A partnership involving rural or peri-urban communities and government agencies should be seen as a flexible and evolving process requiring continual dialogue. NGOs and the private sector should normally also be part of such partnerships, with NGOs commonly having a facilitatory role. The sharing of costs and responsibilities within a partnership will vary according to a variety of factors, including the:

- choice of existing or proposed technologies;
- capacities of the various stakeholders; and
- type and stage of development of the partnership.

More complicated technologies such as multi-village regional piped water schemes require more substantial government agency inputs. Simpler technologies such as handpumps are likely to require only back-up support from agencies. Work is continuing world-wide on the development of VLOM (Village Level Operation and Maintenance Management) pumps and systems that need minimal external inputs. As partnerships develop, management agreements between the various key parties should be considered as a means of clearly allocating responsibilities. Such agreements have been used on DFID-supported multi-village piped water schemes in Maharashtra, India. Further guidance on community-based operation and maintenance is set out in a box in Section 2.6.8.

If a village institution such as a Village Water Committee is expected to take on a key role of managing O&M, it is preferable that it also collects water charges and manages O&M finances. Such an arrangement balances accountability with empowerment, although capacity-building requirements need to be addressed.

The balance of responsibilities and powers between project partners must be capable of change as capacities are developed. The balance will initially be governed by the technical complexity of the installed facilities and by the relative capabilities and finances of the partner bodies. Both may change; skills development in the community might allow a transfer of O&M responsibilities — it should then bring a corresponding transfer of powers for charge collection and service financing.

The private sector could have a key role to play, particularly in corrective maintenance and the supply of materials and spares. If it can provide the flexible responses required, an enabling environment is established. The box below describes how project partners in Karonga, Malawi supported the long-term supply of handpump spares to communities by local wholesalers and village shops.

Practices

2.6.8 Scoping proposed sector and institutional appraisals

An appraisal of host country institutional structures and of individual institutions in the water sector is a necessary preliminary to DFID involvement at programme and project level.

Determining the scope of Institutional Appraisals is an iterative exercise which depends on the realistic potential for achieving DFID's objectives and the likely size of the country programme in the water sector. The DFID Institutional Adviser dealing with the concerned region should be consulted at an early stage. Institutional Appraisal is essentially a two-fold process. The first stage entails considering the whole sector— that is the broader institutional arrangements in which services are planned and delivered — while the second stage examines the internal environment and functioning of individual organizations. Before moving to the project identification stage there should be a well-documented institutional appraisal of the WS&S sector and a broad understanding of the institutional arrangements in typical WS&S institutions, as well as the external environment within the country concerned.

VLOM: Karonga, Malawi: Facilitating the provision of Afridev handpump spares by the private sector

The Danida-supported Karonga integrated groundwater supply project on the northern shores of Lake Malawi evolved from having a construction target focus to being a project where priority was given to setting up a sustainable operation and maintenance system.

In 1992 arrangements were agreed with 15 existing village shops in the project area. This entailed the project supplying fast-moving spares such as o-rings and u-seals to the village shops, who received a 10 per cent commission on sales. An agreement was then reached in 1993 with two wholesale stores, who received a year's supply of pump spares (initially on commission). It was agreed that in future the stores would obtain the spares from local producers.

With the introduction of the wholesale link, shopowners were required to purchase their supply of pump spares from the wholesalers. Realizing that the shopowners could not afford to invest in stock, the project delivered an equal amount of fast-moving spares to all 15 shops. This functioned as start-up capital or a revolving fund.

Handpump committees are generally satisfied with the new system, apart from having to travel to the wholesalers for the slow-moving spares. The village shopowners felt that stocking the spare parts is mainly a community service because of the small profit margins, but all expressed a willingness to continue to stock the fast-moving spares.

D. Noppen, 1996

Table 2.6.3 identifies a range of key focus areas to consider in conducting appraisals under four main categories:

- Water and sanitation sector
- External environment
- Appraisal of water and sanitation institutions/municipalities
- Appraisal of community organizations

Institutional Appraisal extends to an overview of the general conditions and structures in the country. It is an ongoing, continuous exercise, in which detail is added at succeeding stages of a project but the initial complexity and scope is defined by the size of the intended programme and the complexity of existing institutional structures.

In many countries, good information may already be available from the government, other donors, and academic institutions. It can be advantageous to conduct appraisals in conjunction with other donors and host governments. Decisions will need to be made on the focus areas to be included in an appraisal. For example, should the complex issue of water resource allocation and management be examined? More detailed appraisals of WS&S institutions and of community organizations that are intended to participate in a programme are more likely to be required at the project preparation and appraisal stages, but *'Institutional Appraisal should never stop. Implementation is a*

Sustaining community-based operation and maintenance

Implications for practice

- Participatory methods of working are centrally important, and not simply participatory contributions of labour and money in response to agency instruction, but continual processes of shared decision-making between the agency and primary stakeholders at all stages of the project cycle, with the aim of developing the community members' sense of responsibility for and control over the local operation, maintenance, and management system.
- Increase as far as possible the room for manoeuvre that community members have in relation to aspects of the service design — choice and location of service, and operation, maintenance, and management of the system.
- Where community management is required, capacity building should be a project output, especially the development of skills in management, planning, analysis, decision-making, and problem solving. The time scales for construction work and capacity building are different. Capacity building requires separate resources of time, resources, and personnel.
- Provision for the transfer of responsibility should be built in from the beginning of the project, with clear recognition that this is a process not an event.
- Recognition that tackling the problem of non-payment of recurrent costs is not simply a matter of adjusting payment levels, but addressing all aspects of effective community management, including institutional and technical.
- As far as possible, make change pay, that is by creating paid jobs in service operation and management wherever possible and reducing or eliminating reliance on volunteer labour.
- Keep technology very simple to maintain and repair, where possible, with a reliable supply of spare parts and technical assistance available locally.

Derbyshire & Vickers, 1997

Table 2.6.3 Focus areas for institutional and sector appraisal

Appraisal categories	Focus areas
1. Water and sanitation sector	• Regional allocation of water between user groups • Water pricing and subsidy distribution • Allocation of responsibilities between WS&S institutions • Government policies, strategies, and regulation in the sector • Actual service levels, particularly for the poor • Sector performance against key indicators • Cost recovery, transparency, and lending terms • HRD for the sector • Private sector participation (PSP) in water and sanitation • Climate for change and change champions
2. External environment	• Social, technical, economic, and political environment • Government policies and progress on reform • Employee conditions of service and recruitment policy • Opportunities and constraints for PSP • Formal and informal structures • Absorbtive capacity • Consumer and media pressures
3. Appraisal of water supply and sanitation institutions	• Organizational performance against key indicators • Actual service levels, particularly for the poor • Organizational autonomy • Leadership • Commercial orientation • Consumer orientation • Management and administration • Technical capability • Developing and maintaining staff including training needs • Organizational culture, formal and informal structures • Interactions with key institutions/departments • Availability of financial resources • Priority areas for improvement often include: Management of O&M, cost recovery, customer services, demand assessment, and investment planning
4. Community organizations	• Demand for improved water and sanitation services • Capacity/willingness to manage service provision and recover costs • Representation of different community groups in the community organization • Social cohesion within the community • Linkages with government/water utility/NGOs, etc. • Training needs

The key stages in appraisal, applying equally to national structures/policies and to those of individual sector organizations are:

- establish current policies, objectives, and programmes;
- evaluate actual progress against programmes; and
- assess policies/plans against 'fitness for purpose' and against best or recommended practice.

A more detailed understanding of national policies and their effectiveness/equity can be obtained by examining subsidies and their outcomes and by clarifying the functions and responsibilities of sector organizations from national to local level.

Within individual organizations existing service and financial performance is measured against key indicators, allowing comparisons between similar organizations. SWOT and STEP techniques are useful analytical tools.

further opportunity for learning — the project cycle should not be a linear process' (DFID Technical Note No.14, 1995).

2.6.9 Tools for appraisal

For Sector Institutional Appraisals, the government's policies, plans, and progress against those plans provide a useful starting point. It is important to consult widely using participative techniques such as semi-structured interviews, workshops, stakeholder analyses (DFID Technical Note No.13, 1995), and problem tree analyses to develop a common understanding of the interlinkages of problems and potential solutions. After developing a good understanding of the existing situation, a key question is: *are the current or proposed institutional arrangements appropriate?* Some of the key institutional appraisal techniques and considerations are summarized below with a brief discussion of their applicability.

Activity/Responsibility matrices are a particularly useful tool in the water sector for establishing the actual allocation and fragmentation of responsibilities between the various institutions. An example matrix is shown in Table 2.6.1.

Assessment of apparent and hidden subsidies is a means of determining if there are perverse incentives that could distort demand and equity on any proposed projects. Hidden subsidies can be in the form of capital grants, inter-sector subsidies, electricity subsidies, etc. 'Single-entry' accounting, which is common in some government departments, does not reveal hidden subsidies as well as commercial 'double entry' accounting. (For more detail on subsidy analysis, see Section 2.5.)

SWOT analysis is a technique for diagnosing key institutional issues by looking at S(trengths), W(eaknesses), O(pportunites), and T(hreats). Although it can be used by DFID staff for their own analysis, it also lends itself to a workshop approach, facilitating self-diagnosis by the institution concerned. It encourages not only diagnosis of internal issues but also of the external environment (DFID Technical Note No.14, 1995).

Key performance objectives and indicators are the quantitative means of assessing how an organization is managing its service provision. A number of widely applicable indicators for a water utility are summarized in Table 2.6.4, under categories of water production and delivery, efficiency, water consumption, sanitation, and productivity. Indicators generally have three distinct levels: process and performance indicators within water sector organizations and impact indicators in the external environment. There are risks that some indicators can be misinterpreted, for example 'coverage' implies the percentage of people receiving water, but in India, for example, it is the percentage of people within the water distribution command area. In the project context, it may be worth confirming some data by surveys, such as the consumption of water per capita in poor areas, particularly in the dry season.

Other organizations, such as an agency responsible for hygiene and sanitation promotion, would have different indicators, mainly related to behavioural change (see Section 2.8).

Financial objectives and indicators are a key means of determining an institution's priorities and capacity. Typical financial objectives could be: to meet O&M costs, to break even, to make a profit, to achieve a specified percentage return on fixed assets, marginal cost pricing, to achieve social equity, or to achieve a combination of these. Some selected financial indicators for the urban water sector are shown under the bottom five headings of Table 2.6.4. Progress achieved against such indicators can be used as comparators among similar institutions.

STEP analysis can be used to assess the external environment by examining the S(ocial), T(echnical), E(conomic), and P(olitical) environment that an institution or sector has to operate within. These factors can then be considered in terms of the potential threats and opportunities for the institution/sector concerned.

Assessment of organizational structures

Different situations call for different organizational forms and this is generally true for urban and rural water supplies in developing countries. Some of the key factors to consider when examining an organizational structure are:

- organizational levels
- chain of command
- grouping of functions and objectives of those groups
- responsibility and authority limits
- job descriptions
- formal and informal structures

Analysis will include a focus on the structure of the organization, with a view to determining the extent to which its formal processes and systems are actually followed in practice, and how the informal culture of the organization exerts a dominating influence on actual practice.

Assessment of roles, policies, and strategies

As part of the Sector Appraisal, the roles, mission, policies, and strategies of key stakeholder institutions should be assessed. DFID Technical Note No.14 (1995) provides a checklist for assessing these aspects.

A good overall assessment of an institution's strengths and weaknesses can be gauged by looking at nine critical aspects of its management philosophy and operational capacity. The method is described in literature of USAID's Water and Sanitation for Health (WASH) programme.

2.6.10 Assessment of critical success factors in water institution performance

A methodology for diagnosing institutional deficiencies in the water sector emerged from the WASH (Water and Sanitation for Health) project that was funded by USAID. The methodology is described in *Guidelines for Institutional Assessment for Water and Wastewater Institutions*, Cullivan et al., (1986). Other documents in the WASH series provide useful further reading. The methodology involves making rating assessments against a number of indicators within each

Table 2.6.4 Performance indicators for typical urban water supply institutions

		Formulae	S Asia	E Asia	SE Asia
Water production	Quantity of water produced		270mld	128.7mld	1,189mld
	Quantity of water			75%	na
	Energy/Chems% Op Costs		35.4%		
Water delivery	Target population		2,800,000	1,079,000	3,057,000
	Connections		190,000	32,064	799,049
	Service coverage		90%	34%	100%
	Connections/ Standposts		55%	70%	100%
	Service timing		1-4 hrs	12-24 hrs	24 hrs
	Population density		165.7/ha	varies	48.3/ha
Efficiency	Unaccounted for water		40%	35%	8%
Water consumption	Quantity water consumed (av.)		45lpcd		168lpcd
	Water consumed in slum areas				
	Metered consumption			26%	100%
	Quality of water delivered			na	100%
Sanitation	Service coverage				100%
	Treatment		10%	50%	100%
Effectiveness	Water related diseases	per thousand population	4.2	na	na
	Customer surveys		na	na	na
Productivity	Connections/ employee		55	5 - 24	417
	Population/employee		720	325 - 536	1,566
	Percentage staff costs		51.7%		na
Marketing ($US)	Socio-economic GNP pc		$330	$170	$14,210
	WTP to vendors		$0.5	$2 - $8	na
Financial sustainability ($US)	Average domestic tariff		$0.09	$0.2 - $0.3	$0.44
	Community tariff				$0.68
	Sewerage sustainability		20%	100%	22%
Profitability	Operating ratio	$\frac{\text{total cost}}{\text{total revenue}}$	96.4%	84%	43%
	Return on fixed assets	$\frac{\text{profit after depreciation}}{\text{net fix assets}}$	0.16%	2.42%	
Liquidity	Current ratio	$\frac{\text{current assets}}{\text{current liabilities}}$	na	6.7	
Credit-worthiness	Debt equity ratio	$\frac{\text{long-term loans}}{\text{equity}}$	na	0	
Financial efficiency	Days receivable ratio	$\frac{\text{365 x accounts receivable}}{\text{annual billed revenue}}$	286 days	242 days	33 days
	Bill collection efficiency	% of bills collected	na	55%	na

of the nine Critical Success Factor or Performance Categories listed below. The relevance of these factors have been found to be high in many ID projects in the water sector.

- **Organizational autonomy** is critical in terms of an organization's ability to manage and respond to its customers' needs. Municipal water departments, for example, which are not able to hire staff or raise tariffs to meet their projected costs, have insufficient autonomy to manage effectively. Effective organizational autonomy can be categorized as the authority to make decisions about budgets, tariffs, revenues, hiring levels, pay and incentives, control of personnel, institutional policies and systems, planning of projects, and organizational goals. There are also regulatory functions that need to be performed by governments, such as setting and monitoring objectives and targets, to balance the autonomy provided.
- **Leadership** is the capability to inspire key stakeholders to develop and understand the institution's mission/objectives, to commit themselves to that mission, and to work towards its fulfilment. Effective leaders/change agents serve as positive role models and are required at all levels of an organization. Leaders are essential for agreeing and implementing institutional change programmes, but over-reliance on one leader in development projects can be a problem, particularly if they are then transferred, as happened at the DFID Water Authority Assistance Project in Lesotho. It is generally better to have 'Core Groups' plus a Steering Committee, if the long process of change is to be sustainable.
- **Effective management and administration** is demonstrated by the capacity to get the most out of the resources available (human and other) in a deliberate or planned manner. Good managers have a clear sense of objectives and priorities; they know who to rely on to get a job done and how to delegate to them the means to do it. An effective management climate is characterized by team-work, co-operation, and good communication among staff. To enable managers to perform effectively an efficient administrative system is required. This includes the policies and procedures which regulate, guide, and facilitate the actions of managers. A mature organization has effective sub-systems such as personnel, budgeting, accounting, financial management, procurement, contracting out, and management information.
- **Commercial orientation** is the degree to which actions in an institution are driven by cost effectiveness and operating efficiency. The performance should be guided and disciplined by a strategy to achieve financial self-sufficiency at an appropriate stage of growth. Commercial orientation can be viewed at both operational and policy levels. At the policy level, commercially oriented institutions structure and stage investments, expenditures, and revenues to achieve financial equilibrium annually. At the operational level, everyday activities are guided by quality

standards and by constant attention to cost. The institution strives to establish a reputation as a financially well-run business in the eyes of its consumers (to promote the payment of tariffs) and in the financial and political community in order to obtain financial support for growth and to maximize financial and operating autonomy.

- **Customer orientation** is organizing and directing the services and output of the organization towards the demands and desires of the customer. Staff of a successful WS&S institution see serving consumers as their primary function. All work, including all programmes, and projects, are directed towards greater efficiency, effectiveness, and equality of service to all consumers. Every effort is made to inform and educate customers about the role of the institution and the means it is using to achieve its (and the customers') objectives. The marketing of differentiated services to poorer communities can lead to reliable service provision at affordable prices.
- **Technical capability** is the measure of the institution's competence in conducting the technical work required to carry out the responsibilities of the institution. Most of the technical work is performed directly by skilled, qualified employees, as well as outside specialists supervised by the institution's own staff.
- **Human resources development** includes an assessment of training needs and the capacity to meet those needs, as well as employee incentives and motivation. DFID Technical Note No.14 (1995) provides brief checklists for Human Resources Management and Human Resource Issues. There will usually be HRD requirements at all levels of sector institutions.
- **Organizational culture** is the set of values and norms which inform and guide everyday actions. An unhealthy organizational culture is likely to be highly resistant to change, and will protect narrow interests (such as graft or petty bureaucratic authority). A more positive culture has a clear sense of mission and identity. In the water sector, the institutional culture is often bureaucratic and supply driven. The box opposite briefly describes how Hyderabad Metro Water Supply and Sewerage Board is changing to a more consumer and commercially orientated working culture. An organization's culture can be assessed by means such as an 'Attitude Analysis' (refer to DFID Technical Note No.14 (1995) for a checklist) and an appraisal of the level of transparency. Corruption has a deleterious, sometimes devastating effect on administrative performance, although a distinction should be made between 'speed money' taken by very low paid staff and substantial misappropriations. Klitgaard considers that:

  Corruption = Monopoly + Discretion - Accountability - Transparency

  There are various anti-corruption measures that can be undertaken by host governments, including professionalizing staff and improving transparency and hence accountability.

Hyderabad Metro Water Board's changing organizational culture in India

The Hyderabad Metropolitan Water Supply and Sewerage Board was constituted in 1989 as an autonomous institution to serve the city of Hyderabad, with a population of 4.3 million in 1991, that is expected to rise to 6.2 million in 2001. Successive managing directors have provided a continuity of leadership in change management away from the previous supply-driven engineering culture, towards a more commercial and customer orientation. This has been achieved through measures such as:

- agreeing a corporate plan and an HRD plan;
- redesignating engineers as managers, encouraging then to be multi-disciplinary, revising the staff structure with increased delegation and agreeing new job descriptions;
- increasing accountability by making area managers responsible for O&M of water and sewerage, billing, and customer service, within a distribution zone. Targets are then set and monitored for improvements in cost recovery. This provides the incentive for improving services to customers;
- improved communication with customers and community groups, particularly with the 'single window' local Customer Service Offices;
- HRD and management development in collaboration with a local university as part of an institutional strengthening programme; and

Despite all the improvements, much work remains to be done in Hyderabad, particularly in developing new water sources and increasing tariffs.

- **Interactions with key external institutions** are judged by the capacity to influence positively and strategically those institutions which affect its financial, political, and legal ability to perform effectively. An adequate legal and regulatory framework (both on the statute and in practice) is an enabling factor in this respect. The multiplicity of institutions in the water sector means that positive interaction and the influencing of external institutions, such as state and national government departments, is generally a priority for a water institution's managers.

The aim of institution building is to create the skills, working environment, and systems for self-sustaining development. The appraisal process may identify weaknesses in one element of institutional structure but changes there will impact to varying degrees on the remaining five key elements. Strengthening must therefore be an integrated and continuing process with adjustments made as implemented changes are evaluated. The six key elements are described in Sections 2.6.13 to 2.6.18.

2.6.11 Institutional development

The aim of institution building is to create the skills, working environment, and systems for self-sustaining development.
The basic strategy for achieving sustainability is a twofold process of improving institutional performance (showing results) and training at the same time (Edwards, 1988). Performance against objectively verifiable indicators should improve over the life of a project.
Promoting the ideas of ID should preferably be a natural process arising out of analyses by key stakeholders, supported by facilitators and experts as appropriate.

Institutional Development (ID) is a learning process, both for the individual and for the organization. The figure below shows the learning cycle used by the National Irrigation Administration in the

The five principal steps of the organizational learning cycle are shown below.
Frequent monitoring against an agreed plan and evaluating against programme objectives is needed.

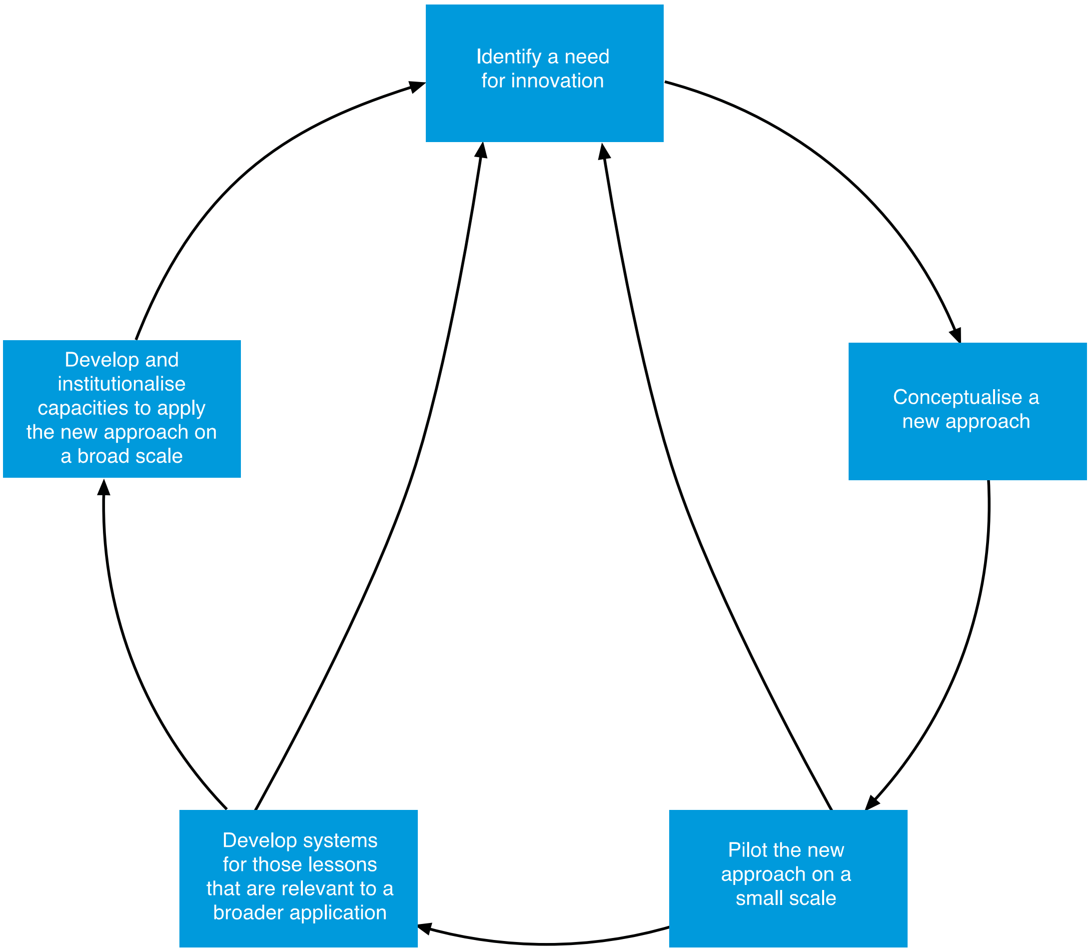


Figure 2.6.2. Organizational learning process cycle
(Korten and Siy, 1988)

Philippines as part of an ID programme that enabled them to become a more participative and effective institution (Korten & Siy, 1988). The feedback loops within the cycle are as important as each step. The overall process was managed by a working group.

2.6.12 Key elements of institutional development

Building on the Institutional Appraisal (where are we now?) options for ID can achieve sector/organizational objectives, using best practice locally and elsewhere (where do we want to be?). The agreed Institutional Development/Strengthening Programme should evolve from discussions with key stakeholders, including staff at all levels. There are six key elements of ID that need to be comprehensively integrated:

- Sector policy development and regulation
- Structural and organizational adjustment

Transformational and transactional analysis

The Burke-Litwin Model distinguishes between two categories of institutional change factors: transformational and transactional change.
Transformational factors operate at a more strategic level, providing the environment within which the institution operates a strategic direction and impulsion for change. They include the External Environment, Leadership, Mission, and Culture. Any fundamental change has to be associated with change in them.

Transactional factors may be equally important in particular circumstances but are more operational and incremental. They include structure, management practices, systems, work-unit climate, task requirement, individual needs and values, and motivation. For change at the transactional level to be effective and sustainable, it needs to be consistent with the transformational factors. In turn, however, energy at the transformational level needs to have an impact at the transactional level to overcome specific problems, such as systems or motivation.

based on DFID (1995a) Technical Note No.14

- Human resources development
- Management development
- Systems and procedures development
- Physical and financial resources

Previous experience has shown that ID programmes need to be comprehensive; deficiencies in one area can subvert the best efforts to improve one sub-system alone. Emphasis on each element would depend on the programme objectives and priority areas identified. Further discussion of each element is set out below.

In contemplating support of ID work, the transformational factors (for example external environment and organizational culture) that are described in the box above, need to be borne in mind. Transformational change is difficult to bring about, so there is a need to be opportunistic in detecting a 'climate for change' in the state, country, and institution being considered.

The objective is an enabling framework of policies and an encompassing regulatory regime. Governments need not take an active role in service provision but may beneficially play a part in aiding capacity building in service provider organizations. For effective regulation the regulatory body must be fully informed in all spheres of service provider activities.

2.6.13 Sector policy development and regulation

Governments need to develop and implement agreed water, sanitation, and hygiene promotion sector policies and legislation that provide an enabling framework for adequate and sustainable service provision. There are opportunities for DFID to support such a process as the box on the next page on experiences in South Africa shows. Some countries have policies that seem worthy but they are not always so in practice. Recent thinking on the role of governments in the water sector has favoured the concept of an 'enabling environment', with governments concentrating on setting up the right legal and institutional framework, and stepping back from actual operation (Winpenny, 1997a).

A clear role for government is *regulation*, which is often neglected due to the preoccupation with service provision. There is a strong

Development of water and sanitation sector policy in South Africa

DFID is supporting policy development and its implementation in rural community WS&S programmes, in conjunction with DWAF (Department for Water Affairs and Forestry). The programme focuses on community management, staff development, institutional frameworks, strategy development, data management, and research. Collaboration occurs through a number of relatively small linked projects including:

1. DWAF capacity building
Project purpose: Institutional framework and capacity to support community WS&S established in two provinces

2. Development of a national sanitation programme
Project purpose: Develop and implement the start-up phase of the national sanitation programme at national, provincial, and local levels

3. Human resource development support
Project purpose: Establishment and development of an HRD service in DWAF

While such projects can have relatively high staff inputs in relation to aid expenditure, they offer potential benefits in terms of widespread sustainable poverty-focused government initiatives. In South Africa good progress has been achieved in terms of developing policy documents, although some problems have occurred in implementing the policies, in terms of capacities at the local level. DFID is now supporting a follow-on project to DWAF Capacity Building, which is aimed at operationalizing the Water Services Act, especially at local government level.

However, there is a genuine risk that efforts to promote community participation can be circumvented by ambitious construction programmes, which is also a common occurrence elsewhere.

Such policy-focused projects are more likely to be successful where there is a shared agenda between the donor and the host government, as in South Africa, as well as good potential capacity for policy development and its implementation.

based on Harvey & Kirk, 1997

argument that regulation should be separated institutionally from service provision. Otherwise regulation will be weak, as shown for example by UK experience before the setting up of the National Rivers Authority.

Key areas which government should consider in customer protection and regulation are:

- responsiveness to customers;
- service standards and service levels achieved;
- water availability, use, and allocation;
- safety net for the poor;
- tariffs, prices, and value for money;
- asset serviceability and efficiency;
- environmental and health standards;

- infrastructure development for future needs; and
- performance-related incentives (particularly for substantial private sector participation).

To regulate effectively requires good management information in these areas. Where there is insufficient organizational autonomy or fragmentation of responsibilities, regulation is more problematical because it is difficult to hold any one institution accountable. In many developing countries, the government also undertakes service-provider functions, particularly in the areas of training, staffing policies, and capital investment. For water supply institutions which need to improve their capacities, the government needs to undertake a facilitatory role using incentives where appropriate. For example, public capital loans can be conditional on water supply institutions addressing cost-recovery issues.

HUDCO in India uses such conditionality on loans to municipalities for water supply projects. Useful references in this area are contained in the further reading section.

The example given in the box opposite highlights some key lessons from DFID policy-focused projects in South Africa.

2.6.14 Structural and organizational development

Beware of seeking change by creating new institutions. Where possible, good institutional development is achieved by patient building around the best of existing capacity.

The answer to the question 'what are the most appropriate institutional arrangements?', may suggest a new organization. The

NWSDB Sri Lanka: Decentralization and ID

Indicators	1984 (before ID project)	1990 (end ID project)
Piped water produced (Mm 3/y)	155	218
Billed connections (000)	79	185
Billed connection to employee ratio	13	26
Billing lag time (days)	180	30
Collections (Rs. million)	56	442
Collection efficiency (% of billings)	25	87

The impressive improvements against these key indicators have been achieved with the assistance of an ID project supported by USAID. The most significant initiative was decentralization or deconcentration within the National Water Supply and Drainage Board (NWSDB). This entailed the development of five Regional Support Centres which became responsible for many of the organization's functions. Regional operational autonomy and delegated financial authority increased significantly, and resulted in both a more responsive service to customers and improved financial performance. Substantial management development and HRD supported this process.

The positive trends against key indicators have continued. Further improvements, however, are considered to be dependent on greater autonomy and role clarity for the NWSDB as service provider, and the government as regulator.

based on Franceys, 1998 and Tillekeratne, 1993 case for the creation of new institutions, whether they are new village water committees or a corporatized water board/company, needs to be carefully assessed in terms of prospects for sustainability. Issues such as the degree of financial and managerial autonomy, legal status, incentives, capacity-building requirements, and pressures from the external environment, need to be weighed against alternative arrangements, including the perceived risks. There is also a danger that new institutions take over all or part of the functions of existing ones, but the old ones remain in being, increasing the bureaucratic complexities of the sector.

An institution need not always reorganize to develop itself, but most institutional development efforts involve adding and dropping functions, moving towards decentralization or amalgamation, or a combination of both (Edwards, 1988). Historically, many institutions are centralized, with power concentrated in the hands of a few. Since no one person can do the job of everyone, this arrangement usually does not work very well.

Structures often need to be set up to delegate authority combined with the development of management skills, in order to respond to consumer needs. This was undertaken at the National Water Supply and Drainage Board in Sri Lanka, where substantial improvements were achieved (see box on previous page). Structural changes take time to implement and require a careful process of developing and communicating new roles and procedures, with adequate training and involvement of those concerned.

2.6.15 Human resources development

The development of human resources is likely to be a key intervention in DFID WS&S sector programmes. While there is no standard approach to training design, the training cycle can be considered to be four inter-related activities:

- identification of training needs
- training development/planning
- training implementation
- assessment/evaluation

Refer to the 'Guide to human resource development and training in developing countries' (DFID, 1997b), for a discussion of the overall training process and what is entailed in the four stages listed above. As part of a project it may be appropriate to support the development of the capacity of a local training institution. A useful reference in this respect is Edwards and Salt, 1990.

Where project partners are expected to adopt new approaches, training will be required for those concerned. Decisions will need to be made relatively early in the project cycle regarding training needs and specifications, who will be trained, and how, when and where will the training take place. Overseas training may be appropriate for changing

Sectoral moves to programmes driven by user demand and to the partnership approach require personnel at all levels and in all agencies to adapt their attitudes and thinking. Building capacity in this area is therefore likely to occur in almost all WS&S interventions. Many staff will need multidisciplinary training to equip them to adopt participatory approaches and to guide communities on economic, social, environmental, and technical issues. Training curricula have to respond to the changing demands.

attitudes and developing an open-minded, professional approach, particularly when it is undertaken with a broad range of other international participants.

HRD focus areas

Successful demand-responsive water and sanitation projects require project partners to have the requisite skills and motivation to implement their component of the project and integrate effectively. Much of the guidance given in the other specialist sections of this manual implies a need for new skills and more trained people. HRD programmes need to take into account each of these new demands and to develop appropriate capacity building components covering: hygiene and sanitation promotion; social development; economics; environmental issues; and technical aspects.

HRD focus areas for institutional aspects HRD in this area needs to address the *content* of the various aspects involved in ID work, as well as the *process* of change. Competent facilitators are required to oversee the process. For effective integration of different disciplines, it is preferable to train change managers in the relevant related subjects. For example, senior engineers engaged on improved O&M and cost recovery would benefit from training in subjects such as finance, communication skills, management, customer care, etc.

2.6.16 Management development


WEDC-IHE/Richard Franceys

The objective is to instil in managers the changed attitudes needed to effectively implement new policies. Development programmes should begin with top management and work down to all levels.

A management development programme is not merely a management training course, although management training is an element of it (Edwards, 1988). A well-conceived programme will aim to change managerial behaviour to achieve agreed objectives. This component should coincide with the development of new systems (delegation of financial authority, improved procedures, performance review, etc.).

One approach is to engage managers in proactive problem analysis; this will open minds to solutions and best practice used elsewhere and facilitate the consideration of potential solutions. A *Management Development Strategy* needs to start with the top level of management and should then be developed with staff consultations at all levels. A useful reference is Edwards and Salt, 1989.

An important aspect to consider is the incentive structure for staff in terms of job satisfaction, conditions of service, and working environment. Improvements in incentives are likely to be incremental in nature. Very low salaries in comparison to the private sector are a key constraint and over-staffing in some job categories may be a big problem. DFID is supporting a retrenchment programme in the health sector in Tanzania, as a means of enabling the sector institution to develop.

Staff must work to set procedures, and within established and recognized systems, as a basis for maintaining acceptable standards of performance.

2.6.17 Systems and procedures development

Some initial identification of potential new systems can arise out of the Institutional Appraisal (Section 2.6.8). The objectives of developing systems and procedures are twofold: to develop a needed

Block tariffs to subsidize the poor?

Many urban water utilities use a block system of tariffs for metered households. The principle is that families using less water pay less per cubic metre up to a threshold consumption per month. More affluent households who use more than the threshold pay more per cubic metre of water consumed above that threshold, in accordance with the next tariff 'slab'. This is in recognition of the fact that water is a social as well as an economic good.

Problems can arise in developing countries where a number of poor families use the same metered connection, illegally or otherwise, and they use more than the threshold amount, thus paying more for their water. Under such circumstances poor families can pay more with a block tariff system than if there was a flat tariff per kilolitre consumed. Such disparities can encourage a climate of not paying.

In Santiago, Chile, they have dealt with this problem by not subsidizing the poor through lower water charges like block tariffs, but instead providing separate well-targeted subsidies. Other cities which suffer water shortage problems will wish to retain the block tariff system to send economic signals to consumers to conserve water. In those cases, they will need to carefully design and market service options and tariff levels to ensure equity for multi-family pipe connections. (See also Section 2.5.13.)

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Satisfactory development is best achieved from within the organization with maximum design input from staff. Externally designed systems are not recommended.

controllable standard of excellence to carry out the work of the institution; and to train staff to develop and carry out their own procedures. It is tempting to try and 'implant' a system by having outside consultants introduce or impose them. This rarely works. Systems and procedures are most effectively developed by working together with staff. Common systems to be developed in water supply institutions include: management of O&M, billing, financial management, and customer services. Systems for cost recovery, including metering and block tariff design, can present problems in terms of achieving equity as is illustrated in the box above.

Computerization is often seen as a way of solving all sorts of problems in organizations. But it should follow, not precede, the redesigning of business processes. Great caution should be taken in introducing computerized information systems.

Useful reference documents for various systems are included in the further reading section.

New hardware is often a necessary component of institutional strengthening but it is rarely the key component and its priority in the scheme of things should be allocated accordingly. Since long lead times on delivery and commissioning are frequently involved, the

2.6.18 Physical and financial resources

The provision of physical resources (computers, vehicles, maintenance equipment, etc.) is an important part of institutional development, which needs to be clearly related to the objectives of the programme. If there are limitations on the funding of such resources, equipment sufficient for demonstration purposes only may be provided, or a donor who is collaborating (e.g. the World Bank) may offer loans for equipment. Decisions need to be made concerning how critical the equipment is and how critical the timing of its provision. Situations where a whole project is delayed because certain items of equipment have not been provided would hopefully be avoided. It has been observed that as a rule of thumb need for and timing of critical hardware should be carefully assessed.

it takes twice as long as estimated to procure and commission equipment! A procurement strategy and plan should be drawn up to avoid such problems.

Local conditions and influences external to the WS&S sector in the host country may present major impediments and risks to making significant institutional reforms. The needs identified from an appraisal may therefore not be achievable. A process approach may then offer the better route to effective programme management, obtaining the commitment of local staff and partner agencies by fully participatory processes that allow them to guide the direction and extent of change on the basis of their experiences and knowledge.

2.6.19 Translating institutional appraisal into project plans

An appraisal that has been reasonably participatory should lend itself to a natural development into project plans. However, information is critical to WS&S management, and frequently the information required for more detailed problem analysis and planning is not available without further data collection, which can take considerable time. This is one reason why a *Process Approach*, where project activities are not specified from the start, is appropriate for ID work.

Another reason is that managerial staff working in the sector are often more orientated towards crisis management, and may be reluctant to commit themselves to very specific institutional development plans over a long period. There may also be specific local reasons why things are done in a haphazard manner, and it is worth discovering these reasons before alternatives are suggested. In summary, a process approach allows project partners to apply the lessons *they* have learned, thus gaining confidence and a sense of ownership of the programme.

In order to obtain strong commitment from project partners, the process of developing the logframe and plan needs to be worked out jointly. This is likely to involve the use of independent facilitators with key stakeholders actively participating. Various ways of working together should be considered, including workshops, study tours, dialogue with *change champions*, working groups, etc.

The quality of government in the external environment is a key determinant of institutional performance and the prospect for change. If, for example, politicians expect to exert influence over matters of detail, or corruption is rife, or the project partners do not recognize the need for accountability and good management information, then it will be difficult if not impossible to achieve significant change. InstitutionaI Development is usually risky and requires careful analysis and management of risk. If a project proposal includes ID, the project preparation team must be able to argue convincingly that it can be achieved (DFID, 1995).

Wherever institutional development is proposed as part of a project there are several approaches that are recommended and several that should be avoided.

2.6.20 Institutional development approaches

There are several rights and wrongs in approaches to institutional development, and it is helpful to bear these in mind:

Change management: Approaches to encourage

- Explain and promote Institutional Development where it is a potentially viable objective.
- Promote a programme sequence as if it were a training project, where learning, systems development, and inputs should dovetail and build upon one another. Use pilot projects where appropriate.
- Encourage the collection and use of management information at an early stage — information is power.

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- At the start of a project, seek a project area or pilot project where early success can be achieved in order to raise confidence in the approach.
- Encourage the use of local consultants where they have the requisite skills.
- Allow sufficient time for institutional development, including time for stakeholders to make the necessary changes, using a flexible approach. Four to seven years is the minimum time for institutional renewal of a substantial organization.
- Champions of change who proactively support change (e.g. senior government officials) should be identified, while avoiding over-reliance on them.
- Working groups of people committed to change from the various departments/disciplines should be encouraged to plan and manage the implementation of change programmes.
- Support local and South–South networks/study tours for experience sharing.

Change management: Approaches to avoid

- Patching up organizations that are in need of more fundamental reorganization.
- The ‘sacred cow’ pilot project: where lots of time and resources are devoted to a small project that it would not be possible to replicate elsewhere.
- Flying in a lot of experts for brief visits — fewer consultants, and developing mutual understanding with project partners, is preferable.
- Rushing the formation of working groups and committees to meet targets.
- Adopting the role of a ‘diplomat’ by using guarded language and avoiding commitments. Effective collaboration on development projects usually involves open, genuine, and polite dialogue, with a willingness to learn.
- Over reliance on voluntary inputs.
- Emphasizing that the project is the responsibility of the local government but then not allowing it to influence the management of the project and its consultants.

2.6.21 Private sector participation (PSP)

There is a strong push, driven powerfully by the World Bank, for city water utilities to privatize, or at least to engage with the private sector in various forms of partnership contracts.

PSP in the water and sanitation sector offers the potential benefits of introducing private sector incentives and management skills, and it can act as a catalyst for change. There is a continuum of different types of contracts that can be used; from basic service contracts through to complicated concession contracts where the management of a whole city’s water and sanitation is let to a private operator for 25-30 years. The different types of contract are briefly described below in order of increasing scope and complexity (Sansom and Franceys, 1997). Specific contracts can also be developed with features from two or more types.

Service contracts are the simplest form of PSP. The public authority retains overall responsibility for operation and maintenance of the system, except for the specific system components that are contracted out. The contractor's responsibility is limited to managing its own personnel and services efficiently. Typically, service contracts are used for maintenance in components such as pumping stations and meter reading. Payment is usually on a lump sum or schedule of rates basis. A typical contract duration is one to three years. Similar arrangements may apply on a small scale in community-managed projects. In such cases, the village water committee or other management body enters into contracts with local entrepreneurs for items such as deepwell pump maintenance and repair.

Management contracts are a more comprehensive arrangement, where the public authority transfers responsibility to a private contractor for the management of a range of activities such as the O&M of a water supply distribution system or major sub-system. Terms of remuneration can vary, but the inclusion of appropriate success incentives and penalties for poor performance offer better potential for service improvements. The public authority usually finances working and investment capital and determines cost recovery policies. A typical contract duration is three to five years.

Lease contracts, also known as *affermage*, are used where a private operator or lessor rents the facilities from a public authority and is responsible for operating and maintaining a complete system and collecting the tariffs. The lessor effectively buys the rights to the income stream from the utility's operations and thus assumes a significant share of the commercial risk associated with those operations. The lessor generally provides the working capital and the public authority deals with the capital investment. The duration of a lease contract can be from five to 15 years.

BOT contracts, (build, operate, and transfer) is a form of concession whereby a private firm or consortium agrees to finance, construct, operate, and maintain a facility for a specific period, before transferring the facility to a government or other public body. BOT arrangements are attractive for new plants that require large amounts of finance, such as large water treatment plants, but they are not suitable for water distribution or wastewater collection systems. The contract period is normally greater than 20 years, sufficient for the private contractor to pay off loans and achieve a return on investment. These contracts often require high tariffs and/or subsidies to meet the BOT operators' costs.

Concession contracts are very substantial in scope, where the private sector company takes on full responsibility not only for the O&M of the utility's assets, but also for investments, often for a whole city. Asset ownership remains with the government. Frequently the concessions are awarded according to price — the bidder who proposes to operate the utility and meet the specific investment and performance targets, for the lowest tariff, wins the concession. The

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contract, which is usually over a period of 25 to 30 years, sets out: the main performance targets; the mechanism by which prices can be adjusted over time; and arrangements for arbitration of disputes between the project partners. Concessions generally require tariffs to be at a sufficiently high level at the start of the contract to meet the full costs of service provision. There is a danger that such contracts can only be taken on by a small number of experienced international companies, who are only likely to bid on favourable terms to cover the cost and risk of their involvement in a small distant country.

Each type of contract has its own potential benefits and disadvantages, which must be assessed when selecting an appropriate form of contract for a particular situation.

Many lower-middle-income countries are opting for the more comprehensive forms of contracts such as lease, concessions, and BOT contracts. *Toolkits for private participation in water and sanitation* (World Bank, 1997), was produced with DFID support and provides detailed guidance in selecting which type of contract to use and how to develop such forms of contract.

2.6.22 The implications of PSP on poor communities

While there is clear evidence that the commercial approach leads to greater efficiency and reliability of services, concern for the poor is by no means automatic. Concessions need to include enforceable requirements that affordable services will be available to all sections of society.

The lesser forms of private sector participation, service and management contracts, do not generally threaten the poor, because they are limited in scope and duration. BOT contracts are also usually risk-free because they apply on the whole to discreet items of infrastructure. The risks come from long-term, all-encompassing lease and concession contracts where the

A key question is what type of contracts are appropriate for low-income countries (LICs) in the water sector? The World Bank and others advocate substantial PSP in LICs, perhaps using simpler forms of contracts such as management contracts in the interim, before moving on to longer term lease and concession contracts. There is increasing concern about how such long-term PSP contracts will provide water and sanitation services for very poor communities, particularly those communities that are established during the course of a contract.

Many LICs already use service contracts, but in general neither service nor management contracts should pose a threat to the poor. This is because these contracts are usually small, with the contractors taking on only very limited commercial risks, so these contracts can be easily amended to ensure that the poor are not being marginalized. BOT contracts are not likely to have a direct adverse effect on services to the poor because this type of contract is normally for discreet items of infrastructure such as water treatment plants and transmission mains. If, however, the water utility over-commits itself in paying the BOT operator’s charges, this could indirectly affect the poor.

There is resistance in some countries to more substantial forms of PSP, such as concession contracts, because the provision of water is seen as primarily a social good and the private sector may be viewed as ‘profiteers’. In such circumstances a more incremental approach may be appropriate, particularly where capacity for regulation is low.

The best way of ensuring that the poor do not miss out under a PSP is to monitor in great detail against appropriate indicators the level of possible private partners are a limited number of international companies with a dominant profit motive and whose thinking is geared to the water supply and sanitation systems of the western world.

If these contracts are to serve the poor they must be formulated accordingly and be closely regulated. Both functions require the strong institutional structures that are often lacking in countries where the needs of the poor are greatest.

service provided to the poor communities, before and during a PSP. Appropriate measures can then be taken to improve their services. Appropriate clauses will need to be included in the contract. The problem is that detailed measurement of service levels in poor areas is rarely undertaken regularly by water utilities and municipalities. This calls into question the capacity of such authorities to regulate long-term PSP contracts.

Standpost supplies may not be effective under a long-term PSP contract, because it is notoriously difficult to collect water charges from standpost users, so the private operator has little incentive to maintain these supplies. Group connections could be a better alternative option. In Buenos Aires, which has a Concession contract, means of reducing connection charges for the poor are being examined. They include allowing the poor to pay in kind through labour in making pipe connections to their houses. Alternatively, if water from standposts is subsidized, the private operator can bill the government for the water consumed in the same way as other large consumers.

Successful PSP is a balanced partnership between the private sector and government/client. The regulatory role is crucial; if the government/utility are not well versed in the practice of the measurement of financial and technical performance in the sector, they are not likely to make good clients/regulators without substantial ID. Well-designed contracts with the right balance of minimum standards with penalties and ‘success incentives’ are a key factor. Where substantial PSP contracts are being considered in LICs, the regulatory authority will need to focus on services to the low-income areas, because the operator will be inclined to focus on the richer areas to maximize income.

DFID could facilitate increased PSP in the sector by a number of potential interventions, including technical assistance on:

- feasibility studies;
- risk analysis;
- institutional development for generating management information and regulation, particularly for poorer areas;
- contract development;
- enterprise support and restructuring;
- policy and legislative development;
- developing training capacity;
- public/private sector consultations; and
- support to lending institutions.

Further advice on potential means by which DFID can provide assistance is included in DFID Technical Note No.11 (1997) on Private Sector Development.

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Key institutional terms

as used by DFID Government and Institutions Department

Institution

There are two basic interpretations of the term institution:

The first is sociological, and refers to a set of constraints and humanly devized rules which influence and shape the interaction and behaviour among groups and individuals. Institutions are the arrangements which exist in society. They are often referred to as the 'rules of the game'. The second interpretation is a more specific and refers to an individual organization. An *organization* is defined as an individual body with an explicit structure and hierarchy of authority and the formal allocation of tasks and responsibilities.

The terms 'Institution' and 'organization' are used synonymously throughout this manual (although a more strict definition of the second interpretation would require, in addition, the organization to have a collective set of values and interests which define the way it presents itself to the world).

Institutional structure

The institutional structure is the totality of institutional arrangements that exist in an economy in order to undertake particular activities. It encompasses linkages among individual organizations, and the framework of law, policy, convention, ideology and culture in which they operate. This is also sometimes referred to as a country's institutional endowment.

Institutional arrangement

The institutional arrangement refers to the set of behavioural rules that govern and influence behaviour and interaction in a specified domain, such as the legal sector.

(It is worth noting that DFID Technical Note 14 referred to both institutional structure and institutional arrangement as the 'external environment').

Institutional strengthening

Institutional strengthening is designed to improve the capacity of an organization to deliver its existing remit in a more effective and efficient manner, the purpose being to improve the effectiveness of the existing structure, processes, and systems. Institutional strengthening therefore does not admit organizational innovation.

Institutional development

Following on from the two-fold interpretation of the term 'institution', this term can be used to refer to two types of change:

- the creation or development of the capacity of an organization both to reflect upon its role and function in relation to its changing environment, and to plan, implement, and manage its own change programme. Institutional development therefore enables an organization to act reflexively. It encompasses the capacity of an organization to introduce changes in its internal structure, processes, and systems, as well as the process by which they are brought about. It reflects the capacity to introduce change and development in the way the institution is organized in order better to meet its mission; and

- change in the broad institutional arrangements for a particular sector or domain.

Institutional change

A generic term referring to either institutional strengthening or development.

Institutional appraisal

The process of analysing:

- a country's institutional structure;
- the institutional arrangements of specific sector (a sector institutional appraisal); or
- the formal and informal functioning of an individual organization.

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Capacity building

Often used loosely and interchangeably with institutional development and institutional strengthening. DFID's 'Glossary of Aid Terms' defines it as 'training, and other actions, that enable personnel in a recipient organization to develop the necessary skills to carry out required tasks'.

Some writers suggest that this term should only be used with regard to the construction of new organizations.

Capacity development

Another term used interchangeably with institutional development, some suggest it should be used to refer only to developing the capacity of existing organizations.

Organizational structure

The distribution and disposition of functions, activities, processes and responsibilities within an organization; where

Function refers to the basic role of the unit or department (marketing, production, financial reporting, policy and planning, etc.);

Activities refer to subsets of functions, i.e. to the individual jobs performed (selling advertising space, preparing budgets etc.);

Processes refer to the ways in which functions and tasks are strung together within the organization; and

Responsibilities refer to the authority vested in individuals to manage and deploy resources, and the lines of accountability that exist in an organization.

2.7 Technical aspects

This section examines the technical principles and practices involved in the successful implementation of WS&S projects and programmes. It accepts from the start that the associated principles covered in relation to social development (Section 2.2), health and hygiene promotion (Section 2.8), and institutional development (Section 2.6) will apply in conjunction with the technical principles outlined here. In particular, that means assuming that the consideration of technological options, design features, and operation and maintenance requirements takes place in a participatory way. Though it may not say so explicitly every time, the guidance should be read as indicating approaches and decision-making carried out with the full involvement of appropriate stakeholders. These issues are developed in Chapter 3, which also includes a list of indicators in Section 3.6.7.

2

General principles

2.7.1 Water, sanitation, and hygiene promotion

Health benefits are maximized only when improvements cover the three inter-related areas of water supply, sanitation, and hygiene behaviour.

A major shortcoming of past interventions has been a concentration on water supply alone. User demand is heavily biased in this direction, where the needs are perceived and the benefits tangible.

This does not apply to hygiene or sanitation where the education and promotion of benefits are essential components of support.

Water supply stands apart in one other important respect. It has a relatively high technological content requiring technical support that continues from the design and planning stage through construction and into operation and maintenance.

Household water supply, sanitation, and hygiene promotion need to be planned together, if the desired health and other benefits are to be achieved. In making the link, it is also necessary to recognize that there are significant differences in the approaches to the different elements.

All are essentially local issues, usually with wider connotations in terms of integrated water resources management and pollution prevention. At the community level water supply is primarily a communal service, whereas sanitation and hygiene behaviour are individual or family affairs (although in urban areas especially, inadequate sanitation has communal implications and solutions may well involve shared facilities such as sewer systems).

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Water supply improvements are usually implemented by some form of co-operation between an organization or institution and representatives of the communities to be served. User involvement in construction and management is commonly through a community committee, as are payments for implementation, operation, and maintenance. The levels of technology involved are often such that there is a need for technical support at all stages of the process. The key technical issues are selection of possible solutions, detailed design, costing, supervision of construction, and management of operation. It is common for technologists to be the professionals most involved in implementation. Furthermore improved water supply is a commonly felt need of communities; hence they are usually happy to co-operate in its development.

Sanitation for the poor can involve shared facilities, but more often the appropriate facility is a household latrine for which the family retains responsibility. Families decide when and what to construct and are normally responsible for construction, operation, and maintenance. The role of external organizations is usually limited to sanitation promotion, aiding the selection of technical options, and

For these reasons support in water supply programmes is dominated by technicians whereas sanitation and hygiene interventions mainly need social and health workers, with inputs beginning well before facilities are installed.

support to implementation. The groups most involved in development are primarily social and healthworkers. The ability to understand and relate to ordinary people is more important than technical expertise. The main technical issues are related to selecting feasible solutions, preparing detailed designs and material lists, determining unit costs, and advising on construction or production of prefabricated components. While these look similar to the issues addressed in water supply, the level of technical skill required is usually considerably lower.

Since water supply is so different from sanitation, there is no reason why they should be implemented by the same organization. This is particularly true when the implementing agency is connected to government. All the evidence points to the fact that when a single organization is charged with implementing both water supply and sanitation in a region, one of them will receive more attention than the other and it is usually water supply. Concurrent, co-ordinated development should be the guiding principle, but the lead partners may well be different for each component, depending where the appropriate skills reside.

Hygiene promotion is important because it provides the link between the technologies and users. It explains why the new systems are so important and how to obtain the maximum benefits from their use. Promotion must begin before implementation as it gives users the knowledge with which to make informed decisions. It helps, too, to create the demand which is necessary for all community-based activities. Although hygiene promotion is a necessary component of both water supply and sanitation interventions, the skills required for its use are more likely to be found in organizations linked with sanitation than in those focused on water. Hygiene promotion is discussed further in Section 2.8 below.

2.7.2 Sustainable technology choices

To be sustainable technology-based improvements must be affordable to the users and properly operated and maintained. The supporting institutions must ensure adequate training for the latter functions, and assured systems for obtaining spare parts and technical assistance for major repairs. In-country supplies should be aimed for, the more local the better.

Water and sanitation facilities are community services, just like electricity and roads. If they are to be of long-term use to the community and the country they must operate reliably for a considerable period. In other words, they must be sustainable. As we saw in Section 2.1, sustainability is dependent on financial, social, institutional, and environmental factors, but the choice of technology is also central to achieving sustainable systems.

- The technology must be understandable and physically within the capability of the people responsible for operation and maintenance.
- Spare parts and equipment need to be easily obtainable, preferably in-country.
- The technology must be affordable to operate and maintain for the people bearing these costs.
- The technology or level of service provided must be attractive and culturally acceptable to the users.

Appropriate technology and levels of service for the urban poor

A housing estate for council employees was constructed in a town in Uganda during the 1960s. The houses were all equipped with internal plumbing and flush toilets with water-borne sewerage. The council undertook to pay all employees' water bills.

Since Idi Amin's regime, the council has not been paying these bills; a survey in 1996 found that, as a result, 92 per cent of the inhabitants of this estate had been disconnected from the water supply system but were still using flush toilets with water-borne sewerage — clearly an unsanitary situation.

The lesson is that people should be provided with facilities and levels of service which they can fully afford to maintain without relying on external subsidies.

Handpump production and maintenance by women

The Sarvodaya Movement in Sri Lanka trains mostly uneducated women to produce, install, and maintain a type of handpump. Among the skills the women learn are metalworking and borehole drilling. Sarvodaya staff work with the communities, showing the men how to construct the apron slab ready for installation of the pump. They train the local women in handpump maintenance and give back-up support when required. They also provide health and hygiene promotion.

House, Smith, and Smout, 1997

An appropriate technology is, by definition, a sustainable one, but it does not necessarily have to be low cost. ActionAid has recently installed windmills in Uganda to drive borehole pumps for rural communities. This is not a cheap option, but it seems appropriate in an area that is frequently windy but has poor access and a population that cannot afford to pay for the fuel to run a motor pump.

Support agencies should be alert to ongoing training needs. Skills are valuable. In many cases those initially trained in O&M duties, for example, move on and have to be replaced.

Sustainability of technology will depend on the institutional arrangements that are in place, and on the capacity building that has been undertaken to make available local spares, materials, and skilled operators (see also Section 2.6). Staff must be motivated and skilled to ensure that duties are carried out correctly.

An area of sustainability often overlooked is training. Projects frequently include training for all cadres, but it is often forgotten that people do not remain static after the end of the project. Handpump mechanics move on and engineers become managers. Sustainability requires that structures are in place to replace skilled workers as they depart.

2.7.3 Design for operation and maintenance

The ease of operation and maintenance of a facility is central to its sustainability and must be given careful consideration in design. Some operation and maintenance issues are location specific, but urban and rural projects differ fundamentally in the complexity of the technologies involved.

For rural projects the principle of designing for Village Level Operation and Maintenance (VLOM) has proved its worth. There is no reason why the enshrouded maxims of simplicity of operation and ease of maintenance, so that systems can be managed by the community, cannot be extended into urban systems. More technically advanced hardware may mean that operation and maintenance is not within the scope of users but it should be possible for suitably trained local technicians.

For all systems the objective is minimum need for external input.

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2.7

In rural areas the concept of Village Level Operation and Maintenance Management (VLOM) is a philosophy which has been gaining favour over the years. The VLOM approach restricts technology choices to those that can be operated and maintained within the community for which the intervention is intended. It was coined at the beginning of the International Drinking Water Supply and Sanitation Decade, as an approach for achieving reliability, sustainability, and replicability.

VLOM was first proposed as a concept for use in handpump projects. Twenty years ago the handpumps supplied for most projects in developing countries were similar in design to those used in Europe in the last century. They were expensive and could only be maintained using specialist equipment and skills. The VLOM principle has revolutionized handpump design and manufacture. Many are now capable of being maintained by local people using very simple tools. The concept has been so successful that it has spread to many other areas of rural development.

It is rare for the VLOM principle to be taken to its ultimate conclusion. In most situations there will be a time when external materials or skills are needed. Good planning will ensure that those occasions are minimized and support is available when required. In fact, the VLOM concept allows for this. The two Ms (Maintenance and Management) imply only that the village *manages* maintenance. The fact that it may choose to do so by summoning a district mechanic from the nearest centre does not invalidate the principle, providing the service is dependable, affordable, and under village control.

In urban situations, where supply systems will generally be more complex, the design and technology chosen will shape the long-term operation and maintenance requirements. The following quote (Wagner and Lanoix, 1969), although it is thirty years old, illustrates the responsibility of the engineer in finding and designing appropriate solutions:

> 'If by diligent work he can eliminate a pump, an engine, another piece of equipment or a treatment process, he is thereby removing a possible obstacle to efficient operation.'

(Of course, many water engineers are women nowadays!)

When designing a piped water supply or sewerage system, the engineer must take into account operation and maintenance factors such as the availability of chemicals for treatment, spare parts, and equipment, the reliability of power supplies, and the availability of local skills and capacity to undertake O&M.

2.7.4 Standardization

At first it may seem that there is an inherent conflict between the principles of user choice and standardization. In fact, standardization is a crucial part of any strategy to achieve sustainability and replicability, and users can appreciate that point just as well as any

Standardization of designs, equipment, parts and construction methods is a valuable aid to effective, sustainable improvements. When allied to simplicity of design the benefits are pervasive. Familiar techniques lower the skills levels needed in all programme phases from design to maintenance; the benefits of training programmes are spread wider. In plant and equipment terms 'more of the same' encourages local production and stockholding, thereby aiding availability.

Some caution is needed — there must be options, for example in construction materials or elements, to ensure affordability for all. And, at a wider level, donor agencies and host country organizations must seek to address a major continuing failing of standardization planning — the lack of linkages between the practices of donor agencies that can leave a country with a host of localized 'standard systems' impossible to sustain.

The Afridev experience: The original VLOM handpump

The Afridev handpump is the result of a design and development process which started in 1972 and has been evolving ever since. The original pump was designed to the following criteria. It:

- used appropriate technology;
- used lightweight, non-corrosive components;
- could be maintained by women;
- could be manufactured locally to an exact specification;
- needed only one or two simple tools for installation and maintenance;
- was relatively cheap; and
- was designed with preventative maintenance in mind.

Over the years some design features have been modified and improved to aid VLOM. The Afridev has been specified for standardization in many countries including Ethiopia, Cambodia, Pakistan, and Ghana.

Wood, 1993; Skinner, 1996

other stakeholders. The point is that standardization applies within a range of technological options and alternative management approaches. So users may choose whether they want supplies from a handpump, standpost, or house connection, accepting that if, for example, they opt for handpump supplies, the model will be a standard one for which local spares are available and which local mechanics can be trained to repair.

The standardization of equipment, parts, designs, construction methods, etc., has many benefits. Design is simpler. Choices are made from a limited range of options. In the short term this may marginally increase construction costs as the standard designs may not be perfectly suited to the situation. But it requires lower skill levels in the design process, and repetitive construction of the same item improves quality.

Operation and maintenance benefits too. Limiting the range of spare parts increases the quantity of each item that is required (i.e. more of a few items rather than less of many). This encourages local manufacture because the limited range reduces start-up costs and the increased quantity improves profitability. Local tradesmen will also be more willing to stock the parts because the increased demand for a more limited range of items will both reduce the investment required in stock and increase turnover. Standardization also reduces the number of skills required to install and maintain the piece of equipment, thus increasing the probability of local craftsmen being able to carry out the work.

In rural water supply schemes it is common to standardize the design of storage reservoirs and limit the number of pipe sizes used. Handpump schemes usually limit the number of types of pump used to two or three. In sanitation projects it is common to limit the range of latrine designs offered, and to design them so that many of the components used in each design are the same (the pit cover slab for example).


WEDC/Sarah Parry-Jones

Handpump standardization in Cambodia

The Cambodian government recognized the need for handpump standardization in order to achieve sustainable VLOM in rural areas. The following pumps were selected for national standardization:

suction lift — No.6 Pump

medium lift — TARA Pump

deep lift — Afridev

These choices were made through a two-day standardization workshop which was attended by all the partners involved in public water supply The selected pumps have all been proved to be reliable and easy to maintain at village level and can be locally manufactured.

Kjellerup & Ockelford, 1993

Standardization is very common within individual projects, particularly those related to water supply. It is less common between projects, especially if they are funded by different donors. The multiplicity of designs and equipment installed under different donor projects has left many countries with such a wide variety of facilities that none are supportable. It is important that governments develop policies and guidelines to address this problem and that donors respond with a willingness to support national standardization strategies.

In some cases, though, standardization can be detrimental, particularly where it limits user choice. Insisting that all families construct a simple pit latrine with a concrete floor slab and brick superstructure may prevent the poor complying because of the high cost, and deter the wealthy because of the perceived low level of technology being promoted. Standardization must never be so narrow that it prevents users choosing from several options to suit their income and preference.

2.7.5 Replicability

Project partners must confront too the fact that donor-based projects can do no more than illustrate the way ahead, building operating systems and supporting institutions that can be replicated by the indigenous populations using their available material and human resources. Only in that way can the growing WS&S needs of the poor be satisfied.

Project-based development, especially when funded by external aid, will never be able to satisfy fully the demand for water and sanitation services for the poor. If full coverage is to be achieved, then populations will have to implement their own services. National and local governments must draw up policies and strategies for ensuring that best practice, as developed in individual projects, is expanded to improve coverage in other areas of the country. If we wish those facilities to be of good quality then we must set good examples that others can follow. In other words we should try to develop solutions that others want, can afford, and are able to copy. This is what is meant by replicability.

Replicability applies to process as much as to outputs. Wells, piped supplies, pit latrines, etc., should be constructed using designs, materials, and techniques that local populations appreciate and are

Condominial sewerage in Brazil: A case for replication

Condominial sewerage is a low-cost system which was developed in Brazil in the 1980s. Sewers are laid through back yards at shallow depth, rather than under the street. This approach involves a high level of negotiation between agency staff and customers, who are offered the choice of three levels of service. The system has been proven to work well when there is political will and the pace is driven by customers' demands. While there are still problems with implementation, the condominial approach has been successfully scaled up and replicated in a number of cities in Brazil, where there are now extensive condominial networks.

Watson, 1995

Incremental upgrading of pit latrines, Medinipur, India

An incremental improvement approach can be used to upgrade a pit latrine as the family's income increases. They can start with a simple pit and superstructure. In time, the latrine can be upgraded to a pour-flush type, a more permanent structure can be built, and ultimately a twin-pit might be added.

willing and able to copy. In addition, management and operational structures must be installed that can be understood and copied. Community motivators, like the teams in the WAMMA project described in Section 2.2, can be real powerhouses for replication, if they are empowered and equipped for the task.

2.7.6 An incremental approach

The essence of a WS&S programme is offering people a choice of improvements over what they already have. All people need water to live, so there must be *some* form of water supply already or the people would not be there. Similarly, everyone needs to excrete and so there must be some existing sanitation facility or practice.

To design improved facilities, it is first necessary to look in detail at current practices, views, and the performance of the existing infrastructure. The problems, constraints, and shortcomings of the existing water and sanitation infrastructure need to be identified. In rural areas these issues may include:

- unlined pit latrines are collapsing
- people have to walk far to water sources
- handpumps have failed
- traditional sources are contaminated
- seasonal droughts affect surface water

In urban areas, with more complex infrastructure, a whole different set of problems may be encountered, including:

- sewers are blocked
- water supply is intermittent and unreliable
- water pressure is low
- illegal connections are common
- distribution system is too limited.

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2.7

User demand may drive an improvement programme or, as frequently happens with sanitation or hygiene projects, the driving force may come from an outside agency with the expertise to see that improvements could bring health benefits. In either case a 'step by step' approach is to be favoured, fashioning improvements that are affordable and relevant to immediate shortcomings rather than to an ambitious long-term objective. At the same time the next step should be borne in mind, building in 'upgradability' where possible.

At the most basic level, where communities have no sanitation and no close water source, new facilities are the only answer. There are many other instances where improvement may be brought about by repairing or rehabilitating what exists, always bearing in mind that systems do not fall into disrepair without reason. Dysfunctional facilities may have been inappropriate to need or demand or suffered from inadequate support. Corrections in these areas are an essential preliminary to technology changes.

Rehabilitation is not always the best option

Mozambique's Limpopo Railway Line, which was constructed by the Portuguese in the 1950s, originally ran steam trains. In order to meet the high daily water demand of these trains, elaborate water supply systems were built to supply the main stations. These systems were sabotaged and ceased to function during the years of the civil war.

In 1995 a project was initiated to restore water supplies to the townships around these stations. The client was keen to rehabilitate the existing systems, some of which comprised up to 35 miles of transmission mains together with numerous pumping stations. Since the steam trains are no longer running, however, and the projected demand of the local population was found to be less than half the existing system's capacity, it was clearly inappropriate to rehabilitate. It was found to be much cheaper to develop groundwater sources at most stations.

The state of the existing system or practices will affect the decision of whether to replace, upgrade, rehabilitate, or leave it as it is. In a demand-responsive approach, however, the needs and desires of the primary stakeholders will be central to this decision-making process. (See Sections 2.1, 2.2, 2.5 for discussion of participatory approaches and willingness-to-pay surveys.)

If the facility is operating satisfactorily, not producing a significant health hazard, and all the users are happy with it, then there will probably be no effective demand for change. There may, however, be a case for promoting improved hygiene behaviour or improving the sanitation facilities, building on satisfaction with an existing water supply system. The main point about the incremental approach is to seek feasible and affordable improvements to the current situation, rather than insisting on major change to achieve an ultimate solution.

Small improvements are likely to be more sustainable and replicable. An emphasis on upgradable technology also provides scope for further improvement to meet growing demand, as shown in Figure 2.7.1.

If a facility is functioning satisfactorily and is sustainable but does not meet the demand from the community, then upgrading or extending what is already there may turn out to be the best option. The old adage 'If it ain't broke don't fix it!' is very appropriate.

If the current facilities are beyond repair or improvement, then the provision of new infrastructure has to be considered. The main reason for their failure must be investigated, however, to ensure that the new facilities do not suffer the same fate.

2.7.7 Least-cost solutions

Cost is a major consideration. For affordability, least cost must be the aim.

All WS&S interventions should be designed to provide the best value for money to all stakeholders. This is particularly important when targeting the most vulnerable users in both rural and urban areas. Engineers have a responsibility to find the most appropriate, least-cost solution to match the needs and desires of a community. Initially this

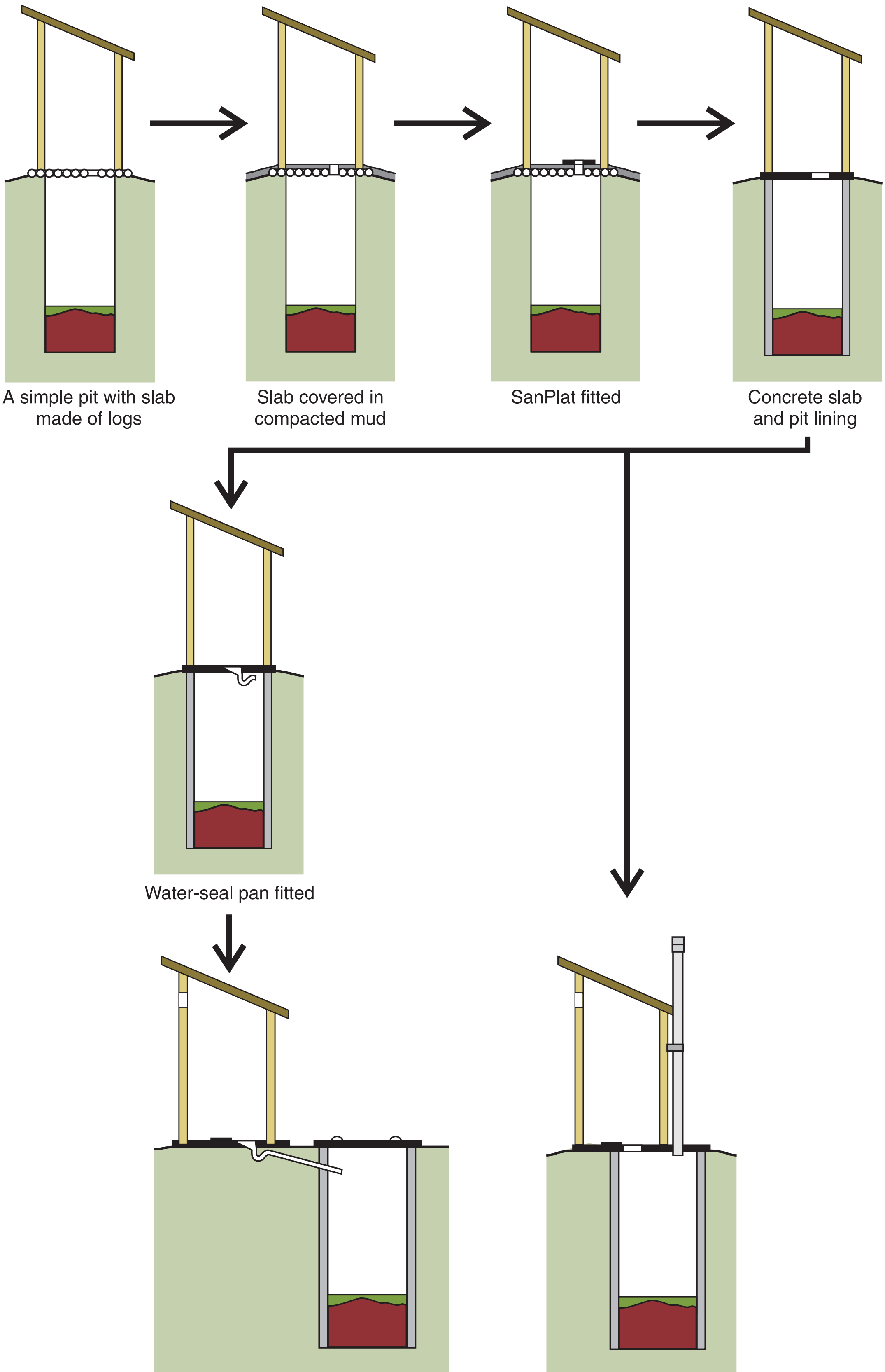


Figure 2.7.1. Incremental improvements to sanitation facilities

Technical options must be assessed on their whole life costs with main equipment items and structures given an annual depreciation value based on assessed design life, and all costs converted to Net Present Value.

In choosing equipment an obvious consideration is the longer design life and lower maintenance costs that might be expected from an item with higher initial cost. Less obvious, but equally important, are the repercussions of breakdowns on such items — typically a need for more skilled maintenance labour and more sophisticated parts and tools than might be locally available; long periods off line are the usual result.

Cheaper equipment may fail more often but be easily and quickly repaired with local resources. It has one other distinct but not immediately obvious advantage in that the long design life of an expensive item may never be fully used in the volatile environments of the poverty-ravaged areas where WS&S interventions are made. Situations and demand on equipment can change very quickly.

will involve developing a range of options and building up a cost estimate for each option. This estimate should include all the capital costs of the infrastructure (e.g. the handpump, pipeline, valves, standposts, etc.), the construction costs, and the long-term operating costs (electricity or diesel, replacement of spare parts, maintenance). The operating costs need to be considered for the entire design life of the system, so in order to compare different options on an equal basis, the long-term costs for each option should be discounted to the present so that all the options are compared by their Net Present Value (NPV).

The design life is the length of time that a system or piece of equipment is expected to be in use before it either wears out or can no longer meet the demand. It can be an important criterion in identifying the standardized technologies which will be most appropriate for a country or region. The choice of design life is always a compromise between cost and durability. Facilities with a long design life will tend to be more robust and require less major maintenance. On the other hand, they will tend to be more expensive than equipment designed to last a shorter period.

It is necessary to consider changes which are expected to occur during the design life of the facility, for example new demand due to increases in the population served, or growth in demand due to increased consumption (e.g. from consumers changing to higher levels of service). This is particularly important for the water supply distribution system.

Long design lives assume a stable environment where the future can be predicted with some certainty. In unstable societies or those undergoing rapid social or political change, such as urban slums, designing facilities to last a long time is probably inappropriate, as no

Example of incremental design approach

A simple spring catchment and transmission main for a rural community can be upgraded. As demand increases a header tank can be added to provide the storage capacity. The dendritic distribution system can then be upgraded to a loop main, with additional tapstands or yardtaps, etc.

Convenience of water sources is important

Gravity systems were built in rural areas of Rwanda to provide water of good microbiological quality. Two years after construction, water fee payment had dropped from over 90 per cent to under 20 per cent and many people went back to their traditional sources. On carrying out a participatory analysis with the community, it was discovered that a major reason for this was that the waterpoints were often no nearer than the old polluted sources. To the community, distance was more important than quality. They saw little improvement in the new system and therefore were unwilling to pay for it.

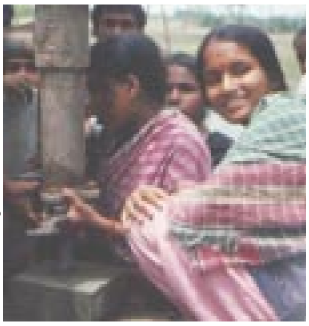
Bailey, 1996

one can predict what is likely to happen even in the short term. There is also a trade-off between durability and repairability. Heavy pumps and valves need special equipment for repair and may be out of action for a long time when they do eventually break down. The origin of the VLOM concept was the long downtime of old-style handpumps waiting for trucks and mechanics to make long journeys to repair them. Lighter pumps, it was argued, may break down more frequently, but if they could be repaired in a few minutes by a village caretaker, the 'reliability' was much improved.

There is no need for all parts of the same facility to have the same design life. The water pumps in a simple water treatment plant will probably have a shorter design life than the buildings or the pipework in the distribution system, simply because mechanical equipment wears out more quickly than buildings and pipes. Similarly the floor slab of a pit latrine may be designed to last longer than the superstructure if the slab is to be used on a succession of pits as the previous ones fill up.

2.7.8 Convenience

Improvement means more convenience (in terms of use) than what was previously available, but there is more to convenience than siting the water source nearer the house. In sanitation matters, for example, women and children especially may have good but less overt reasons for wishing to take more than the first step up the improvement ladder. Support agencies must be alive to the underlying personal and family values and community social norms that may influence demand.



WEDC/Sohrab Baghri

As Section 2.3 makes clear, the health focus of government and donor investments in WS&S improvements is not the benefit most understood by users. Convenience of both water supply and sanitation facilities is given a high priority, particularly by women and children. Facilities need to be easily accessible and easy to use: if they are not, users will look for alternatives. It is important therefore that new facilities are at least as convenient to use as existing ones. This concept is particularly relevant to selection of levels of service for water supply programmes (see Section 2.7.14). In the case of sanitation facilities, the level of service considerations are more subjective. They often relate to feelings of pride, prestige, and local custom rather than any measurable indicators. A flush latrine with a soakaway pit will provide the same measurable benefits as a latrine connected to a sewer, but most families would consider the latter a higher level of service.

2.7.9 Gender in technology

Sanitation and water supply facilities are used by women and children more than by men. It is therefore imperative that all sections of the community are fully consulted at all stages of the project and that the facilities are designed for all to use. Most water and sanitation technologies are designed by men and they are frequently unaware of the impact that the differences between the sexes can make on the convenience of using a piece of equipment. Simple things such as the height of taps and handles or the spacing of footrests on a latrine slab can make all the difference to the ease with which a facility can be used.

Gender has other impacts on technology besides simple design. The location and the way the technology interacts with the community are important and can affect their usage. For example, women may not use a handpump placed near a mosque. While men see a tapstand purely as a place for collecting water, women may see it as a place to meet others and discuss points of common interest. Designing facilities to promote such interactions may make them far more desirable to the users. Similarly, designing a latrine superstructure so that it can be used for bathing or laundry may considerably increase its value to women but have little impact on men. There are many other socio-cultural issues involved in the design and use of WS&S facilities which make it crucial for women to have an influential role in their selection.

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2.7.10 Construction


WEDC/Sohrab Baghri

The quality of construction will impact on the sustainability of the scheme: for example, a concrete mix made with a low cement content will be weak and could ultimately result in the failure of pit latrine slabs. It is therefore important to have an adequate level of skilled supervision in order to ensure that the desired quality is achieved. If the work is not properly supervised then incompetence, corruption, or corner-cutting may affect the end product.

While it is often considered appropriate to involve the community in construction and supervision, this may not always be possible. In urban or peri-urban areas many people already earn a living and would not be prepared to contribute labour to a water supply or sanitation scheme but would rather contribute cash. This situation needs to be assessed at the early stages of a project. It is generally more cost-effective to use labour from within the community as much as possible. Using community labour does have training implications, however, since most residents will not be skilled in construction. It would clearly be inappropriate to use small local contractors and community supervision for the construction of a large pumping main or a complex treatment works.

A key consideration in the construction of WS&S improvements is the need for effective supervision both to ensure worker safety and the quality of the end product. Neither may be of the standard expected on UK sites but the same principles should be applied, with the desired standards instilled by appropriate training and communication.

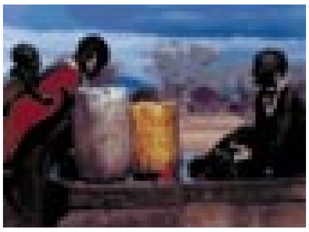
2.7

Construction is a notoriously dangerous occupation and it is important that local safety standards are maintained at all times. These may be well below the accepted UK standards, but it is not realistic to expect all labourers to possess hard hats and steel toe-caps! The key to good safety and also to quality construction is good communication, so

Community labour and supervisory input is desirable if local conditions, such as viable money-earning activities elsewhere, do not preclude it. Local input almost always produces the least-cost solution.

Table 2.7.1 Comparison of construction and supervision costs of collector sewers in Orangi, Pakistan

Construction and supervision	Length of sewer (m)	Cost per metre (Rs)
Built by small contractors, supervised by community group	89,536	52
Built by small contractors, supervised by individual user groups	189,926	50
Built by large contractors, supervised by local government agency	34,267	295



WaterAid/Jim Holmes

Design for the needs of the users — normally women

In 1992 DFID evaluated the Eastern Region Water Supply Project in Nepal. The project had been primarily engineering-led, and local and expatriate technical staff had liaised with communities mainly through the leaders of the Panchayats, the local political structures. Links with the communities were therefore only through a small group of local leaders who might not have been broadly representative of the various interests and views of all sections of the communities. Where users developed views on scheme design, there were no channels for these views to be fed back to the engineers. The distribution of water supplies was generally equitable, but in some cases tapstand locations were considered to be unduly public, especially for women. Tap stands are used for bathing purposes, and some tapstands were close to roads, where there was little or no privacy. The design of the tapstands was also considered unsatisfactory, as users and especially women wanted larger concrete aprons around the tapstands for washing clothes and to reduce crowding.

In the town of Letang, some hand-dug wells were in use, and these had head walls built above ground level. The head-walls were tall and wide, so it was difficult and exhausting (even for one of the assessors, a tall man), to lift water from the wells because the headwalls came up almost to his armpits, and he had to lift the water with his arms straight. The difficulty must have been much greater for Nepali women, who were significantly shorter.

House, Smith, and Smout, 1997

channels of communications between all parties on site should be simple and well-defined (Coburn, 1995).

Construction planning should take account of and aim to circumvent the common tendency for community commitment to wane when users believe their main demand objective has been achieved. If less obvious health benefits are to be realised, support agency staff may need to devise means to maintain user interest until all the works are completed as planned. Sometimes there must be acceptance that substantial completion gives most of the benefits; the users may raise their sights at a later date.

Perceptions of project completion

The decision on when a project is complete often causes friction between implementers and the community. Completion for the implementer is quite straightforward. It is defined by contracts, drawings, and statutes. Communities have a more practical approach to completion. Once the project produces the benefits for which they agreed to undertake it they see no reason to spend further time and money on it. A common example of this is in shallow well construction. When communities participate in their construction they will frequently cease to participate once the hole is dug. The implementing agency may wish to build some form of structure on top of the well to improve both durability and the quality of the water produced. To a community suffering from water shortage this is often seen as unnecessary. Once the hole is dug and the water reached they have access to water and the implementer's desire to spend additional time and money on the well-head may not be supported, even though it is necessary to maximize health benefits.

The answer is to reach some form of compromise. The main reason for improving WS&S provision is to improve the health and well-being of the community. If this has largely been achieved then trying to force people to do things that they do not want to, especially when they are paying for it, is counter-productive. If there are any items that the implementer considers essential but the community does not (e.g. a building to put a water pump in), then the reasons for it should be explained to the community to try to persuade them to build it before the main works reach a point where work is likely to cease, or to build the project into some form of contract between the implementer and the community. The principle of incremental improvement is worth bearing in mind here. The project may not be finished to the implementer's perception of completeness, but it is the users who count. It is possible that at a later date they will upgrade the facility to something similar to what was wanted originally.

Sanitation principles

WaterAid/Jim Holmes

In most instances affordable sanitation for the poor means on-plot latrines of varying degrees of sophistication. Restricted space or unsuitable ground conditions may force people to resort to other techniques in urban slums; usually piped sewerage is the only safe alternative. This expensive solution generally brings with it an obligation of long-term subsidy as cost recovery for construction and probably operation will be beyond the means of users.

Adherence to western design and construction standards has contributed to an in-built acceptance of high costs. More appropriate standards are beginning to be used to

In rural areas, the most appropriate and affordable technology for excreta disposal is generally provided by on-plot pit latrines, such as simple pits (Figure 2.7.2) with pre-cast slabs which may be re-inforced or domed (Figure 2.7.3), ventilated improved pit latrines (VIPs) (Figure 2.7.4), and pour-flush latrines (Figure 2.7.5). A particularly low-cost solution is to upgrade an existing pit with a SanPlat — a pre-cast concrete slab placed on top of the existing pit cover. This is also usually the case for poor people in small towns and peri-urban areas. In urban slums on-plot sanitation is often the most cost-effective solution, but it may not be appropriate in some circumstances, for example:

- if there is no room available to construct a latrine with an on-site disposal system (see Section 2.7.20 for more detail on this);
- if ground conditions are unsuitable for on-site disposal systems; or
- where water usage is greater than the disposal capacity of the existing facilities.

There is commonly pressure from urban communities to provide a higher level of service for waste disposal, in which case pour-flush or cistern-flush latrines may be used with on-site disposal. These can also be used on upper floors in multi-occupancy buildings, which pose problems for other types of on-plot sanitation.

When on-plot sanitation cannot provide a solution, alternative forms of sanitation must be considered. In nearly every case that will be sewerage. Unfortunately sewerage is very expensive and usually unaffordable by the urban poor. It must be accepted that if sewerage is to be implemented then subsidies will be required during both construction and operation, and the local government or other body will need to accept the recurrent subsidy as a justifiable long-term commitment (see Section 2.5 on subsidies).

2.7.11 Reducing the cost of sewerage

Work carried out in a number of countries has shown that the cost of sewerage can be considerably reduced. Past design and operation of sewerage has been based almost entirely on methods developed in North America and Europe. Many of the standards used are inappropriate for either developing countries or the needs of their communities. Costs can be significantly reduced by:

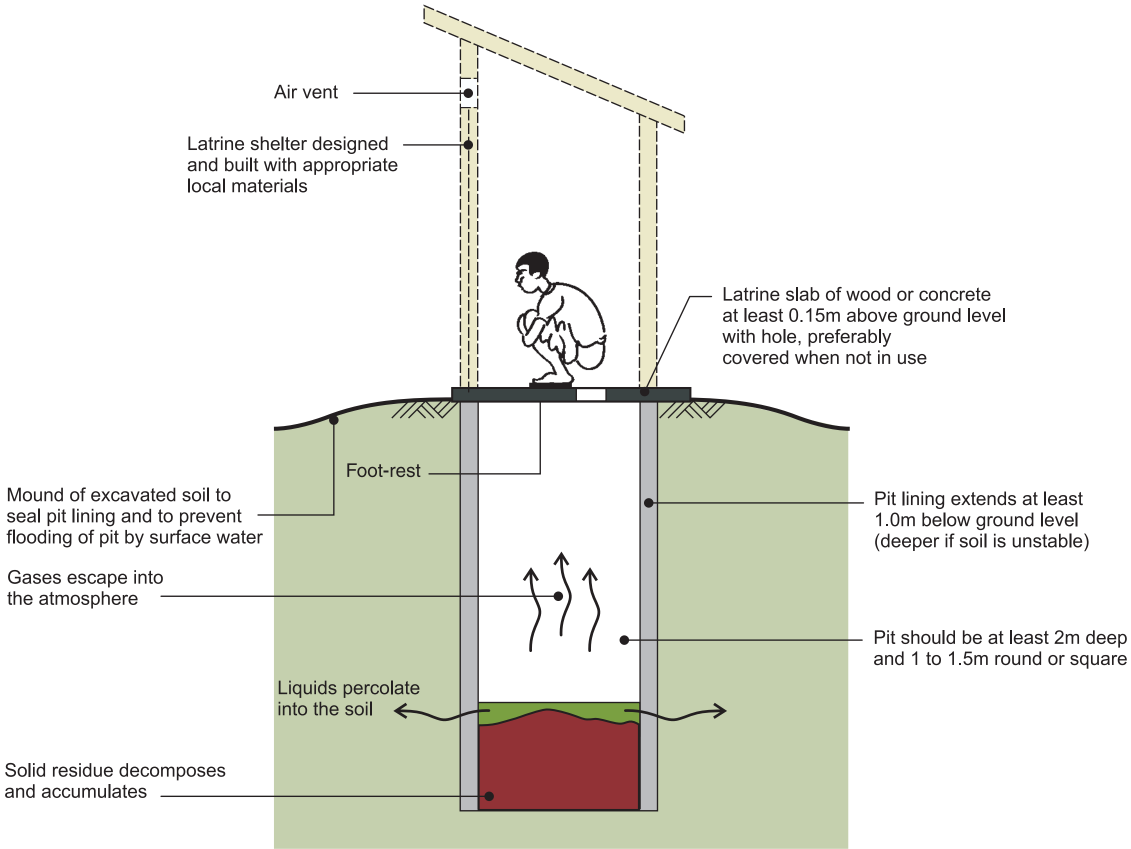


Figure 2.7.2. A simple pit latrine

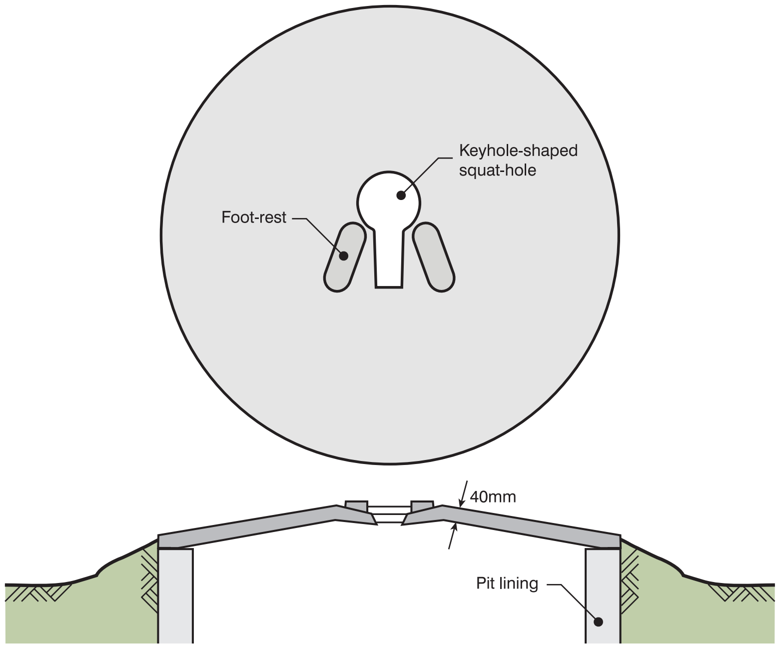


Figure 2.7.3. A domed slab

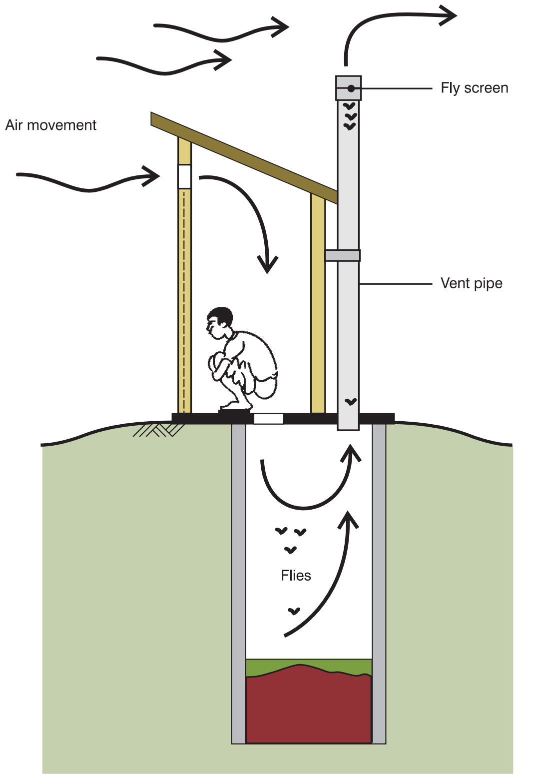


Figure 2.7.4. A VIP latrine

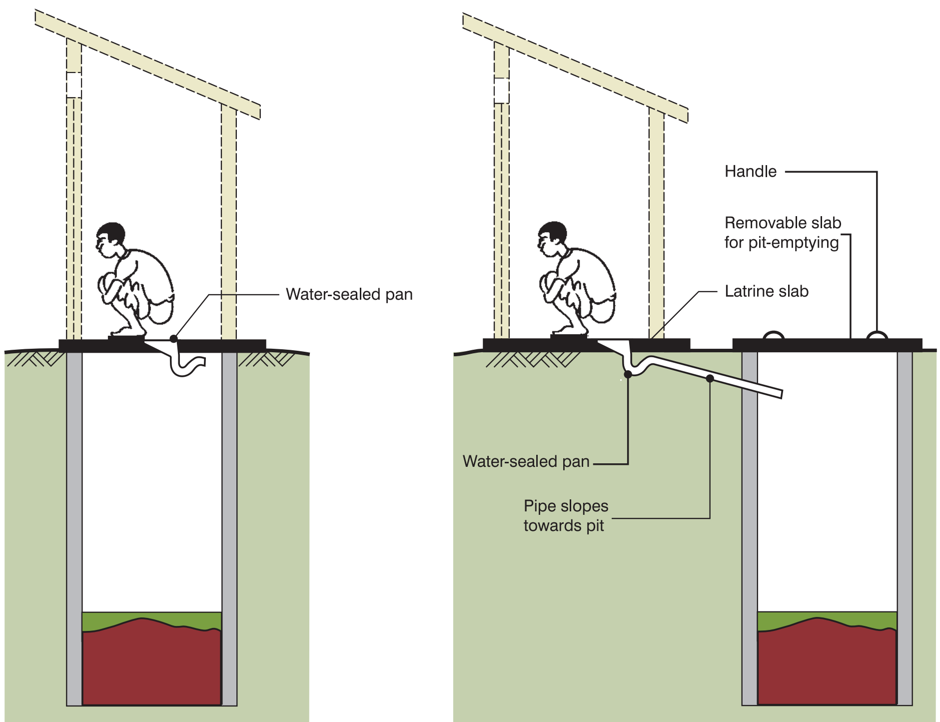


Figure 2.7.5. Pour-flush latrines

good effect and costs can also be reduced by revised approaches to operation and maintenance and charging.

Western thinking is biased towards off-site disposal of faecal material with piped sewers leading to high-tech sewage treatment works where wastes are processed to separate the liquid and solid components, remove nutrients from the liquid, and make the solid residues (sludge) fit for disposal. Public health remains a priority objective but others, ranging from clean rivers to avoiding public nuisance, are added to dictate the need for these hugely expensive systems.

Properly maintained on-site sanitation is equally effective as a barrier to the spread of pathogenic organisms — the over-riding priority in the developing world — and has the added advantage of dispersing rather than concentrating wastes, an important consideration if facilities are not well maintained. As the affordable, least-cost option it should therefore be the first choice in WS&S interventions unless user demand or local physical conditions force a move to piped sewerage.

One other serious disadvantage of piped

- reducing construction costs by revising design criteria, and eliminating redundant features (see Section 2.7.21);
- improving the quality and methodology of operation and maintenance; and
- strengthening institutions to improve the efficiency of tariff setting and collection.

In addition, a marginal costing approach can be used to encourage families to connect to the sewer network after it has been constructed.

2.7.12 Sewage treatment

On-site sanitation is often (and should be) the first option when considering a sanitation intervention. Such systems have very distinct advantages, not least that they are individual systems, which means that the disposal of faecal material is dispersed over a wide area and not centralized, as with a conventional sewage treatment works. One problem with centralized facilities is that when they go wrong, the resulting problems are much more acute.

It should be remembered that from a *health* point of view, there is not much difference between any of the different options for sanitation (both on- and off-site) — as long as they are all functioning properly. It is largely a question of *convenience* — an off-site system where wastes are flushed off the owner's property is more convenient as it gets rid of the problem from the owner's property. Off-site sanitation is usually much more expensive than on-site.

There are instances where off-site sanitation is deemed necessary — because of unsuitable ground or housing conditions for on-site systems, or because of a community's desire to have a 'better' system. There is a certain amount of prestige in having an off-site connection — such 'peer pressure' is often a significant motivating force.

Once the decision has been made to implement an off-site system, then sewers become a necessity. Water has a large dispersion, dilution, and carriage capacity, and it is therefore used as the carriage medium in most sewer systems. Usually, potable water is supplied to the house and used for flushing toilets — and as much as 40 per cent of household water use may be for this purpose. Some countries do use dual-supply systems where non-potable water (often seawater) is used for toilet flushing, but such a system requires more infrastructure and has obvious capital cost implications. Therefore, most sewer systems are a heavy user of precious potable water supplies, which should be a factor when considering their implementation, especially in water-short areas.

Sewerage is a mechanical system for removing wastes (sewage) from the place where it is generated. It does not clean the wastes. At some point the wastes must leave the network to be either treated or discharged into the environment. The decision as to whether or not to treat the wastes is an important one, as installing a sewage treatment sewerage systems should be borne in mind — they need a lot of carrier water, and may require increased water supply.

Going a stage further, to sewage treatment, raises more questions. It can double construction costs without adding any health benefit to the community it serves. Unless adverse impacts on other communities are clearly indicated, the money spent on sewage treatment is usually better allocated to extending piped sewerage or more basic sanitation to other deprived communities.

Where treatment facilities are planned the selection of appropriate technology is fundamental, as is a shift from the design thinking of the West. Domestic sewage uncontaminated with dangerous industrial constituents need not be viewed as a problem to be disposed of after removing as many undesirables as possible. It can be a resource.

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plant may almost double the cost of construction. There can be no doubt that sewage treatment is preferable. It reduces the environmental damage done by polluted waters and removes a potential source of disease.

Unfortunately, in a developing country these benefits have to be weighed against the benefits that could be obtained from using that money in other ways, such as constructing more sewers. The biggest benefits of sewerage are gained by the communities using the system. Sewerage improves the local environment and reduces exposure to disease. In most societies these benefits will far outweigh the potential damage being done to the environment downstream of the outfall by untreated sewage, and the economic justification for sewage treatment may be weak (see Section 2.5.12). It should be remembered that in Europe and the USA sewage treatment only became common practice many decades after the sewers were constructed.

The discussion in Section 2.4 on water quality objectives for water courses is highly relevant to decisions on whether or not sewage treatment should be considered.

Traditionally, sewage has been seen as a *problem* requiring treatment and disposal. Most conventional sewage treatment options are based on protecting the aquatic environment in Northern countries — which has usually meant a reduction in biodegradable organic material and suspended solids and, perhaps, some nutrients (nitrogen and phosphorous). Treatment involves ‘removing’ these pollutants — but removal is usually conversion to another product, usually sludge. The disposal of sewage sludge is a major consideration in many locations — it is often seen as an offensive product which is either dumped or burned.

The priorities in developing countries are often different from those in developed countries. Often the main issue is protecting people by controlling pathogenic material — and any form of sanitation (on- or off-site) should have this as the main objective. There are treatment options which can remove pathogenic material — notably waste stabilization ponds (see Section 2.7.20).

Increasingly, sewage is being seen as a *resource*, and it is often re-used legally or clandestinely. The water and nutrient content, in particular, can be very useful for agricultural purposes — for example, through irrigation — particularly in relatively arid environments. This can involve substantial health risks, for both those who consume the crops and those who grow them. There are various ways in which the practice can be made safer, including:

- treating the waste;
- restricting its use;
- using it only on industrial or fodder crops; and
- applying the waste in specific ways or only at certain times.

Whenever sewage is put to use in this way the practices must be adequately regulated to prevent health risks.

Experience has shown that regulation of the practice to make it safer is more effective than attempting to ban it. For further details see Mara and Cairncross (1991).

There are treatment options which seek to use this resource potential (see Section 2.7.20). As another example of re-use, traditional sewage treatment practices in South-East Asia pass wastes through pond systems which are used to cultivate fish and generate feed for animals. Some community-based approaches (in Latin America in particular) separate 'grey' wastewater (non-faecally contaminated wastewater) from 'black' water (that which is faecally contaminated) so that they can both be recycled and re-used as appropriate. In principle, the grey water can be re-used as irrigation water and the black water/waste treated and re-used as fertilizer.

Traditionally, sewage is treated through large centralized schemes. Many of these do not work — and when they do not work, the resultant pollution and health problems are often severe. The reason for failure is frequently that inappropriate, unsustainable, options have been chosen in the first place. Often, sewage treatment is a low priority compared to water supply, and municipal councils simply do not have the resources to keep the facilities operational. In such circumstances, there is a growing body of opinion that advocates moves towards *decentralized*, local systems, which, it is argued, could be supported by community-based organizations. Such approaches have been implemented in locations in South America.

Water supply principles

SCF/Alan Nicol

2.7.13 Quantity and quality

As we saw in Section 2.3, research into the relationship between water quantity and quality and health impact shows that the benefits of additional water quantity far outweigh those of improved quality. From a technical standpoint the aim should be to deliver the quantity and quality of water that the user demands. However these aspects of demand are not always clear. Users may know how much they use now, but may be unaware of how a change in supply will affect their future use. To that extent the professionals must use their knowledge of similar situations to advise users on what is likely to happen in the future. This applies particularly to the use of water for productive uses such as watering livestock and gardens.

For water supply interventions the starting point for facilities design is to establish the quantity and quality of water needed. It has already been said that health benefits depend more on quantity than quality of

Water consumption will depend on the convenience of the supply, as shown in Table 2.7.2, but as a general rule, water supply systems for a minimum level of service should be designed to deliver at least 20 litres per person per day (plus wastage) without excessive queuing. For the design of standposts, including flow rates, number of taps, etc., see IRC Technical Paper No.14 (1979).

Particularly in urban areas, a major component of total supply from the source may be unaccounted - for water due to leakage, illegal connections, and deficiencies in metering and billing. It is also supply, and here two key points should be borne in mind; consumption increases with convenience of supply (current consumption is therefore not a good guide to the future), and system input must be greater than supply at the tap to account for intermediate losses by, for example, leakage and illegal connections.

necessary to consider water consumption by institutions such as schools, hospitals, markets/shops, and offices.

Water quality demand is even more difficult to quantify. Few users are aware of all the factors that affect quality. They are more likely to be interested in aspects such as taste and colour than in bacteriological quality. Again the professionals must advise the users on what is feasible and acceptable. The World Health Organization's *Guidelines on Water Quality* (1993) permit countries to adapt standards to suit local circumstances, and are a good source of information on the parameters to be taken into account. It is recommended that countries adopt national or regional standards for drinking water quality, and that sources and treatment options be assessed in accordance with the agreed standards.

2.7.14 Levels of service

Convenience of supply, use of facilities, and affordability are three of the closely linked issues that make decisions on levels of service a complex matter. A single level of service may have to be accepted in some instances, but is not usually the best choice or what users want. Willingness and ability to pay vary within communities; service levels should be varied accordingly.

Convenience is accorded a high priority; tap supplies in some houses may provide the impetus for wider moves from yardtaps and standpipes at a later date. Conversely unreliable but clean standpipe supplies will do little to advance community health if dirty but free pond water is close by.

In general, the more water a community uses, the better the prospects for health and the higher the community's status and well-being. However, the amount of water used is related to the level of service — the convenience of the water-supply facility in terms of distance to source, time to collect, quality, quantity, and timeliness. Thus, for a given system, a private house connection provides a higher level of service than a yardtap outside the house, which in turn gives a higher level of service than a public standpost at some distance from the household (see also Section 2.1.4). This convenience factor is a high priority for users, particularly where a range of sources or supply options is available. People will choose the level of service which is perceived to suit their needs best at an affordable price, and may use different sources of water for different uses.

Therefore it is desirable to design for a mixed level of service within a community, in order to provide each customer with the service they are willing to pay for. This is more complex than designing and implementing a uniform level of service, and in some circumstances the simpler uniform approach may be preferred as a pragmatic solution.

A rural example would be the installation of new handpumps in a village. If the original water source, say a pond, was easier to use and required less effort, then it is likely that users would continue to use the pond rather than change to the handpump. This would be

Planning for demand

If the progressive development of service levels is not planned ahead, piped water supply schemes can quickly meet capacity problems. A public standpost scheme for 400 villages in Latin America ran into financing problems because the demand for private taps was higher than anticipated. Conversion to house connections brought operational problems which resulted in non-payment. The whole scheme was eventually abandoned.

IRC, 1991

Table 2.7.2 Example of average water supply consumption figures

Type of supply	Distance from home	Range of consumption (litres/capita/day)
Communal water-point (well or standpost)	>1000m*	5 - 15
Communal water-point (well or standpost)	250m-1000m*	10 - 30
Village well or Communal standpost	<250m	15 - 50
Yardtap	in compound	20 - 80
House connection — single tap	in house	30 - 80
House connection — multiple taps	in house	70 - 250

* Note these supply systems are below the minimum level of service standard (see Section 2.1.4)

Table 2.7.3 Example of levels of service versus household incomes from Jinja, Uganda

Level of service (water supply)	Sanitation facilities	Typical weekly household income (US$)	Average water consumption l/c/d	Cost of water per 20 litres	Weekly expenditure on water supply (US$)
traditional sources, springs or handpumps	simple pit latrine	<10	15.8	free	0
standpost	simple/ improved pit latrine	<30	15.5	USh 36	1.2
yardtap	pit latrine or pour-flush connected to septic tank	>30	50	USh 14.4	1.6
house connection	flush toilet connected to septic tank	>50	155	USh 14.4	4.9
house connection	flush toilet connected to sewer	>50	155	USh 25.4*	8.7*

**includes charge of 75% of water bill for sewerage*
Exchange rate: $1 = USh 1000

The table illustrates the range of payments that people make for different levels of service, and also shows the relationship between household income and level of service for water supply and sanitation. It is interesting to note that the people using standpipes are paying 2½ times more per 20 litres than people with yardtap and house connections. The actual water company's tariff for water from standpipes is only USh9 for 20 litres but the standposts are mainly operated as private enterprises and thus water is sold at a significant profit. Many poor people could actually receive a much higher level of service at the same monthly cost if they upgraded from a standpost to a yardtap connection. However they are normally constrained by the high initial capital cost of obtaining a private connection.

particularly true if the users were asked to pay for maintenance of the handpump. In circumstances with insufficient demand (or tariffs that are higher than people are willing to pay), it is unrealistic to rely on hygiene promotion to create demand for improved water supply.

In urban and peri-urban areas, poorer people may be served by public standposts. The level of service from these standposts may be affected by low pressure or intermittent supply. Thus a programme could seek to improve levels of service by improving the reliability of supply to standposts. However, many people would like to improve their level of service by obtaining their own yardtap to save time on collection and increase consumption. A demand-responsive approach to programme development should aim to meet people's desired levels of service, and provide flexibility to allow them to upgrade over time. Generally, the more convenient the facilities are the more people will be willing to pay for the service.

2.7.15 Metering policy

Meters are a popular aid to cost recovery and water conservation in the West but there are many valid reasons for not including them in WS&S programmes. In certain situations some of the problems may be overcome by using a pre-payment meter, in effect an in-house control valve that can be actuated with a previously purchased token or card, to pass a known volume of water. A more effective route to revenue collection in low-income settlements is for the utility to use a community-based organization as intermediary, responsible for bulk purchase of water and then for equitable distribution and cost recovery from users.

Many water utilities are keen to install domestic meters in order to improve cost recovery and minimize consumer wastage. However, even if the concept of metering is acceptable to the consumer, there are still constraints to achieving effective coverage with domestic meters. The cost of installing a meter is relatively high and the utility must decide whether to bear this cost or pass it on to the consumer. This may affect new connection take-up. The utility must then allocate substantial resources to read the meters on a monthly or quarterly basis. There is also a risk of sabotage to the meters and under-reading due to corruption. On the other hand, intermittent supplies can cause false high readings and damage to meters.

There is also the problem of replacement. Cairncross and Feachem (1993) refer to a World Bank study in Lahore, Pakistan which found that the average meter lasted only five years. It concluded that metering was not an economic proposition unless it reduced consumption by at least 60 per cent. The situation may have improved since. Kent Meters (1998) expect a life of at least ten years where the water is of average cleanliness. Meters are now made in developing countries, but if they need to be imported the foreign exchange cost for replacement meters may be substantial.

If a water supply is going to be managed by a community, then there is a good case for a community-based organization (CBO) bulk-buying water at a metered connection off a transmission main. The community can then organize itself to take responsibility for distributing water, maintaining the tertiary pipework, and collecting revenue to pay the utility. This concept of bulk delivery has another big benefit in urban fringe areas: it helps to overcome the dilemma posed by squatter settlements with no land tenure. If a utility delivers bulk supplies to a legitimate CBO, it avoids the implication of 'legitimizing' otherwise illegal settlements, while still providing the means to satisfy basic needs.


WEDC/Sarah Parry-Jones

Token or card-operated pre-payment water metering has been tried in some countries, for example South Africa and Uganda. This system has the advantage of ensuring cost recovery and reducing the operating costs associated with meter reading, invoicing, and debt collection. It also enables customers to link consumption directly with expenditure on a daily basis so that large, unaffordable bills are avoided. However, prepayment systems require relatively complex technology, and require a high initial capital investment. In trials in South Africa, the system has also been faced with political and public opposition.

2.7.16 Demand management

Demand management has become the watchword for water conservation. Enforced restrictions on abstractors and end users can help, but worthwhile curbs on demand come only by a composite of actions on a wide front, using appropriate tariffs to discourage waste in conjunction with a range of 'hardware-based' interventions.

Traditionally, engineers and planners have sought to provide for ever-increasing demands in water supply. There is now a realization that there is a limit to water resources, and supplies have to be carefully managed in all circumstances.

In the face of ever-increasing demands, attention should be shifted away from trying to ***manage the supply*** of water by providing for these increasing demands. Instead, the *management of the demand* should be the priority, i.e. attempts should be made to reduce the need for increasing the water supplied. *Demand management* must be a fundamental aspect of any water supply scheme, including mandatory practices where appropriate.

Methods of demand management can be grouped into two categories: financial or physical. Financial control includes the setting of appropriate water tariffs to penalize waste. Physical methods includes techniques such as:

- control of unaccounted for water and leakage (illegal connections are a particular problem in many urban areas);
- adoption of water-using devices with lower consumptive use (e.g. low-flush toilets);
- use of fittings that give lower flow (e.g. spray or self-closing taps);
- use of non-potable water for non-potable uses (e.g. salt water is supplied in a dual supply systems for use in toilet flushing in Hong Kong and in several small island states, e.g. Marshall Islands, Kiribati, and Cayman Islands); and
- re-use of suitably treated wastewater for irrigation purposes. This is quite common practice in many locations worldwide. In extreme

Freshwater resources in short supply

There are many areas of the world where freshwater resources are in short supply. Many major cities are in severe danger of water becoming so short as to present a severe constraint on any future development. The location of some new cities in developing countries has not taken account of available water resources — these are located where they are because of other reasons (e.g. mining/mineral resources). Cities like Bulawayo in Zimbabwe regularly face water shortages. In the drought of 1992-3, Bulawayo was days away from having no water at all. It has been estimated that Beijing will have a daily water shortfall of 500,000m^3 by the year 2000.

Faced with such problems, many city authorities have turned towards grand water transfer schemes. The Lesotho Highlands Water Project is an example of this — water is transferred from one river basin to a neighboring one to supply Johannesburg and the cities in the Transvaal area of South Africa. The financial costs of such schemes are huge, and the environmental implications of such inter-basin transfers are largely unknown.

cases, treated wastewater can be recycled back into the supply network (e.g. in Windhoek, Namibia). Bulawayo (Zimbabwe) uses wastewater for irrigation of park land, after treatment both by sewage treatment and water treatment processes.

2.7.17 Leakage control

One example, offering potential for significant savings, is leakage control. Leakage losses are typically 40 per cent or more, aggravated in developing countries by the high incidence of leak-forming illegal connections. High-tech methods of leak detection are not essential; effective investigation can be made by locally trained operators using simple, locally manufactured 'listening sticks'.

Not all the water that leaves a water treatment works reaches the consumer. A significant amount — as much as 50 per cent, or even more — is lost through leakages. All pipe materials deteriorate with age, and all connections are potential sources of leaks. A common feature of water distribution networks in developing countries is the high number of unauthorized connections to the network. These cause many problems, including loss of pressure and contamination of the supply, and contribute significantly to leakage.

It is impossible to get zero leakage from a system. There comes a point where the cost of leakage detection and control outweighs the benefits of locating and repairing the leaks. This is sometimes referred to as the economic level of leakage. Recent experience in the UK where great efforts have gone into leakage control show that it is difficult to get under a figure of about 12 per cent of water lost through leakage. Typical figures for leakage in an average developing country are around 30 to 40 per cent.

For real effectiveness leakage monitoring and control must be a regular activity, and not based on incident response as is often the case in developing countries. Leaks waste a scarce resource: the money invested in treatment and distribution and the revenues from lost sales.

There are many electronic methods of leakage control used in developed countries. Most of these are expensive and inappropriate for developing countries. A common feature of water supply networks in low- and middle-income areas is that they do not supply water 24 hours a day. Sometimes, the rationale is that by limiting the hours of supply, then the consumption can be limited, but the reverse if often true. When supply is limited, many people store water as a safeguard, and when supply is resumed they waste the stored water. Also, as the supply is limited and there are many illegal connections, the pressure of the water is often very low. In such circumstances, people tend to connect their own small booster pump to their connection to the main, and draw out what water they can. This reduces the pressure in the main further and sucks out all the available water — and adds to the possibility of further leakage.

Mott MacDonald Ltd

Water in a pipeline is under pressure, so when there is a hole it will escape. As it does so, there is a noise — a 'hissing' sound. Most leakage detection methods are based on listening for this sound. There are many types of sophisticated instruments used to listen for the sound electronically, but the most traditional way is through the use of a listening stick used by a trained operator. As labour is usually cheap and listening sticks can be made by local craftsmen, this is often the most appropriate way of detecting leaks. When there is an intermittent supply at low pressure, however, leakage detection is very difficult because if there is no flow in the pipe, there will be no sound to detect. Under such conditions, leakage detection has to be carried out by isolating sections of the network and testing under pressure when it is there (and it will often have to be artificially induced).

Leakage detection and control in many developing countries is usually done as a response — when a leak is reported it is repaired. However, leakage detection should be a routine preventative function of a water utility as the water lost is a waste — of a valuable commodity which is limited in its availability, and of money (in the effort spent in treating and distributing the water which is wasted, and in the loss of the potential revenue associated with the lost water).

2.7.18 Source selection and treatment

Source selection determines treatment needs and, in turn, construction costs for abstraction and treatment and the ongoing operating and maintenance costs of the treatment process. Groundwater is generally preferred, often requiring only minimal treatment, but it can be difficult to locate and to assess yield.

In most areas, there will be more than one source to choose from when developing a new supply system. The different types of source are detailed in Table 2.7.3 and the range of treatment processes is shown in Table 2.7.4. Broadly, water sources are classified either as surface (e.g. rivers, streams, and lakes) or sub-surface groundwater (which can be deep, shallow, or a spring). The choice of water source and the level of treatment are interdependent: in general groundwater is preferred, particularly in rural areas, because the water is relatively pure and requires minimum treatment. However, groundwater can be difficult to locate and yields (the amounts of water which can be abstracted) are often hard to assess.

The choice of source and treatment will affect the design of the system, the cost of construction, and the long-term operating requirements. It must therefore be a well-informed decision based on available data, local knowledge, and field surveys.

2.7.19 Wastewater drainage

At water delivery points, whether communal or in households, designers must make adequate arrangements for the collection and safe disposal of spillages and wastewater. Standing water breeds disease.

Programmes should institute systems for maintaining sullage drains from households and from standpoints where clothes washing and other activities occur.

Whenever water is delivered to a community some provision must be made for its removal after use. In rural areas the problem is most significant at the supply point. All water points waste water and its removal is important for health and environmental reasons. Standing water around a water point promotes mosquito breeding. If animals are present the ground will become smelly and muddy. All water points need to have an impervious surface around them with facilities for collecting and disposing of the spilt water. This usually takes the form of a concrete apron discharging into a nearby surface-water drain or soakaway. Sometimes, users will want to have dishwashing or clothes washing facilities adjacent to the water point, in which case disposal of the sullage water has to be part of the design too.

In urban areas the problem can be much greater. Not only is there a larger quantity of water entering an area but there is less space for its disposal. It is common to provide surface drains along the side of roads to collect waste from both water points and domestic properties.

Drainage systems need a lot of maintenance to keep them operating properly. They frequently block up with silt and refuse and can become a favourite place for defecation. A structured maintenance programme is therefore required to keep them running.

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Technical staff supporting WS&S programmes have clearly defined duties that begin with the selection of appropriate technical solutions and go on to cover all stages of design and construction. They can, and should, contribute to technical training on current projects and, by using the experience gained, to the improvement of future designs.

Practice

The descriptions of technical principles outlined above generally have clear implications for the actions to be taken by DFID staff and other members of the stakeholder team who are designing and implementing a WS&S project or programme. The main responsibilities of the technical staff in a water and sanitation project are:

- determine which technical solutions would operate successfully in the particular environment;
- prepare outline costings and lists of parameters that would make each of the options successful and sustainable;
- *in association with others* produce a short list of options acceptable to all stakeholders;
- *in association with stakeholders* prepare outline designs and both capital and recurrent costs for each option, followed by detailed designs, costings, and materials lists for selected options;
- provide supervision and advice during the implementation of the project;
- support long-term sustainability and replicability by arranging training for local technical personnel and organizing the management of operation and maintenance;
- monitor project implementation and evaluate on completion; and
- disseminate lessons learned to improve future projects.

See Chapter 3 for further details.

Sanitation practice

WaterAid/Jim Holmes

2.7.20 On-site sanitation

(Recommended reading for information on the design and construction of on-site sanitation are Franceys, Pickford and Reed (1992) and Cotton and Saywell (1998b).)

Plot size and building design for pit latrines

In urban areas, small plot size is frequently given as a reason for discounting the use of pit latrines. The evidence shows, however, that

Cultural considerations for location of toilets and design of plots, India

A slum area in Vijayawada, Andhra Pradesh, India, had been upgraded but the community were not using the new toilets provided on their house plot. This was not immediately apparent to outsiders, but when a local woman resident was asked by a speaker of the local language (Telegu) if there were any problems with the recent developments, she explained that most of the residents had not been using the toilets provided. The reason she gave was that the toilets are located on the north-east — corner of the house plots, and according to Hindu astrology this is a bad place to locate the toilet. The north-east — corner is preferential for items such as the water source, the prayer room or the main door. Toilets should be located at the south of the plot. As a result, many residents do not use the toilets provided, and go to the edge of the upgraded area to defecate in the open areas.

House, Smith and Smout, 1997

Some misconceptions surround the design and applicability of pit latrines, the most common solution to the sanitation problems of the poor. Lack of space, for example, is rarely a governing factor. If there is space for a toilet room there is space for a pit latrine; pour-flush types are suitable for use inside buildings, including multi-storey buildings. Nor, with correct but minimal horizontal separation, do they pose threats to groundwater sources and, where risk is identified, another source is generally a cheaper option than a piped sewerage system.

in most low-income housing areas this is not a valid reason. A pit latrine requires little more than one square metre of land and even the most densely populated areas usually have that much land available on the plot outside the house. If the property has sufficient land to construct a toilet room then it has enough room for a pit latrine, as the pit can be constructed beneath the toilet.

In many parts of Asia, pour-flush latrines are constructed with the pit immediately outside the property. The toilet building is constructed adjacent to the boundary wall and connected to a pit or pits built under the footpath immediately outside. There are very few situations in urban Africa where housing density is so great that a pit latrine could not be built. Constructing a pit latrine inside the house is not always recommended, but there are examples of indoor pit latrines which work well, and in Lamu (Kenya) they have been used for hundreds of years. Pour-flush latrines are a particularly suitable way of meeting demand for low-cost indoor latrines, including in multi-storey buildings.

Groundwater pollution

Potential pollution of the groundwater is another common argument against pit latrines. Again, it can easily be overstated. In general, provided a pit latrine is located more than ten metres horizontally from a groundwater source such as a spring or well, there is little chance of source pollution (Lewis, Foster and Drasar, 1980).

Even if technical advisers identify a possibility of cross pollution, it will often be more economic to find an alternative water source than to opt for a more expensive sewered alternative to a pit latrine.

Control of smell and flies

Designs exist too that overcome the often-quoted problems of smells and flies, provided the facilities are respected and maintained.

Another common reason given for not promoting pit latrines is that they smell or are filled with flies. User surveys, however, show that these do not have a serious effect on satisfaction with improved latrines such as SanPlats and VIPs (Cotton and Saywell, 1998b), and the problems are less than in unimproved latrines. Flies are attracted to pit latrines because of the presence of a food supply and a suitable breeding site, and flies born in latrines are covered in faecal organisms.

WEDC/Darren Saywell

All latrines give off some odour. Whether that odour is objectionable or not depends on the experience and background of the user. If the contents are more than a metre below the latrine floor, there will normally be no objectionable smell.

Where flies and odour are a problem they can be controlled relatively simply; a simple stopper in the latrine hole will often be sufficient. In more difficult cases the installation of a ventilation pipe will usually eliminate the problem. Pour-flush latrines should not have fly or odour problems. It is important to keep all types of latrines clean to prevent the slab or pan and surrounds becoming the sources of fly and odour problems.

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Latrine emptying is a practice best avoided unless absolutely enforced by local conditions, usually as a result of space restrictions in urban slums. Rural areas do not often suffer in that respect; pits may then be cheaply constructed, used once, and abandoned. A higher standard of construction is needed when pits have to be emptied. There are no convenient or hygienic solutions although twin pits alternately used may slightly reduce the health risks and obnoxious nature of the task. Risks continue at the disposal stage — the safest option is a sewage treatment works, otherwise burial.

Emptying latrines

The golden rule when it comes to pit-latrine emptying is: *if possible, don't*. Unless properly managed, using the correct equipment, pit-latrine emptying is a highly hazardous procedure. It requires the handling and movement of fresh excreta, exposing the operators and general public to unhealthy and unsightly conditions.

In rural areas there should be no need to empty a pit latrine. Sufficient land is usually available that when a pit is full (the contents are within half a metre of the surface) a new one can be constructed. It is only in urban areas where land for new pits is unavailable or specific ground conditions occur that it is necessary to consider emptying pit latrines.

The need to empty latrines impacts on their design. Pits that are abandoned when full can be constructed of poorer quality materials since they will only have to last a limited time. Pits that are to be emptied must be made of more durable materials and the pit itself must be fully lined to withstand the suction forces. One approach is to construct twin-pit latrines. Because there are two pits that are used alternately, the contents of one pit do not have to be emptied until the other pit is also full. This allows time for the disease-causing organisms in the excreta to die off, making it harmless to handle. However, it is rare to find twin-pit latrines used correctly, and they are much more expensive than simple pits.

The option of emptying by mechanical means (a slurry tanker) is favoured by many local authorities because it reduces contact with excreta and appears quicker than other options, but there are problems. Tankers are very expensive to purchase and maintain and they are frequently unable to negotiate the narrow roads and alleys of urban slums. They also cannot remove large solid objects such as stones, sticks, tin cans, and plastic bags. If they are to be used then a strong promotion campaign is required to persuade the community not to throw such articles into their pits.

Manual emptying is common in many parts of the world, though it has little to recommend it. Workers, usually unprotected, dig or bucket out the pit contents into a nearby hole or a small tanker that takes the sludge away for disposal. Fresh excreta are invariably spilled on the

Latrine emptying technology

The two common techniques for emptying pit latrines are to manually excavate with a bucket or to use a large vacuum tanker. The former is unhygienic and the latter is costly and sometimes impractical. Alternative technologies have been devised; for example the MAPET (Manual Pit Latrine Emptying Technology) which has been used in Dar es Salaam. This technology builds on the traditional method of hand emptying, but uses a piston pump with a flywheel and a 200-litre vacuum tank, both of which are mounted on a handcart. The equipment provides a low-cost solution in areas where latrines are inaccessible to latrines.

Muller & Rijnsburger, 1994 and Waterlines *Technical Brief No.54, 1997* surrounding ground and the workers are exposed to serious health hazards. While the method cannot be condoned it has to be accepted that it will continue to be used in some places. Making the practice illegal is unlikely to work if a demand still exists. It is better to remove the need for handling fresh excreta by installing twin-pit latrines or, in the last resort, improve the conditions of the workers and the tools they use, to minimize health risks.

Ultimate disposal of the sludge must also be considered. In the case of twin-pit latrines this should not be a problem since the sludge is harmless if the twin-pits are used as intended, and it can be deposited anywhere. While not a good fertilizer, it has some beneficial qualities and can be used as a soil conditioner. Fresh excreta must be disposed of safely. Options include adding the sludge to the inlet of a local sewage treatment plant, burying it, or mixing it with domestic garbage (when this is disposed of hygienically!). Composting sludge with other organic matter has been tried in a number of countries but is rarely a success because of the level of management required to operate the system successfully.

There are a number of designs for recycling human waste at the household level (Winblad and Kilama, 1985). These have generally been developed in North America and Europe and are not recommended for developing countries because of their cost, difficulties with operation, and maintenance and health hazards.

2.7.21 Sewerage options

If on-site sanitation is not feasible the alternative of piped sewerage need not attract the high costs inherent in systems designed to the standards and specifications of the developed world.

Professional advice and some caution should govern deviations from standards that are known to protect infrastructure and ensure trouble-free operation but, with that proviso, several cost-cutting techniques can be used. They include increased spacing of access structures and system designs that allow reductions in pipe sizes and in the depths at which they are laid.

(For further information on low-cost sewerage options, recommended reading includes Reed (1995) and Mara (1996).)

For areas where on-site sanitation is no longer a satisfactory option, the only realistic alternative is sewerage. While traditional sewerage schemes have relatively high capital and running costs, lower cost solutions have been adopted in some communities. The main sewerage options are:

- conventional sewerage;
- simplified sewerage;
- condominial sewerage; and
- an interceptor tank system.

A sewerage system is a series of underground pipes collecting and transporting excreta and household sullage to a point of discharge (a septic tank, natural watercourse, or treatment plant). The fixtures and fittings required include: sewer pipes, household connections, grease traps, interceptor tanks, and access chambers.

The cost of a system can be significantly reduced by limiting the number of fittings: for example, access chambers which are rarely used can account for 25 per cent of the capital cost of a system (Reed, 1995). Simplified sewerage systems are modified versions of conventional sewerage design and are built to reflect the local environment and customer affordability. This may involve reducing

Table 2.7.4 Options for excreta disposal

Excreta system	Water required for operation (litres per person per day)	Technical skills for construction	Skills needed for O&M	Relative construction (cost per person)	Relative O&M (cost per person)	Institutional dependency
Simple pit	nil	similar to local house-building	cleaning only	1	1	promotion only
Pour-flush	5-25	ditto	ditto	1.1	1.1	promotion and minor education, pit emptying service
Twin-pit pour-flush	20-30	ditto	Changing and emptying pit every 2 yrs	1	1.2	promotion, education and minor ongoing technical support
VIP pit	nil	some additional skills required	cleaning only	2	1	promotion, education, and technical support, pit emptying service
Twin-pit VIP	nil	ditto	Changing and emptying pit every two years	2	1	promotion, education, and ongoing technical support
On-site septic tank*	5-40	some additional skills required	periodic tank emptying	15-25	2-3	Design, construction, emptying
Conventional sewerage*	>100	considerable additional skills required	regular maintenance of sewers and operation of treatment plant	20-70	10	Very high
Simplified sewerage*	>100	ditto	ditto	10-60	10	Very high
Sewered interceptor tanks*	2-20	ditto	ditto plus emptying interceptor tanks	5-70 depending if interceptors already existing	10	Very high
Condominial sewerage*	> 75	ditto	regular maintenance of sewers and operation of treatment plant	10-50	10	Very high

Note: * These options require a reliable water supply. Costs are indicative and need to be related to local unit costs.

minimum pipe diameter to 100mm and minimum collector gradient to 1 in 220, increasing spacing between access points, and postponing construction of treatment works.

Condominial sewerage, which has been used extensively in Brazil, involves the laying of collector sewers at the rear of properties close to the point of waste generation. This unconventional layout reduces the length and depth of house sewers and also minimizes the amount of pumping required. The maintenance of condominial sewers is the responsibility of the community, and the housing block will generally be required to pay all the construction costs. The total cost of condominial sewerage is about half the cost of a conventional system, and it may be cheaper than on-site systems at high population densities (Mara, 1996).

An interceptor tank system relies on the settlement of solids near the point of generation. This allows the sewer network to be designed for a much reduced peak capacity: the minimum sewer diameter can be as little as 40mm. This type of system evolved from the need to sewer communities with individual septic tanks, but some systems have been specifically designed to function in this way. It is estimated that costs can be up to 75 per cent cheaper than conventional sewerage where interceptor tanks already exist.

The choice of sanitation system should take full account of its technical complexity and operation and maintenance needs in relation to the available skills and local institutional capacity.

Caution in this respect takes on added significance if sewage treatment is contemplated. There are too many non-functioning treatment plants in the developing world, memorials to wasted investment and inappropriate technology transfer. The lesson is that the large-scale, high-tech facilities of the West are not sustainable in regions where human and financial resources are severely limited.

Table 2.7.4 summarizes the range of options available for excreta disposal as discussed above. The column headings attempt to combine the principles in a way that is easy to use and non-technical.

The columns on capital and operating costs are used to bring in considerations of affordability, sustainability, and replicability. Institutional dependency data can be compared with the strength of local institutions. A technology with a high institutional dependency in an area with weak institutions is unlikely to be sustainable. Information on skill levels will help in deciding the level of community or family involvement in construction and operation. Technologies with high skill requirements will tend to require external inputs which will have to be paid for. This too will impact on sustainability and replicability. Water for operation links excreta disposal to water supply. Disposal systems that use a lot of water will require a high level of water supply service. Note too that though some latrines are described as requiring no water for operation, hygiene considerations mean that water for cleansing after defecation should be conveniently available.

2.7.22 Sewage treatment

In Section 2.7.12, the factors to consider when thinking about the implementation of a sewage treatment scheme were discussed. It is not a straight-forward decision. Most sewage treatment facilities in most developing countries do not work. This is often because most technologies for sewage treatment are big, centralized schemes which have been developed in Northern temperate climates, where adequate financial, material, and human resources are available. Transferring these technologies to tropical low- and middle-income communities is

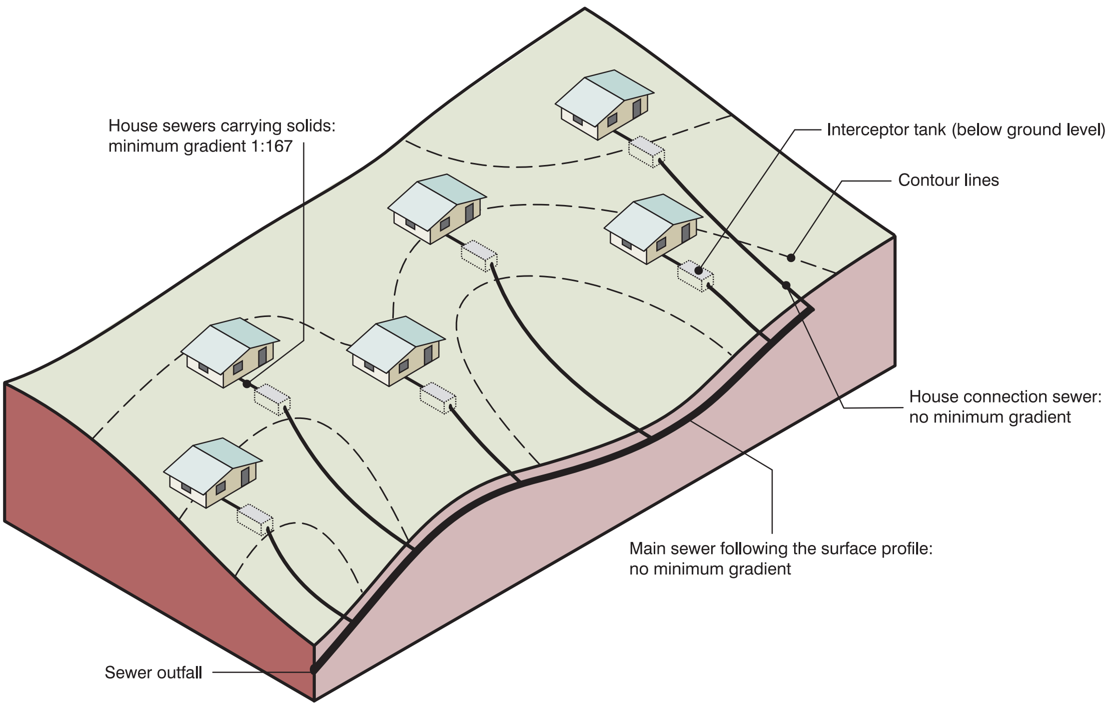

Figure 2.7.6. A schematic cut-away view of a sewered interceptor system

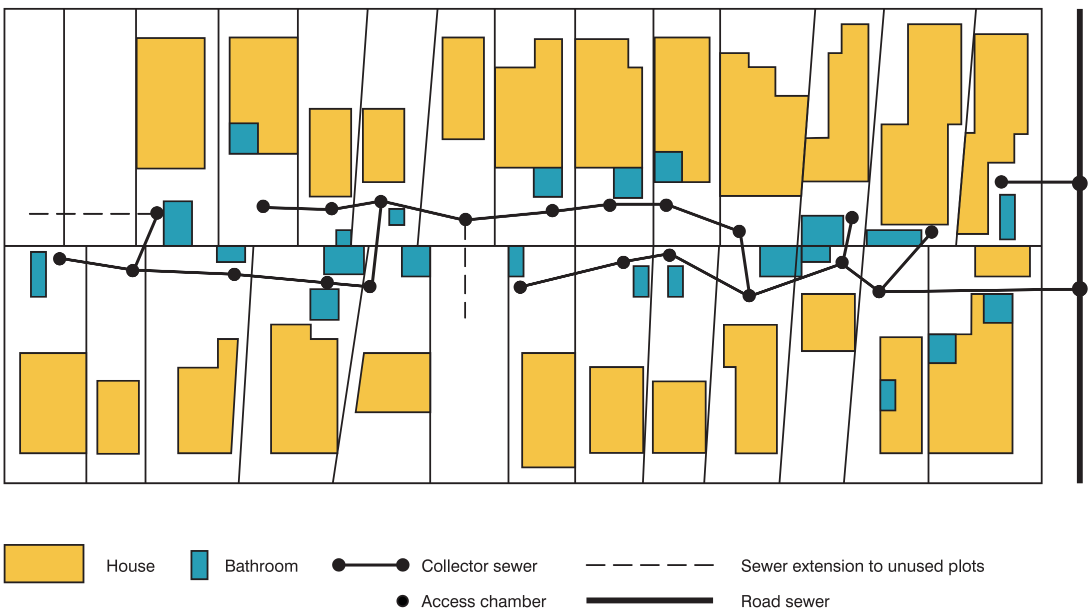

Figure 2.7.7. Condominial sewer layout in Petrolina, Brazil

fraught with potential difficulties. However, there are some sewage treatment options which are more appropriate to developing country scenarios. Such systems should generally be low cost, have low operation and maintenance requirements, and maximize the use of the potential resources (principally, irrigation water and nutrients).

Sewage treatment options may be classified into groups of processes according to the function they perform and their complexity:

- *Preliminary* includes simple processes such as screening (usually by bar screens) and grit removal (through constant velocity channels) to remove the gross solid pollution.
- *Primary* is usually plain sedimentation — simple settlement of the solid material in sewage can reduce the polluting load by significant amounts.
- *Secondary* applies to further treatment and removal of common pollutants, usually by a biological process.
- *Tertiary* is usually for the removal of specific pollutants, e.g. nitrogen or phosphorous, or specific industrial pollutants.

Preliminary and primary treatment are common to most sewage treatment works, and are effective in removing much of the gross pollution. There are many different types of secondary processes, and the most common are described in Table 2.7.5, with brief comments on their suitability for low- and middle-income countries. Tertiary treatment processes are generally specialized processes which are beyond the scope of this manual.

For further information on sewage treatment options, the reader is guided to standard texts such as Metcalf and Eddy (1994) and Mara (1976).

The majority of secondary treatment processes are biological in their nature — that is, they use the activity of bacteria to break down polluting material. Much of the polluting material is organic waste (such as faeces). Biological treatment processes can themselves be divided into two general sub-divisions — aerobic and anaerobic processes. With *aerobic* processes, bacteria use oxygen to feed on the organic material (which is a food source) to produce carbon dioxide and water, with the production of large quantities of extra bacterial mass (sludge). Most aerobic processes require the mechanical addition of oxygen to the process, which is expensive. In addition the sludge material requires disposal itself, which is often a very significant problem. *Anaerobic* processes take place in the absence of oxygen, and the bacteria break down the organic wastes to produce carbon dioxide and methane. This mixture of gases is often called *biogas* and can potentially be harnessed as an energy source. An additional advantage of anaerobic processes is that they produce much less excess sludge than aerobic processes. The major disadvantage is that the treatment efficiency is not as high as it is for aerobic processes. Some processes are a mixture of aerobic and anaerobic.

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Table 2.7.5 Options for secondary sewage treatment (*indicates processes more suitable for developing countries)

Treatment process	Description	Key features
*Land treatment (soil aquifier treatment — SAT)	Sewage is applied in controlled conditions to the soil	Soil matrix has quite a high capacity for treatment of normal domestic sewage, as long as capacity is not exceeded. Some pollutants, such as phosphorus, are not very well removed. Can be used as a method of recharge of aquifers.
*Reed beds (or 'constructed wetlands')	Sewage flows through an area of reeds	Treatment is by action of soil matrix and particularly the soil/root interface of the plants. Requires significant land area, but no oxygenation requirement.
*Waste stabilization ponds (WSP) ('lagoons' or 'oxidation ponds')	Large surface area ponds	Treatment is essentially by action of sunlight, encouraging algal growth which provides the oxygen requirement for bacteria to oxidize the organic waste. Requires significant land area, but one of the few processes which is effective at treating pathogenic material. Natural process with no power/oxygen requirement. Often used to provide water of sufficient quality for irrigation, and very suited to hot, sunny climates.
Aerated lagoons	Like WSPs but with mechanical aeration	Not very common — oxygen requirement mostly from aeration and hence more complicated and higher O&M cost.
Oxidation ditch	Oval-shaped channel with aeration provided	Has more power requirement than WSPs, but has much reduced land requirement, and not as difficult to control as processes such as ASP (see below)
Rotating biological contactor (or biodisk)	Series of thin vertical plates which provide surface area for bacteria to grow.	Plates are exposed to air and then the sewage by rotating with about 30% immersion in sewage. Treatment is by conventional aerobic process. Used in small-scale applications in Europe.
Trickling (or 'percolating') filters	Sewage passes down through a loose aggregate bed — bacteria on aggregate treat sewage	An aerobic process in which bacteria take oxygen from the atmosphere (no external mechanical aeration). Has moving parts, which often break down in developing-country locations.
Activated sludge process (ASP)	Oxygen is mechanically supplied to bacteria which feed on organic material and provide treatment	Sophisticated process with many mechanical and electrical parts, which also needs careful operator control. Produces large quantities of sludge for disposal, but provides high degree of treatment (when working well).
*Upflow Anaerobic Sludge Blanket (UASB)	Anaerobic process using blanket of bacteria to absorb polluting load	Suited to hot climates. Produces little sludge, and no oxygen requirement (no power requirement) — but does not produce as high a quality effluent as processes such as ASP.

Note: Other anaerobic processes exist, but UASB is the most common at present.

Table 2.7.6 Source selection for water supply

Source	Yield features	Abstraction requirements	Advantages/ benefits	Risk factors	Likely treatment requirements
Rainwater harvesting	Variable and unlikely to meet demand. Useful as a household supplement	Catchment structure (e.g. roof) and storage facilities	Simple to implement and low cost	Seasonal supply only	Depending on catchment, may need Disinfection, sedimentation
Lake or pond	Depends on size — yield may diminish during dry season	Intake structure and pumping equipment	Generally easy to locate and assess	Difficult to protect source from contamination by humans and livestock, so bacteriological quality is poor. Fluctuations in level may cause abstraction problems	Sedimentation, filtration, and disinfection
Lowland river or stream	Large river flows are normally stable. Some rivers dry up in dry season	Intake structure and pumping equipment	Generally easy to locate and assess	Need to protect upstream catchment and ensure adequate downstream flow. Fluctuations in level or changes in channel profile may cause abstraction problems	Sedimentation, filtration, and disinfection
Highland river or stream	May be seasonal	Gravity flow through piped supply with diversion structure	No pumping costs, good quality for surface water	Source may be inaccessible. Protection from moving boulders required. Upstream catchment may also need protecting	Disinfection. Higher turbidities may also need sedimentation/ filtration
Spring	May be seasonal or may move location	Gravity flow through piped supply with spring box or protected spring	High-quality water, no pumping required	Spring may be inaccessible or require long pipeline to point of delivery	Disinfection only
Shallow well	Depends on aquifer, depth of well	Hand-dug well, caisson well or drilled/jetted well. Range of lifting devices from windlass and bucket to handpump to electric/diesel pumps	Better quality than surface water. Flexibility with lifting arrangements — potential for upgrading	Groundwater may be difficult to locate or access	Disinfection. Higher turbidities may also need sedimentation/ filtration
Deep borehole	Can be high depending on aquifer. Not normally affected by seasonal variations	Submersible pumps, borehole housing and transmission system	High quality water, well-protected from contamination, potentially high reliable yields	Difficult to locate water — extensive data or field tests required. Cost of drilling high and requires specialist equipment. Water may have high mineral content/ poor taste	Disinfection and possibly aeration and sedimentation or filtration

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Waste stabilization ponds are the only sewage treatment process to make a significant reduction in transmission of disease-causing agents at a reasonable cost.

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As stated previously, the requirement in most low-income countries is for a low-cost, low-maintenance sewage treatment system. *Waste stabilization ponds (WSPs)* provide the best option in most cases — good levels of treatment at low capital and particularly low O&M cost. In addition, it is one of the few processes which provides good treatment of pathogenic material. This has significant application potential for the re-use of the treated effluent in irrigation. The major disadvantage is that significant areas of land are needed for treatment. WSPs are used in many locations worldwide, including Africa and Asia.

Anaerobic processes, especially the *upflow anaerobic sludge blanket*, are receiving more attention as suitable treatment options for developing countries. They have the advantage of having no oxygen input requirement (unlike aerobic processes) and hence low O&M costs, and they produce low quantities of sludge for disposal — which can be a significant advantage. They are suited to hotter climates as the anaerobic bacteria like warm temperatures. The major disadvantage is that the treatment capacity is limited and their role is often as a roughing treatment to be followed by a 'polishing' stage to remove pathogens.

However, any sewage treatment plant needs significant investment and O&M and control, and therefore *any* decision to implement such a facility should be carefully considered.

Water supply practice

2.7.23 Source selection

The Table 2.7.6 provides guidance on source selection for rural and urban water supply systems. It can serve as an initial checklist, but for detailed information the relevant texts listed at the end of this section should be referred to. Source assessment should be carried out by an experienced hydrologist or hydrogeologist.

For further guidance on source selection, see *Emergency Water Sources*, House & Reed, 1997 and *Small Community Water Supplies*, IRC Technical Paper No.18, 1983.

Using groundwater has many advantages - it is pathogen free, non turbid and drought resistant. However, there are disadvantages including non uniform distribution, extraction costs and remediation difficulties if problems occur.

There are risks associated with groundwater usage and understanding and data are required to reduce those risks. In any groundwater development project it must be accepted that some boreholes or wells will not find water.

Not all rocks contain water in useable quantities and those that do hold it in different ways. In sands, gravels and sandstones the water lies in the intergranular pore spaces throughout the rock which may be sub-divided into near horizontal layers or aquifers. Harder, crystalline rocks such as limestones, granites and gneisses are generally not porous but are often fractured and these can contain water. Unfortunately fractures can be of variable spacing and aperture so prediction of storage capacity can be problematic.

To overcome and minimise the associated risks a hydrogeologist would map and characterise all potential aquifers in a project area. This is done by adopting a structured and logical investigation which could involve the analysis of satellite images or aerial photographs, and by carrying out geophysical surveys to record the electromagnetic, resistivity or seismic properties of the area. Interpretation of these data should help to lower the risk when physical groundwater proving is done by drilling or well digging.

For all projects but especially low budget ones a vital source of data is local knowledge of groundwater occurrences together with a vegetation survey. Because of the potential complexities groundwater development is often remote from community development but such surveys can involve recipients as would the use of Low Technology Drilling Methods which can also increase the skills base.

Low-technology drilling methods

Low-technology drilling methods (LTDM) are simple drilling methods that can make boreholes suitable for handpumps in unconsolidated and weak rocks.

A variety of drilling techniques fall into this category including:

- percussion;
- augering;
- jetting; and
- rotary.

The key aspects of all these methods, however are as follows:

- They are simple and easy to use by local artisans after limited training.
- They are lightweight and able to be carried by hand or small vehicles to remote locations.
- They are robust and easy to maintain.
- The purchase and operating costs are low.
- They involve community members in the drilling process.

A long-term aim is that the equipment should be able to be manufactured and maintained in-country. The designs should not prevent anyone from being involved and they should be a means of skill transference.

Examples are the Vonder Rig (auger) made in Zimbabwe and the Eureka port-a-rig (mud rotary) made in th UK, but there are many others.

Elson and Shaw, 1995

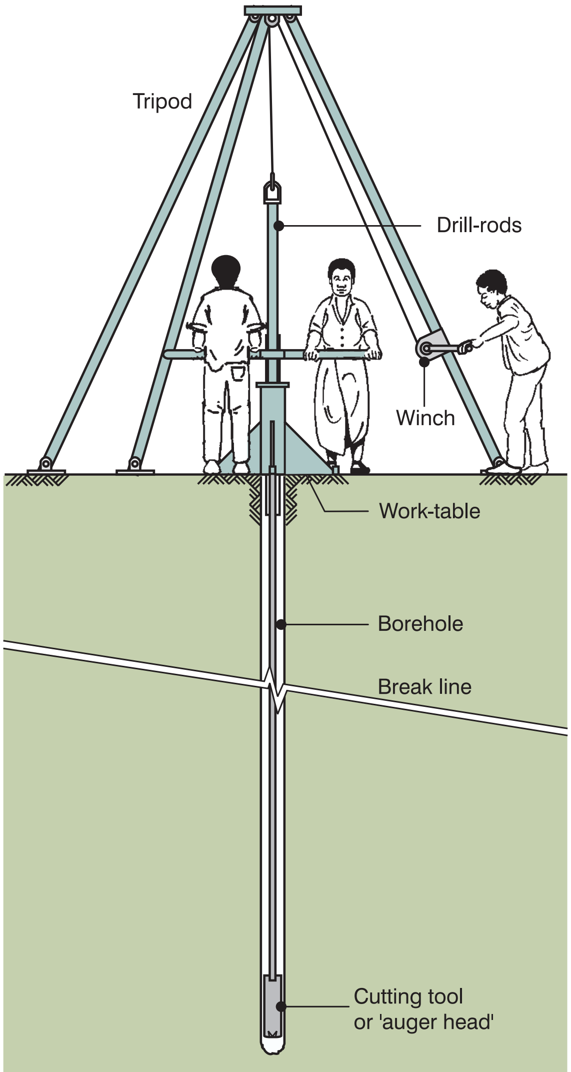

Figure 2.7.8. Hand-auger drilling

Commonly used treatments need relatively high skill levels for operation and there may be recurring costs for chemicals such as chlorine (hypochlorite) for disinfection. Professional advice is essential to determine quality objectives, treatment options, and plant design, and in the selection and assessment of the raw source.

2.7.24 Choice of treatment

The water treatment process that is eventually selected will clearly depend on the quality of the water source to be used. There may be limitations due to the availability of chemicals, lack of skills or supervisory staff, cost, and so on. The desired end quality of the water should be appropriate to the situation, thus WHO or EC drinking water standards may be too arduous to attain in certain situations. The range of water treatment processes available to an engineer is summarized in Table 2.7.7, together with an indication of the O&M skills and costs associated with each process. The design of an appropriate treatment process should be done by an experienced engineer. Further information on treatment processes is available in the references at the end of this section.

Table 2.7.7 Water treatment processes for potable water			
Treatment process	**Description**	**Action on water**	**O&M skills**
Screening	Physical filtering using a metal screen	Removes large floating particles	minimal
Infiltration	Filtering water through natural material e.g. river bank	Removes some turbidity and has screening and anti-bacteriological effect	minimal
Roughing filtration	Horizontal or upflow through designed filtration bed	Reduces turbidity and removes some bacteria and pathogens	low
Sedimentation	Separation of smaller particles by settlement in a tank	Removes suspended particles and some bacteria and pathogens	low
Sunlight	Exposure to sunlight radiation	Kills most bacteria in uncovered tanks	none
Assisted sedimentation	Separation of smaller particles by adding chemical coagulant to form flocs	Removes turbidity, some bacteria and pathogens, and can remove some chemical contaminants	high
pH adjustment	Chemical adjustment of acidity/alkalinity	Modifies pH to required level	high
Pre-chlorination	Initial chlorine dose to assist sedimentation/rapid filtration	Kills bacteria and algae to improve sedimentation or filtration	medium
Aeration	Introduction of oxygen into water	Removes iron and manganese to reduce taste or colour problems	medium
Slow sand filtration	Water is passed down through a designed sand-bed under gravity	Removes 99% of bacteriological contaminants and turbidity	medium
Rapid sand filtration	Water is pushed down through designed sand-bed under pressure to speed up process	Removes some bacteriological contaminants and 50-90% of turbidity	high
Disinfection	Chlorine is added to water in regulated dosage	Appropriate dose of 2mg/l after 30 minutes contact time will kill bacteria and most viruses but not cysts	medium

Significant technical input is also needed in designing and costing supply infrastructure. Careful comparison of options on pipe/pump characteristics is particularly important where high pumping heads are involved.

As always designs and costs must aim to meet the various levels of service demanded by users.

Detailed information on treatment processes can be found in *Water Supply* by Twort et al., 1994 or *Water and Wastewater Technology*, Hammer and Hammer, 1996.

2.7.25 Water transmission and distribution systems

The complexity of the water supply transmission and distribution systems provided will depend on a range of factors, including the location and quality of the source, the levels of service demanded by the community, available capital expenditure, predicted future demand, availability of equipment, local capacity for construction, operation and maintenance, and so on. The broad range of supply options is shown in Table 2.7.8. Detailed design of water supply systems is well covered in Twort et al. (1994), *IRC Technical Papers 14* and *18* (1979, 1983), and Jordan (1984).

Table 2.7.9 outlines the wastewater drainage requirements. The drainage requirements are directly related to the water supply level of service, as outlined in Table 2.1.1.

When designing a new water supply or sanitation system and its component parts, the preferred choice is usually the least-cost option for delivering the required level of service. In order to design the optimum least-cost system it is important that both the capital and recurrent costs are taken into account for each option. In terms of a rural water supply scheme this may mean weighing up the benefit of

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Table 2.7.8 Options for rural water supply

Supply system	Skills required for construction	Skills needed for O&M	Relative per capita capital cost	Relative per capita O&M cost	Institutional dependency
Hand-dug wells	Usually locally available	minimal	1-2	1-2	promotion and construction
Borehole with handpump	medium	medium	5-10	2-3	high
Protected spring	low	low	1	1	low
Rainwater catchment (including surface)	medium	low	5-15	1	low
Pipe network to communal standposts	high	high	10-15	20-25	high
Pipe network with yardtaps	high	high	30-50	40-60	very high

Notes: 1. Costs are indicative and need to be related to local unit costs
2. Comparisons for urban supplies are more difficult because a number of source types and distribution systems may be combined
3. Surface water sources are excluded because of the range of technologies and costs possible, depending on the source.

Table 2.7.9 Options for wastewater drainage from waterpoints and domestic premises

Disposal system	Technical skills for construction	Skills required for O&M	Relative construction cost per person	O&M cost per person	Water disposal capacity	Institutional dependency
Surface infiltration	nil	nil	nil	nil	low — depends on land area and soild impermeability	nil
Sub-surface infiltration	similar to local house building	cleaning grease trap	1	1	low — depends on land area and soild impermeability	nil
Surface water drains	some additional skill required	routine maintenance	10-100	10-50	depends on drain size	construction and O&M
Sullage drains	some additional skill required	routine maintenance	10-20	10-20	depends on drain size	construction and O&M
Sewers	See 'sewerage' in Table 2.7.5					

Notes: Costs are indicative and need to be related to local unit costs
Surface infiltration is not usually recommended because of the environmental and health risk of ponding

Table 2.7.10 Selection of pipe material

Pipe material	Typical range of diameters	Typical maximum working pressure (bar)	Typical usage	Disadvantages/Constraints
Cast iron	150-600mm	25	Old transmission mains. Still used for fittings for asbestos cement pipes	Very brittle. No longer widely available or popular
Ductile iron	150-1600mm	25	Transmission and distribution pressure pipelines. Expensive for diameters >1000mm	Corrosion protection required: plastic sleeve externally and bitumen or cement-mortar lining
Galvanized mild steel	15-150mm	10	Small diameter service connections	Not suitable for high pressure/ large diameter pipes. Needs corrosion protection if used underground
Steel	400-2130mm	40	Cost effective for larger diameter pressure mains	Very susceptible to corrosion if not adequately protected. High degree of skill needed for joint welds. Bedding design also important
Asbestos cement	150-900mm	12.5	Widely manufactured and used in developing countries. Used for underground transmission mains and sewers	Good bedding design required, pipes are brittle. Health hazard from dust when cutting pipes
Pre-stressed concrete	400-1500mm	12	Pumping trunk mains and sewers	Pipes are heavy. Susceptible to chloride/sulphide attack Specially manufactured joints are required
GRP	400-1800mm	16	Good in corrosive environment — used for trunk mains and sewers. Very light for handling	Manufacture is difficult and limited experience makes construction difficult
uPVC	80-600mm	15	Service connections and distribution mains (low pressure)	Susceptible to fracture problems and degrades in sunlight
MDPE	20-600mm	12	Service connections and distribution mains (low pressure). Light and easy to transport in coils (small diameters only)	Only suitable for lower pressures Strength of pipe decreases with time and with low temperatures.
HDPE	20-600mm	25	Pumping mains and sewers, transmission and distribution	Higher cost than MDPE but stronger and more durable. Larger diameters have lower pressure rating

Note: Other materials such as copper, lead, bamboo, vitreous clay, and wood are also sometimes used for distribution pipes.

purchasing a more expensive handpump initially, which will have lower maintenance costs than a cheaper one. Note however that this choice must be made not just on cost grounds, but also considering ease of maintenance at village level.

This issue becomes much more complex for urban piped supplies and needs a rigorous approach. If a system involves a significant amount of pumping, the capital cost of the pipe needs to be optimized against the long-term cost of pumping: that is to say, smaller diameter pipes are cheaper, but have higher associated pumping costs due to high friction losses. If the system has significant lengths of pipeline, this may be the single highest cost component and it is therefore important that the most appropriate pipe material and diameter are carefully selected. Table 2.7.10 gives an overview of the range of pipe materials available and their different properties. The actual choice of pipe material will depend largely on local conditions and preferences, availability, relative costs, etc. The information in this table has been gathered from a range of sources. Detailed information on particular materials should be obtained from manufacturers.

2.7.26 Defining and costing different levels of service

The demand for different levels of service has been discussed a number of times in this manual, but it is important to be clear about the definition of each level of service and to understand the cost implications. There is often confusion over the difference between standposts (used by many households) and yardtaps (used by one household and possibly their neighbours). Detailed cost estimates should be prepared by engineers, based on local data and comparable schemes wherever possible. A useful design guide is *Public Standpost Water Supplies: A design manual* (IRC, 1979).

Table 2.7.11 Cost data from the 'Policies and Guidelines of Uganda's Water Development Department for Rural Towns and Sanitation Program' (1992)

System	Construction Cost (USH '000 per capita)	O&M Cost (USH '000 per capita per year)
Spring catchment	2-6	0.1-0.2
Hand-dug well and handpump	8-12	0.3-0.5
Drilled borehole and handpump	20-30	0.3-0.5
Piped supply to standpost	3-6	2-5
Piped supply to yardtap	100-200	5-10
SanPlat latrine	4-8	1-2
VIP or pour-flush latrines	12-40	1-2
Septic tanks	100-150	3-5
Sewers	100-200	10-20

Further reading

General technical

Bailey, R.A. (ed.) (1996) *Water and Environmental Management in Developing Countries*, CIWEM, London.

This book provides an interesting overview on policies and philosophy. Also has useful chapters on practical procedures for environmental management, water supply and sanitation, and people and institutions. Unfortunately it is currently out of print.

Cairncross, S., Carruthers, I., Curtis, D., Feachem, R., Bradley, D. and Baldwin, G. (1980) *Evaluation for Village Water Supply Planning*, Wiley, Chichester.

Cairncross, S. and Feachem, R. (1993) *Environmental Health Engineering in the Tropics*, 2nd edition, Wiley, Chichester.

Excellent text providing linkages between disease and engineering. Detailed chapters on water quality, water treatment, excreta disposal, and wastewater treatment.

Davis, J. and Lambert, R. (1995) *Engineering in Emergencies*: *A practical guide for relief workers*, IT Publications, London.

Although intended for use in emergencies, this book has a lot of practical information for engineers in the field. Particularly good on water source development, drilling techniques, water storage, and pump selection.

Grover, B. (1983) *Water Supply and Sanitation Project Preparation Handbook, Volume 1: Guidelines*, World Bank Technical Paper No.12.

Hammer, M.J. and Hammer, M.J. Jnr (1996) *Water and Wastewater Technology*, 3rd edition, Prentice Hall, New Jersey.

WASH (1993) *Lessons Learned in Water, Sanitation and Health: Thirteen years of experience in developing countries*, Water and Sanitation for Health Project, Washington DC.

Interesting read for all water and sanitation engineers who want to do things better — it summarizes twenty lessons learned from the field which cover all project phases from programme development to operation and maintenance.

Sanitation

Cotton, A. and Saywell, D. (1998b) *On-plot Sanitation for Low-income Urban Communities: Guidelines for selection*, WEDC, Loughborough University.

Franceys, R., Pickford, J.A. and Reed, R.A. (1992) *A Guide to the Development of On-Site Sanitation*, WHO, Geneva.

Mara, D.D. (ed.) (1996) *Low-Cost Sewerage*, Wiley, Chichester.

Pickford, J. (1995) *Low-Cost Sanitation: A survey of practical experience*, IT Publications, London.

Reed, R.A. (1995) *Sustainable Sewerage: Guidelines for community schemes*, IT Publications, London.

Water supply

Cairncross, S. and Feachem, R. (1986) *Small Water Supplies*, Ross Bulletin 10, London School of Hygiene and Tropical Medicine, London.

House, S. and Reed, R. (1997) *Emergency Water Sources: Guidelines for selection and treatment*, WEDC, Loughborough University.

This publication has a great amount of detail on source assessment and water treatment which would be equally applicable to non-emergency projects.

IRC (1979) *Public Standpost Water Supplies: A design manual*, IRC Technical Paper No.14, IRC International Water and Sanitation Centre, The Hague.

IRC (1983) *Small Community Water Supplies*, 2nd edition, IRC Technical Paper No.18, IRC International Water and Sanitation Centre, The Hague.

Excellent handbook for engineers planning and designing relatively small-scale water supplies. Covers all aspects of water sources, treatment, transmission, and distribution.

IRC (1991) *Partners for Progress: An approach to sustainable piped water supplies*, IRC Technical Paper No.28, IRC International Water and Sanitation Centre, The Hague.

Jordan, T.D. Jnr. (1984) *A Handbook of Gravity-Flow Water Systems*, IT Publications, London.

Twort, A.C. et al, *(1994) Water Supply*, 4th edition, Arnold, London.

Classic text for water supply engineers covering the procurement, treatment, and distribution aspects of public water supply systems. Not specifically written for application in developing countries, but design data are applicable to urban or peri-urban projects.

Wagner, E. and Lanoix, J. (1969) *Water Supply for Rural Areas and Small Communities*, WHO, Geneva.

WHO (1993) *Guidelines for Drinking-Water Quality. Volume 1: Recommendations*, 2nd edition, WHO, Geneva.

Other

Coburn, A., Hughes, R., Spence, R. and Pomonis, A. (1995) *Technical Principles of Building for Safety*, IT Publications, London.

Dudley, E. and Haaland, A. (1993) *Communicating Building for Safety*, IT Publications, London.

FINNIDA (1993) *Looking at Gender, Water Supply and Sanitation*, Finnish International Development Agency, Helsinki.

Snell, M. (1997) *Cost-Benefit Analysis for Engineers, Planners and Decision-makers*, Thomas Telford, London.

Trew, J.E., Tarbet, N.K., DeRosa, P.J., Morris, J.D., Cant, J. and Oliff, J.L. (1995) *Pipe Materials Selection Manual*, 2nd edition, WRc, Medmentham, Bucks, UK.

2.8 A social marketing approach to hygiene promotion and sanitation promotion

The provision of safe sanitation facilities will only improve people's health if the sanitation facilities are well maintained and people have good personal hygiene.

A latrine provides the primary barrier against the spread of faecal matter. This barrier is easily breached by a dirty latrine or if hand washing after use does not become normal practice.

As we saw in Section 2.3, sanitation, along with good hygiene, acts as a fundamental 'primary barrier' to prevent faecal matter, the source of most diarrhoeal pathogens, from spreading in the environment.

It is as important to enable people to change their hygiene behaviour as it is to provide improved facilities. Practices which stop faecal material contaminating the domestic environment are vital, especially for children. The priorities in behaviour-change programmes are thus likely to include hand-washing with soap after stool contact and the safe disposal of stools (see Section 2.3.3).

According to Almedom et al. (1997),

- Hand-washing with soap and water after contact with faecal material can reduce diarrhoeal diseases by 35 per cent or more.
- Using a clean pit latrine and disposing of children's faeces in a pit latrine can reduce diarrhoea incidence by 36 per cent or more.

This section looks at ways of encouraging safer hygiene-related practices. It is based on a new promotional approach that draws on social marketing, health communications, anthropology, and health promotion. It emphasizes inclusion and builds partnership at all levels.

Principles

Promotion of safer practices will best be achieved by new, promotional community-based, social marketing approaches that seek out and use the messages that will motivate change. These must be established and used as the starting point to inspire behavioural change.

The recommended approach differs from classic hygiene and sanitation programmes because it places the consumer at the heart of the programme. Instead of beginning in an office, programme design begins in the community. Consultation actively involves the many different groups in society and develops a shared agenda for action.

The process starts with data collection, to find out what target communities need, want, and do. Appropriate interventions are then negotiated with the health or engineering specialists and developed into a strategic programme.

The approach works well in a participatory, village-by-village manner. It is, however, most useful and cost-effective on a large scale, where the intervention is first developed in a small-scale, participatory manner, and then applied across regions or urban centres.

The promotional approach is not without contradictions. It is centred on the users' perspective, but it has a firm agenda. It uses participatory methods but it is not wholly participatory. And there are other contradictions to be addressed:

- Faecal contamination of the environment may be the main cause of preventable disease. This does not mean it will be the community's highest priority for change.

DFID/Howard J Davies

- Though improved health is the programme’s main objective, the target communities are more likely to be interested in latrines and hygiene for reasons of dignity and aesthetics.
- Messages about potential health benefits are not effective at motivating people to change their behaviour. Attractive, positive, messages which appeal to people’s sense of dignity are often more effective.

It is important to consider the implications of these and other contradictions. The agendas and priorities of development workers often differ from those of the communities with whom they work. This problem is not specific to the promotional approach but is inherent in much development work.

The promotional approach aims to make scant public health resources work effectively and sustainably over large areas, and for large numbers of people.

We will look at the principles of social marketing and hygiene and sanitation promotion and then turn to the nuts and bolts of implementation.

Getting the right messages depends on first obtaining detailed information of what consumers know, do, and want. Successful promotion is then centred on two key processes:

- developing messages or products that suit target audiences; and
- communicating the messages in ways that are appropriate, attractive, and motivating.

2.8.1 Definitions

The following terms are used in this section:

- **Promotion** seeks better health through encouraging behavioural change**.** It puts consumers at the heart of programmes, ensuring participation and partnership in programme development. The focus of this section is on hygiene and sanitation promotion.
- **Social marketing** uses marketing approaches to match available resources with social needs. Social marketing may be applied to service provision and use, the development and acceptance of products, or the adoption of new behaviour. It can be product- or behaviour-focused.
- **Consumer-orientation** is fundamental to **social marketing** and demands that social programmes respond to people’s perceptions and aspirations.
- **Data collection** is a systematic process of investigation and collaboration with target communities to find out what they need, do, and want, that provides information that is essential to programme design.
- **Hygiene promotion** encourages people to adopt safer practices in the household to prevent sanitation-related disease.
- **Sanitation promotion** is the marketing and promotion of sanitation products and services.

The two key processes in hygiene and sanitation promotion relate to the consumer. They are:

- the development of messages or products that suit target audiences; and
- communicating these messages in ways that are appropriate, attractive, and motivating.

What can social marketing achieve?

In Honduras, deaths due to diarrhoea decreased almost 50% following a programme to educate mothers about the use of ORS.

Over six months of hygiene promotion with a pilot group in Lucknow, India, the proportion of mothers washing their hands with soap after defecation went from under a quarter to over a half.

It is used in industrialized countries in programmes to prevent heart diseases, smoking, and AIDS, and to encourage the use of seat-belts.

In Indonesia, 85% of women now feed their child a mixed food with green leaves, which has lead to a 40% improvement in the nutritional status of children under two years of age.

A 30% decline in infant mortality was achieved through the promotion and marketing of ORS in Egypt.

44% of men in Bangladesh discussed family planning with their wives within 12 months of campaign launch. Contraceptive prevalence increased by 10%.

adapted from Mehra, 1997

Social marketing offers a staged, customer-focused approach, converting assessed user needs into demand and then providing the means of satisfying the demand.

Hygiene promotion and sanitation promotion are both concerned with facilitating behaviour change. Health education, social mobilization, community participation, and central planning models have failed more than they have succeeded. Marketing models provide an alternative approach to behaviour change.

The promotional approach starts with the systematic use of data collection to find out what consumers know, do, and want. The results are used to develop concise, positive messages that address specific health problems and to develop behaviour-change objectives that can be monitored and measured by the project team.

2.8.2 Why hygiene and sanitation promotion programmes need a social marketing approach

Lessons from hygiene education and sanitation programmes have shown that:

- When water and sanitation projects do not take adequate account of individual and community behaviour the expected health benefits are not fully realized.
- In sanitation projects, goals have tended to focus on the number of latrines constructed or the number of people given access to them. The behaviours that determine whether new facilities bring health benefits are rarely considered. These behaviours include hand-washing, safe disposal of children's excreta, personal and household hygiene, food handling, and so on.

Hygiene and sanitation programmes have commonly been concerned with the 'supply' of education, and materials, rather than with satisfying a 'demand' from intended beneficiaries. Demand creation is the main aim of commercial marketing. The social marketing approach is demand led in that it uses a strategic, managed process of assessing and responding to felt needs, creating demand and then setting achievable and measurable goals.

Social marketing is a systematic approach to public health problems. It goes beyond marketing. It is not motivated by profit alone but is concerned with achieving a social objective. Social marketing is therefore concerned with how the product is used after the sale has been made. The aim is not simply to sell latrines, for example, but to encourage their correct use and maintenance. The key components of social marketing are:

- systematic data collection and analysis to develop appropriate strategies;
- making products, services, or behaviours fit the felt needs of the consumers/users;
- strategic approach to promoting the products, services, or behaviours;
- methods for effective distribution so that when demand is created, consumers know where and how to get the products, services, or behaviours;
- improving the adoption of products, services, or behaviours and increasing the willingness of consumers/users to contribute something in exchange; and
- pricing so that the product or service is affordable.

2.8.3 What happens in social marketing?

Social marketing programmes use data provided by the target audience to set promotional objectives that satisfy the particular demands of like-minded groups in the audience. These objectives may be the use of sanitation products, or the awareness of sanitation services.

1. A sample of the intended audience, or consumers, are consulted and questioned about their needs, wants, and aspirations. They collaborate in the development of feasible, attractive solutions. This is *Data collection* and is crucial to orienting the promotional activities (see box below).

2. Achievable overall marketing (or promotion) objectives are developed.

3. These data are analysed and used to develop an overall marketing plan in collaboration with key stakeholders.

Data to collect for a latrine programme

- How many households/neighbourhoods have inadequate sanitation facilities or systems?
- What do people perceive as 'good' and 'bad' sanitation?
- What do people see as the advantages of latrines?
- What type of system do women prefer?
- What type of system do men prefer?
- What are the characteristics they prefer?
- How much do people pay and how much are they willing to pay?

4. The audience is segmented into discrete units with common characteristics. This is based on an analysis of the initial data.

5. Products and messages are developed based on consumer preferences and characteristics for the relevant segments. These are tested among representative samples of target populations. How much are people willing to pay for this product? How far are people willing to travel for this service? How feasible is the new behaviour? Products, messages, and price are modified, refined, and re-tested until they are acceptable. Key stakeholders are consulted throughout this process.

6. The product is launched or service introduced.

7. The performance of the product or service is monitored and evaluated in the market and the strategy revised accordingly. This may involve revising the marketing plan or improving the product or service.

The four Ps of social marketing

The basic characteristics of the social marketing approach are 'the four Ps': Product, Price, Place and Promotion.

As in commercial marketing, the 'four Ps' are the basic characteristics of the social-marketing approach (see box below). A clear and well-researched background to define each of these characteristics is essential for the success of social marketing.

The four Ps of social marketing

	Examples
Product Decide on what is the product, its form, format, and presentation in terms of packaging and characteristics	*Products:* VIP latrines, SanPlats *Practice or behaviour:* Wash hands after using the latrine *Idea:* Clean environment, good sanitation for health
Price Decide on what the consumer would be willing to pay, both in terms of direct and indirect costs and perceptions of benefits: make the product worth getting	*Monetary or direct:* Cost of products (with or without subsidies), social cost *Opportunity/indirect:* Time lost from other activities, missed opportunities, transport, loss in production or income *Psychological or physical:* Stress in changing behaviour, effort involved in maintaining latrine or obtaining additional water required
Place Where will the product be available to consumers, including where it is displayed or demonstrated	*Delivery of product:* Tea shops, builder's yards and suppliers, clinics, pharmacies, clubs, local businesses
Promotion How the consumers will know the product exists, its benefits, costs, and where and how to get it.	*Delivery of message:* Television, radio, newspapers, posters, billboards, banners, folk singers or dramatists, public rallies, interpersonal/counselling

Target audiences — or who the project needs to contact

- Primary target audiences are those people who are carrying out the risk practices, e.g. mothers and/or schoolchildren or, for a product-based programme, those who take the decision to purchase particular goods.
- Secondary target audiences are those who influence the primary audience and who are in their immediate society, e.g. fathers, mothers-in-law.
- There is a third target audience which is very important: people who lead and shape opinion, e.g. schoolteachers, religious leaders, political leaders, traditional leaders, and elders. These people have a major influence on the credibility and hence on the success or failure of the programme.

2.8.4 Targeting

Targeting — the audiences

For maximum efficiency of resource use and impact in the community, audiences and unsafe practices must be carefully targeted.

Promotion must concentrate on the primary users and on those who influence them in the family circle or the wider community social structures.

Programmes are more effective if a small number of key messages are focused to specific target audiences (see box above). This concentrates resources and increases the chances that behaviour change will result.

The community is made up of many different groups, or 'segments'. Each segment of the audience may need to be addressed separately, e.g. house-to-house visits to reach mothers, street theatre to reach fathers, and public meetings with a video show for opinion leaders. It is also important to ensure support for the programme from partner and collaborating agencies; they may also be an audience to target.

Data collection is important as it provides conditions for a shared agenda. Through the process of consultation, the best communications strategy for each segment can be developed.

Targeting — the practices

The targets for messages on unsafe practices must be those assessed as having the greatest adverse health effects.

Stools are the main source of diarrhoeal pathogens. Practices which stop faecal material contaminating the domestic environment are vital, especially for children. The priorities for public health in behaviour-change programmes are therefore likely to include hand-washing with soap after stool contact and the safe disposal of stools, especially children's stools, preferably in latrines.

Potential risk practices need to be documented and their frequencies assessed. Practices which occur often and which allow faecal material into the domestic environment are likely to be candidates for behaviour change. The final target practices, to replace the risk practices, are developed in collaboration with target audiences.

Communicating messages

Messages should bolster those aspects of the desired practice that users see as advantageous. The messages must not dwell on negative aspects of current practices.

Messages about child diarrhoea, doctors, and death are more likely to repel target audiences than to encourage behaviour change. *Message positioning* involves the selection of positive values that the primary target audience associates with the target practices. For example, if the data collection shows that using a latrine for stool disposal is valued for self-respect and dignity, then the messages should reinforce this existing positive value of hygiene.

The data to inform the message-positioning decision can be collected in three ways:

1. Interview people who already use the safe practices.
2. Carry out focus group discussions.
3. Interview people after they have tried the safe practices for a few weeks.

Communications strategies are then built around these positive values, e.g. *'hand-washing with soap makes your hands smell good.'*

With a simple questionnaire it is possible to find out what social groupings exist and what access people have to information, e.g. whether people listen to the radio and when, whether people read papers, which papers they read, who goes to the weekly market, etc.

In focus groups it is possible to identify which channels are seen as most suitable and attractive for hygiene messages.

2.8.5 Political will

Seek and take opportunities to enlist leaders from all sectors and at all levels of society to play an active part in promotional activity. Broadening the active stakeholder base increases the sense of consumer and community involvement and helps to spread the message more widely.

Sanitation and hygiene improvements require political will and support. Programmes will benefit if social, cultural, and political leaders are motivated and given an active role (mobilized) such as:

- religious leaders actively supporting the campaign for sanitation; or
- schoolchildren and teachers playing a leading role.

A partnership approach to promotion does not assume ignorance on the part of the people. It is less top-down and develops, and works from, a shared agenda. It widens ownership of the programme by increasing the number of stakeholders who are actively involved from the start. These additional stakeholders not only provide their endorsement (thus widening the appeal of the initiative) but also accept increased responsibility for implementation.

Advocacy creates partnerships with government and NGOs. It operates on many levels: everyone from the head of state to local government leaders should become aware of the importance of the programme (see box on following page).

2.8.6 Programme communication

Good communication stems from accurate identification of the routes best suited to reach individual target groups. Integrate a mix of routes into a promotional strategy. Use as wide a range of communication routes as possible and use training to improve all aspects of promotional output.

Programme communication covers identification, segmentation, and channelling. First of all, the communication channels used by target groups are identified. Then a mix of channels of communication is devised to combine reach and cost-effectiveness. Specific groups/ consumers are reached through:

- strategies and messages for safe sanitary and hygienic practices;
- various mass media and interpersonal channels; and
- improved fieldworker and supervisor training methods.

This process binds advocacy and programme communication together. It makes the programme a priority for the society as a whole and *not just* the concern of a government department, a programme manager, or a donor.

2

Strategies and agents for advocacy

Main strategies
National conferences, speeches, special events, seminars, field visits, letters, directives, news coverage, articles, TV and radio general programming, and special publications

Main targets-cum-agents

Media:	press institutes, journalists' forums, TV and radio
Political:	president, prime minister, ministers, parliamentarians, political parties
Administrative:	cabinet secretary, secretaries, commissioners, project directors
Donors:	UNICEF, USAID, JICA, WHO, and others
NGOs:	NGO umbrella groups and major NGOs, service clubs, and voluntary societies

Political leaders, opinion leaders, social groups, the media, celebrities, and donors should be the focus of advocacy. The aim is to turn these people into advocates themselves — voices who will take the opportunity to speak through their own channels of influence in their own words. Advocacy must change according to progress in the programme.

2.8

WEDC/Ian Smout

Programme communication strategies include:

- Interpersonal communication training: Strengthen the ability of government and NGO fieldworkers to reach potential latrine adopters and to promote sanitation and hygiene. Address interpersonal communication skills and the quality of available support materials.
- Mass media: Build on existing policies and strengthen government and private-sector capacity for creative presentation of standardized messages.
- Print media: Promote the development and dissemination of a clearly defined programme logo to build awareness and aid identification. Develop strategies using print media, e.g. billboards, posters, site-signs, interpersonal support, and other learning materials, manuals and programme guidelines.
- Community-based media: Use local-level media, e.g. public address systems, and employ traditional, community-based entertainment artists, e.g. popular folk singers, dramatists, and poets, and use their talents through the mass media.

Do not let promotional activity become a subsidiary to the 'flagship' phases of a project.

Ring-fencing the promotional activities

Too often the promotional effort is an add-on to a project whose budget and timetable is largely committed to hardware (water supplies, sewage, etc.) and the promotional activities (e.g. the software) are swamped, rushed, or curtailed. The separate projects need to be *ring-fenced* but must be carefully co-ordinated to maintain an integrated approach. (See the box on page 210.)

Table 2.8.1 Examples of mobilization			
Elements	**Examples**		
	Aims	**Involves**	**Communication methods**
Political mobilization	• Gaining political and policy commitment • Resource allocation	National policy-makers and decision-makers	• Advocacy • Lobbying • Goodwill ambassadors • Mass media
Government mobilization	Informing and enlisting co-operation	• Service providers • Other government organizations who can provide direct or indirect support	• Training programmes • Study tours • Mass media
Community mobilization	Informing and gaining commitment	• Local political, religious, social, and traditional leaders • Local government agencies • Non-governmental organizations • Women's groups • Co-operatives	• Training • Participation in planning • Coverage of activities by mass media
Corporate mobilization	Securing support	National and international companies	Endorsement and space in: • Product advertising • Product labelling
Popular mobilization	Informing and motivating the target groups	Community groups, households, families, men, women, children	• Training programmes • Establishment of community groups • Traditional (dramas, songs); mass media

2.8.7 Hygiene promotion

The 'teacher and pupil' approach is very labour-intensive and not always effective. Hygiene promotion accentuates positive aspects of 'clean' behaviour that consumers can relate to day-to-day practices.

Health education programmes, traditionally included as the 'software' part of a 'hardware' intervention, have consistently failed to realize their full potential to effect an improved health status. Why is this? Why do health education programmes fail to hold any relevance to their target audience? If the 'risky' practices which health education identifies are socially undesirable, why do they persist?

Hygiene promotion addresses these and other questions. Hygiene promotion does not 'educate' people about their 'risky' practices but looks at what motivates people to act, and at how hygiene behaviours are articulated within everyday life. It builds on positive values, such as those attributed to cleanliness, and draws on lessons from the social sciences, e.g. anthropology, psychology, adult education, and marketing.

From health education to hygiene promotion

Four principles guided the development from a narrow education-focused approach to a broader promotion outlook:

The evolution from hygiene 'education' to hygiene 'promotion' has acknowledged four key principles:

- Adults are not 'clean slates' on which to write new ideas.
- Adults may have neither the time nor the motivation to learn new ideas.
- New knowledge does not equal new practice.
- It is not feasible to expect people to change a whole variety of hygiene practices.

These are discussed in turn.

2

- *Adults are not 'clean slates' on which to write new ideas*

All adult societies have their own ideas of what is ' clean' and of what causes disease. Those practices and beliefs must be used as the starting point for change, not ignored in the mistaken belief that consumers will instantly reject generations of tradition and rush to embrace the 'truth' as pronounced by hygiene educators.

Adults are not 'clean slates' on which to write new ideas

Classical hygiene education is based on the premise that people persist in unhygienic practices because they do not know about the germ theory of disease transmission — that microbes cause disease and so on. Hygiene educators, and others, sometimes equate this with ignorance and clash with indigenous systems of knowledge.

All societies have concepts of cleanliness which are central to notions of individual, and group, identity. Throughout the world there are many explanations for the appearance of diarrhoeal diseases in children, all of which are internally consistent. In regions as distant from each other as India, Africa, and Europe diarrhoeal episodes are attributed to a variety of social, climatic, and environmental factors. These include the transgression of particular social rules, the consumption of unsuitable foods, the presence of concurrent illnesses, teething, and straightforward bad luck (see box opposite).

If we take no account of what adults in the target population know and we treat them as 'clean slates' on which new (and Western) ideas can simply be inscribed, then, at best, we create confusion and incomprehension. At worst the teaching is entirely rejected: 'these outsiders have no real idea what is making my child sick'.

Solution: Hygiene promotion is founded on knowledge of key aspects of what people know, do, and want.

2.8

- *Adults may have neither the time nor the motivation to learn new ideas*

The women of poor communities have little time to sit in on formal education sessions but they are the ones most likely to see the benefits of change and to strive to bring it about. Clear messages must be disseminated along effective communication routes.

Adults may have neither the time nor the motivation to learn new ideas

Traditional school-type teaching is common in hygiene education programmes. This may be appropriate for children, but is unlikely to appeal to adults, especially hard-pressed mothers who have other higher priorities for their time and energy.

How to drive a SanPlat

The promotion of sanitation and the production of sanitary wares require totally different skills. This is recognized in other markets and should be accepted in hygiene and sanitation promotion.

The person who builds a car is different from the person who sells that car, who is in turn, different from the driving instructor.

SanPlat manufacturers make SanPlats (page 170). They are not necessarily the best people to sell them, to advise customers how to use them, or to suggest to their customers ways of dealing with children's stools.

Folk taxonomies of diarrhoeal diseases in Burkina Faso

Folk taxonomy of diarrhoeal diseases in Burkina Faso — the least important of which is that described by health educators, *diarrhée des blancs* or 'white people's diarrhoea'

Name	Symptoms	Causes
KOLOBO	Green, frothy, frequent stools Vomiting, Weight loss	Teething
KOTIGUE	Small, mucoid stools, Irritated anus Fever	Carrying the child on the back Contact with damp ground
WOLINA	Whitish, liquid stools smelling of rotten eggs Sunken fontanelle	Breast-feeding mother steps on an egg 'Infection'
SERE	Thick, whitish, bad-smelling stools Child thin	Breast feeding after having sexual relations or while pregnant
DIARRHEE DES BLANCS	Liquid stools Ballooned stomach	'Parasites/worms' Dirt

- *New knowledge does not equal new practice*

  Promotion must be to practical effect, encouraging changes that are possible and are wanted, not merely relating lists of good hygiene practices that, for the time being at least, have little chance of being implemented.

- *It is not feasible to expect people to change a whole variety of hygiene practices*

  Long 'wish lists' confuse consumers and dilute the promotional effort. Attention must be focused on a few practices that present the greatest risk in the target community.

Solution: Hygiene promotion uses repeated, coherent, and simple messages. These are disseminated through a mix of communication channels designed to reach target audiences for the greatest effect and the least cost.

New knowledge does not equal new practice

Even if the target audience of the hygiene education programme accepts the germ theory of disease, this does not guarantee they will change their hygiene behaviour. Fear is not a good motivation for change. A fear that germs may make a child ill is unlikely, by itself, to prompt people to adopt new domestic practices (see first box on page 212).

There are other reasons why new behaviours are not adopted as a direct result of new learning: the suggested 'safe' practices may be too expensive or time consuming, appropriate facilities may not be available, and there may be no support, or even discouragement, from other members of society. In other words change may be too difficult.

Solution: Hygiene promotion is based on what people can do and what people want to do. It works to find solutions and not problems.

It is not feasible to expect people to change a whole variety of hygiene practices

It is likely that only a small number of practices are responsible for the majority of diarrhoeal episodes (WHO, 1993b). However, hygiene education programmes rarely identify and target particular risk practices (see second box on page 212). Getting people to change the habits of a lifetime is extremely difficult. The more practices that are targeted the more efforts are diluted.

Cries of resistance from a cholera programme

Government efforts to control a cholera epidemic in north-eastern Brazil caused indignation. *Favela* residents were highly resistant towards the mass media campaigns and official cholera control interventions. They were reacting against the accusatory attitudes and actions of the social élite.

Cholera is popularly called 'The Dog's Disease'. It carries many connotations and must be understood as part of a history of domination and social and economic inequity in north-eastern Brazil. The official campaign, which used two stereotypes, *pessoa imunda* (filthy, dirty person) and *vira lata* (stray mutt dog), suffered a backlash as these seemed to equate the poor with cholera and poverty with dirt. Using this disgracing and disempowering imagery blamed, punished, and stigmatized the poor…

Nations and Monte, 1996

Solution: Hygiene promotion is built by providing simple, attractive alternatives to a few common risk practices. The process is systematically planned and monitored and the impact on the targeted behaviour is measured.

2.8.8 Hygiene promotion in practice

A three month period of data gathering within the community provides a sound base for programme planning and will bring its own rewards. A short period discussing the collated results with the community will allow the formulation of a promotion programme founded on what consumers know, do, and want. Messages, communication channels, target audiences, and target practices should be accurately defined to achieve optimum results.

Consumer-oriented, demand-led promotion is an iterative process with the following stages:

Stage 1 Collaborative data collection
Stage 2 Feedback and discussion with all key stakeholders
Stage 3 Formulation of the hygiene promotion plan
Stage 4 Implementation, monitoring, revision, etc.

If resources and key personnel are available, data collection can be completed within three months and the feedback and project design can be completed in a further month. This investment of time and resources in finding out what people know, do, and want will be repaid many times over in enhanced programme effectiveness.

Message overloading in hygiene education

- wash vegetables
- filter drinking water with sand
- place basins of water in the sun
- keep finger-nails cut short
- wash hands with soap
- do not wash hands with mud
- spray insecticides
- wash hands before eating
- wash hands before feeding a child
- wash hands after defecation
- wash dirty dishes after meals
- clean surrounds
- burn rubbish
- do not bottle feed
- wash latrine slabs
- wash well
- use fly-screens for food
- boil drinking water
- do not spit in public
- add disinfectants to drinking water
- chlorinate well water
- bury faeces
- construct water containers with taps
- wash hands before preparing food
- wash children's hands
- wash hands after contact with child faeces
- sprinkle lime
- bury rubbish
- do not store food
- comb hair
- disinfect latrine slabs
- construct latrines


WaterAid/Jim Holmes

Table 2.8.2 Key steps in a hygiene promotion programme

Objective	Questions to answer	Methods
Identify risk practices	Which specific practices allow diarrhoeal microbes to be transmitted?	Epidemiological common-sense Environmental walk Checklist observation
Select practices for intervention	Which risk practices are most widespread? Which risk practices are alterable?	Structured observation Behaviour trials Focus group discussions
Define target audiences	Who employs these practices? Who influences the people that employ these practices?	Structured observations Focus group discussions
Determine message positioning	What motivates those who currently use 'safe' practices? What are the advantages of the 'safe' practices?	Focus group discussions Interviews with safe practisers Behaviour trials
Select communication channels	What channels are currently used for communication? What channels are trusted for such messages?	Interview representative sample of target audiences Focus group discussions

The table outlines the key questions and some of the quantitative and qualitative data-gathering techniques that can be used (Curtis et al., 1997).

During implementation the key requirements are to start on a small scale and to be prepared to modify programme details as the effects are continuously evaluated. The effects are measured in terms of behavioural change rather than health benefits.

The mix of techniques develops an understanding of the needs, desires, and perceptions of the target audience, and helps to create 'like-mindedness' among the project team members and between the project team and the community.

Different methods will be suitable for answering different questions. For example, questionnaires are of little use in finding out about people's behaviour (Curtis et al., 1993), but may be useful in identifying existing channels of communication. Setting clear objectives for the data collection and a commitment to find out what people really know, do, and think is more important than the choice of methods.
Consultation with key stakeholders is a crucial component of hygiene promotion. A brief, attractive report presenting the recommendations for hygiene promotion is widely disseminated. It is translated into local languages, and made accessible to key stakeholders. A communication plan listing the key objectives of the programme is then drawn up on the basis of the findings (see Table 2.8.3).

Implementation of a hygiene promotion programme
The hygiene promotion programme should begin on a small scale. Time must be allowed for testing and revising strategies in the light of continued monitoring. Use structured observations to conduct an initial survey of target behaviour and establish a baseline. Follow this up at intervals to gauge the extent of behaviour change towards the

Table 2.8.3 Components of a communication plan

Components	Examples
Behaviour change objectives	• Hand-washing with soap after cleaning a child's bottom will go from 5% of occasions to 35% in two years
Key messages	• The targeted hygiene practices
Target audiences	• Age, sex, number in each group
Motivation for behaviour change	• Why do the target audiences want the new practices?
Channels of communication	• Street theatre, house visits, radio, schools
Communications materials	
Methods of monitoring progress	• In programme activities • In programme outputs • In behaviour change
Budget	
Project management	

LSHTM/Sandy Cairncross

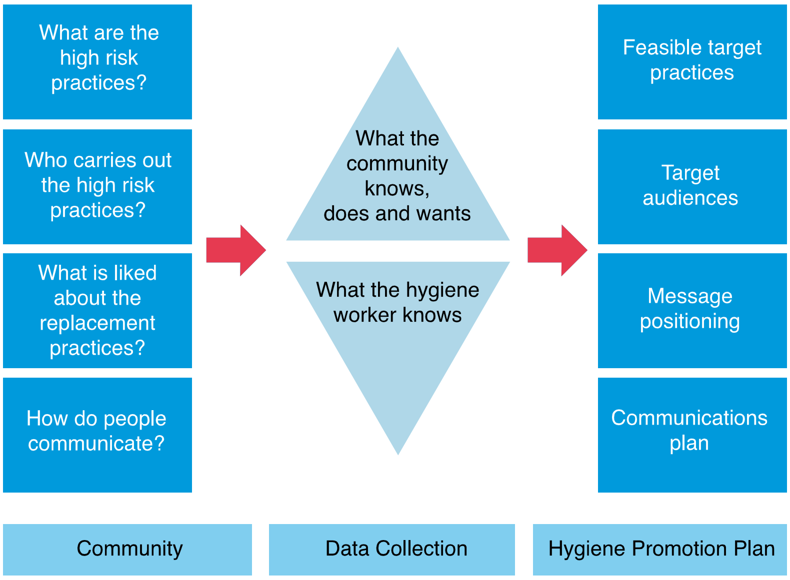

Figure 2.8.1. The process of promotion

project's objectives. Monitoring behaviour change is difficult, but more practical and useful than conducting a health impact study. It is difficult, and expensive, to separate the 'signal' of the public health intervention from the 'noise' of parallel events such as epidemics, economic, climatic, or social change.

2.8.9 Sanitation programmes and the social marketing approach

Social marketing can be a bridge between technology (hardware) and behaviour change (software) for effective sanitation programmes. The following tables take you through the process.

Table 2.8.4 A social marketing plan for sanitation

Steps	Examples	Notes
1A Identify data collection needs	• Low level of latrine coverage in two rural provinces, • Children at high risk of diarrhoeal disease	
What are the causes?	• Latrines are expensive • Materials are hard to find • Latrines are seen as urban structures	
What beliefs, attitudes, and current practices contribute to the problem or possible solution?	• Latrines are 'too dangerous' for children to use • Pregnant women must not use latrines • People dislike using the bush at night • Flies and bad smells are seen as a nuisance	
Determine and define the evaluation indicators (to include for baseline data)	• Number of latrines • Number of latrines in regular use • Proportion of children's stools thrown in latrines	• These could be based on overall programme/project objectives • Including evaluation indicators with data collection helps measure impact at the end of the programme/project inputs • It also means that information need not be gathered separately and it thus saves time and resources
1B Define the intended audience		• Identify consumers and their traits
Who will be most responsive to the intervention (primary audience)?	• Fathers take the decision to buy a latrine • Mothers encourage • Landlords are constrained by law to provide latrines (not enforced)	
Who can support the primary audience in its new practices?	Allies such as • healthworkers • grandmothers • community leaders	
1C Define feasible behaviour(s) or appropriate products for each audience		
What is the desired ideal behaviour? Or ideal product?	A fly- and smell-free, cheap latrine which can be used safely by all family members	
What is the current behaviour? Or products used?	• Adults go to the bush • Children defecate in the yard	
What are the feasible behaviours to be promoted? Or appropriate products?	• Paying a mason to construct a latrine • Buying and using a potty for small children under three	• Define the 'Product' or behaviour
1D Develop the research plan		
What do you need to know?	• Why do heads of family not buy latrines now? • What would motivate them to do so? • Why do mothers not buy potties now? • What would motivate them to do so?	Use research or consumer-based data to: • Identify 'Price' and 'Place'
Who will do it?	• Project field team • Research specialist and students • Experienced extension workers • Sociologist	
What type of research/timing?	• Quantitative latrine coverage survey 400 households • Focus group discussions with mothers, fathers, landlords • Construction of six model demonstration latrines • Observations in 200 households of child defecation • Trial marketing of potties in two provinces	

Steps	Examples	
2. Establish programme goals and objectives *Use results of Step 1.*		
Research finding	**Possible programme goal or objective**	
60% of respondents are aware of proposed sanitation method	15 percentage point increase in the level of awareness of modern method of sanitation from 60 to 75% among respondents by two years	
Only 10% of respondents are aware of distribution outlet for sanitation product	A 30 percentage point increase in awareness of distribution outlet from 10 to 40% among respondents by two years	
30% of respondents rate the sanitation product as effective	10 percentage point increase in effectiveness rating from 30 to 40% (or modification of the product to achieve 40% rating) among respondents by three years	
15% of respondents currently use sanitation product	A 5 percentage point increase in use of sanitation product from 15 to 20% among respondents by three years	

Steps	Examples	Notes
3. Estimate the potential market for a given brand or product		
Research results are very useful if the sample is representative of the total population to be served	• 5% of households have a latrine • Overall potential market is 200,000 households • 25% would build a latrine if it cost less than 50,000F • 15% intend to build a latrine this year • Conservative estimate of potential market is 20,000 latrines in two years	The data can be projected for the whole population and the size of the market (and potential demand) can be calculated • Usage data will provide estimates of the overall size of the current market • 'Intention to use' can predict the potential market
4. Develop a marketing 'mix' strategy *Use the information from Step 1 for developing marketing 'mix'*		
Product Strategy: • What product(s) will best fulfil the needs of the intended audience/ consumer groups	• A choice of models at different prices	
Price Strategy: • What does intended audience currently spend in this area? • What can they afford?	• Current models are VIPs constructed by a previous project. They were provided free. • VIPs are too expensive for most households.	Cost calculations should include both • *direct expenditures* of money and resources and • indirect costs e.g. time energy embarrassment (difficult to quantify)
Distribution Strategy: • What are the distribution channels which are most readily accessible to the intended groups? • What outlets do they use? • Where are they most likely to look for the sanitation product?	• Mason's shops in local market towns • Village mason	
Advertising and Promotional Strategy Research findings can be used for • Setting the communication objectives for the programme for each intended group • The media strategy to reach each intended group	• Masons promote latrines on market days • Extension worker makes house-to-house visits with brochures/invitations to visit demonstration latrines	

2

2.8

Steps	Examples	Notes
When developing the marketing strategy you need to know ...		
Current usage		
• What methods and products are consumers using, if any? • What is the competition?	• Some VIPs • Landlords have provided simple latrines in some compounds	
Attitudes/perceptions		
• What benefits are relevant, meaningful, and persuasive?	• Advantages include privacy, dignity, and convenience	
• What barriers will need to be overcome?	Main barriers • Cost • Previous latrines were subsidized	
Product image		
• What is the image of either the method or product or brand among the intended audience?	• VIPs seen as very grand, only for the wealthy • VIPs seen as to be kept for adults and visitors only	
• How can this be improved?	• Emphasize low-cost models • Stress child use	
Consumer communication		
• What information does the intended audience want and need to use?	• Misperceptions about cost and danger to children need correcting	Consider sources of information for • product effectiveness • product availability • correcting any misperceptions
• What sources does the intended audience currently use for information? • Which one(s) do they believe? • What other potential media are available?	• 61% of male heads of household listen to local radio regularly • 72% of women attend weekly market • Baptisms and weddings	

Further reading

Almedom, A., Blumenthal, U., and Manderson, L. (1997) *Hygiene Evaluation Procedures: Approaches and methods for assessing water- and sanitation-related hygiene practices*, International Nutrition Foundation for Developing Countries.

This book provides the non-expert with guidelines for evaluating water- and sanitation-related hygiene practices. It focuses on the practical concerns of field personnel and enables existing field staff to carry out hygiene behaviour diagnoses. The book looks at how to gather, review, and interpret qualitative information. It weighs the pros and cons of a wide range of techniques and assumes no prior knowledge of social sciences.

Ankur Yuva Chetna Shivir (1996) 'Diarrhoea and hygiene in Lucknow slums'. A document produced for the Gomti River Pollution Control Project, Lucknow, London School of Hygiene and Tropical Medicine, June.

An account of a hygiene promotion project in Lucknow which was written for, and disseminated to, project stakeholders. Producing an accessible report is integral to the process of 'increasing the ownership' of the project. This is attractive and easy to read and shows how the project was designed and what lessons were learned.

Boot, M.T. (1991) *Just Stir Gently: The way to mix hygiene education with water and sanitation*, IRC Technical Paper No.29, IRC International Water and Sanitation Centre, The Hague.

As the title suggests the main concern of this book is hygiene education, and it is based on the paradigm most prevalent in the USA. The book considers issues in project design: for example, negotiations with project stakeholders needed to introduce behavioural components, and the timing of articulating behavioural components with other project components. This is still a good source of techniques for data collection and it stresses the importance of both finding out, and working with, what people know.

Boot, M.T. and Cairncross, S. (1993) *Actions Speak: The study of hygiene behaviour in water and sanitation projects*, IRC International Water and Sanitation Centre, The Hague and London School of Hygiene and Tropical Medicine, University of London.

A comprehensive analysis of ways of studying hygiene behaviour and interpreting the results. The recommended approaches are demonstrated with lots of practical examples and anecdotes. Planning and pre-testing hygiene behaviour studies, involving community members in study design and information gathering methods, the types of behaviours most relevant to achieving health improvements, and different interviewing techniques are all considered.

Cairncross, S. (1992) *Sanitation and Water Supply: Practical lessons from the Decade*, UNDP-World Bank Water and Sanitation Discussion Paper No.9, UNDP-World Bank, Washington DC.

A personal perspective on the ten-year effort to provide low-cost waste facilities. This is a concise explanation of how water-supply and sanitation programmes are part of a wider picture which includes land tenure, housing, drainage, and solid-waste disposal, etc. The main lesson is that sustainable success depends on consumer demand and that programmes should be designed and managed to sell a product, e.g. water supply and sanitation, and not to provide a service.

Curtis, V. (1997) *Hygienic, happy and healthy. A series of practical manuals designed to help you set up a hygiene promotion programme. Part 1. Planning a hygiene promotion programme.* Draft manual prepared for UNICEF.

This series of manuals describes how to carry out the data collection vital for the design of an intervention. They are very readable and have lots of graphics.

Curtis, V., Sinha, P. and Singh, S. (1997) 'Accentuate the positive: Promoting behaviour change in Lucknow's slums' *Waterlines*, Vol.16 No.2. pp.5-7.

A brief article by the project team in Lucknow. It covers the techniques used when planning a hygiene promotion intervention and reminds readers of the need for good news, not doom and gloom.

WASH (1993) *Lessons Learned in Water, Sanitation and Health: Thirteen years of experience in developing countries*, Water and Sanitation for Health Project, USAID, Washington DC.

A review of the lessons WASH took from the Water Decade. The book looks at technical assistance, at shared responsibility and different stakeholders in partnerships, at all levels of programme strategies, and at long-term sustainability and the importance of enabling behaviour change through a range of initiatives.

2.9 Maximizing benefits of interventions

While WS&S interventions bring benefits in their own right, the wider objective is to exploit these gains as a catalyst for general improvement to the services and living environment of the poor. Success in this area has been limited. It can be increased and make a more positive contribution to DFID's prime aim, poverty elimination, by encouraging a move away from isolated WS&S projects in favour of the development of regional and national sector policies in the host countries. Success will be enhanced if these policies can be integrated into pro-poor sector programmes.

Chapter 2 highlighted the principles and practice of successful WS&S, seen as both a social and an economic good. Safe water and sanitation can not only lead to better health opportunities, but can also promote sustainable livelihoods and improve living and working environments. Moreover, participatory approaches within the context of process projects and partnerships can promote improved civic engagement and demand responsiveness, along with meeting the needs of the poor for these services. Effective support to WS&S provision can also make a substantial contribution to DFID's principal aim, the elimination of poverty.

However, it has to be said that globally, the contribution of WS&S to poverty reduction has not been well documented. It has also been constrained by project design. This concluding section summarizes the principles and practice of WS&S which is concerned as much with equity as with efficiency and effectiveness, and it provides a link into the challenge of taking these goals forward into DFID programmes and partnerships. An important starting point for successful interventions is a pro-poor sector policy. In many cases, however, projects are begun without established water and sanitation policies and many successful WS&S projects are confined to the local level. A key challenge, therefore, is to link positive processes and quality services at the micro-level to policy dialogues and sector programming.

2.9.1 Meeting needs and responding to demand

Two key issues which have emerged from the review of principles and practice in WS&S are:

- the benefits of WS&S are not evenly distributed and often fail to reach the poor; and
- WS&S programmes invariably face problems when they are not based on genuine demand.

Superficial assessments of demand can lead to misdirected programmes that meet none of the real needs of the poor. Shared agendas, that unearth the true needs and demands of individuals and communities, are the essential framework on which to build sustainable interventions capable of meeting the combined objectives of equity, poverty reduction, efficiency and cost-effectiveness.

The challenge facing DFID and its partners is to combine the poverty reduction and equity goals of meeting the 'objective' needs of poorer households and communities, with the efficiency and effectiveness goals of demand responsiveness. The most vivid example illustrating this is the now widespread acknowledgement that women benefit in terms of time, health, and well-being from improved water supply and sanitation. This is frequently cited as a justification for intervention in the sector and yet in many communities throughout the world, in the face of competing priorities, poor women find it difficult to make their demands heard. Thus, matching needs and demand implies going beyond posing dichotomies between 'supply driven' and 'demand driven' approaches and identifying means by which shared agendas can be negotiated. Demand can be latent or uninformed, while meeting needs does not have to be a top-down or non-consultative process. Hence the use of the term 'Demand-responsive approach' — see the box opposite for an example of this in practice.

Case study: Demand-responsive approach

The Mvula Trust in South Africa has been implementing a rural WS&S programme using a demand-driven approach since 1994. The process starts by a Mvula Trust representative visiting the community to explain the approach. The community is then responsible for contracting a consulting engineer to assist them in carrying out a feasibility study prior to funding application. The project is allocated a fixed amount of money by the Mvula Trust, and so the community water committee, with the assistance and advice of the engineer, must make informed decisions on the type and level of service they require. For example, in Morapalala, the original design provided 20 public standposts. The community felt this was inadequate coverage and so the committee decided to review the design to save money in other areas and provide 30 standposts. The community also played a central role in identifying potential spring sources and deciding on the location of the reservoir and standposts. This is a good example of interactive planning.

Lessons learned from Mvula's demand-driven approach
Public standposts are proving unpopular as a level of service. There is a high demand for yardtaps, which cannot be financed under the limited Mvula grants. New mechanisms for funding (e.g. loans) need to be developed so that higher levels of service can be achieved.

Delegating management responsibility to community-based organizations is risky and there have been some failures. In two or three projects, money has been stolen from the project bank account. However, the majority of projects (360) have been successful and free of corruption.

The private sector has played an important role in providing training to community-based organizations; for example pipe suppliers, which are contracted by the water committees, offer training in pipe laying in addition to supplying and delivering the pipes.

The fixed ceiling on capital grants has ensured equity between projects and also encourages cost efficiency: the engineer and the community have to work together to design solutions which achieve the highest affordable level of service.

Palmer, 1998

In the past, a community's willingness to make contributions to the capital cost of new facilities has often been seen as evidence of demand. External support agencies have often provided funding to community groups if they accept the project proposals or rules and agree to pay the specified capital cost contributions. The danger is that the full costs and implications of operation and maintenance are not dealt with at this stage, and that other feasible technical options are not considered, for example because of the limited capacity of a local NGO. While such a process may reveal that the community has a clear demand for improved services, it does not mean that the best or preferred technical option has been selected, nor does it mean that the community is willing and able to fund and manage the operation and maintenance of the facilities in the long term. A demand-responsive approach should therefore also include a full consideration of viable options and a participatory assessment of the management and finance of O&M of viable options, if sustainability is to be achieved.

DFID/Dilshad Sheikh

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Participation of primary stakeholders has proved its worth at project level but the principles are only beginning to be applied to sectoral policy and programme development. It is an evolutionary process which, in these early stages, can benefit by absorbing the best experiences of project partnerships.

Overlapping capabilities and responsibilities in the several agencies typically involved in WS&S programmes make for management inefficiencies and inter-agency tensions and disputes, and have frequently caused projects to fail.

Responsibility for specific aspects of the programme must be clearly defined at the project formulation stage, seeking to make best use of the strengths of the individual organizations involved, and to effect good lines of communication between them.

Particular attention must be given to the difficult problem of forging reliable links between internal and external services.

2.9

2.9.2 People, participation, and process

Crucial to meeting the challenges posed in water supply and sanitation is recognizing that successes and failures hinge as much on people as on pipes. Stakeholder analysis and participation (see Section 3.2.2) go a long way towards identifying the different actors involved and their interests and capabilities in the sector. The rationale for primary stakeholder participation is summarized as follows:

- services and service providers are more responsive to and accountable to users;
- sustainability of services improves when technology choices, cost recovery, operation and maintenance, and management of services correspond to what users are able and willing to contribute; and
- conflict over water resource allocation and other competing sectoral uses will more likely be resolved by participatory and processual approaches.

While stakeholder participation is well accepted in DFID's project work and is seen as vital in extending services to the poorest communities, partnership approaches in water and sanitation programmes are comparatively new. Much is yet to be learned about ways to optimize stakeholder participation in sector programming and policy dialogue in the sector. There is no blueprint method but the development of best practice in process projects constitutes an important starting point.

2.9.3 Institutional linkages and partnership

Policy, planning, implementation, and management responsibilities in WS&S, span several agencies and levels of government without well-defined jurisdictions. This causes confusion and is often a reason for project failure. Communities are often then included, in order to rescue or redeem projects, without their participation being rooted in demand and a clear understanding of what community members are willing and able to do. The solution lies not in simply adding more actors to the institutional mix, but rather in looking at the links between those who are involved in or affected by interventions.

If the two main emerging themes of WS&S are integration and partnership, then the challenge is to plan initiatives that ensure effective co-operation across organizational and institutional boundaries, whether formally or informally. This involves negotiating a division of responsibilities based on a thorough understanding of the comparative advantage, capabilities, and priorities of the different groups involved, be they agencies, different levels of government, or relationships between the community, private, and public sectors. With community-based initiatives and demand-led approaches, a critical issue is the problem of establishing linkages between internal and external services. One approach is the intervention of intermediary NGOs. Another is the promotion of processes aimed at institutionalizing links between community efforts and government and agency provision of primary infrastructure and services, processes which need to be built into project design and management.

Benefits of WS&S interventions are maximized by integrating the inputs of the community and public and private sector organizations in an ordered framework with strong institutional links.

In order to develop institutional linkages and maximize benefits in WS&S, the key questions that should be asked at the time of project formulation and implementation are as follows:

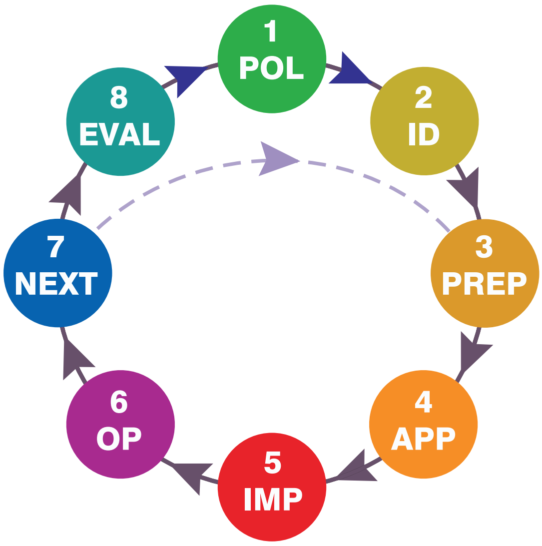
- Who should be responsible for which aspects of design, delivery, and management?
- How can individuals or organizations be strengthened in order to undertake these responsibilities effectively?
- When are partnerships between communities and public and private sector actors possible, and under what conditions?
- What changes are necessary in attitudes, expertise, and procedures, and what action is necessary to reorientate officials and professions to adopt more participatory approaches?

Chapter 3


WEDC/John Pickford

Water supply and sanitation in the DFID programme and project cycle

The principles and practices described in Chapter 2 are relevant throughout the programme and project cycle. In this Chapter, the aim is to demonstrate how the interdisciplinary nature of the WS&S sector can be taken into account in each stage of the cycle. First, a reminder of the eight stages of a Project Cycle used in this document, based on DFID practice.



1. Policy development, sector planning, and programme formulation
2. Programme and project identification
3. Preparation
4. Appraisal and approval
5. Implementation and monitoring
6. Operation and monitoring
7. Extensions or next-phase project identification
8. Evaluation

The dotted arrow linking Stages 7 and 3 represents a cycle within a cycle. Stages 1 and 2 are conducted at national level at the start of DFID's co-operation in the sector. They are major exercises establishing partnership arrangements involving all stakeholders. Their outcomes then set the criteria for what may be a series of projects within the country. Those criteria may change as the overall programme or project is evaluated (Stage 8). Within the criteria, new projects may be identified (Stage 7) and prepared (Stage 3) without necessarily repeating Stages 1 and 2.

'Demand assessment ... needs to be a central part of a process for project development which:

- is multidisciplinary, holistic, and involves key stakeholder groups, including users, from the outset;
- does not close off technical options too early;
- systematically consults all users about feasible technical and institutional options for improved services and about the prices that might be charged for them;
- is multi-stage, allowing for iteration towards a solution acceptable to all stakeholders. Each stage is likely to involve;
  - a degree of technical design, costing, financial projection, and tariff design;
  - demand assessment, participation, and consultation on feasible options;
  - an analysis of findings; and
  - a political review and decision; and
- allows some flexibility for different users to opt for different levels of service, including the possibility of upgrading over time.'

DFID, January 1998

The guidance in this chapter includes frequent cross-referencing to Chapter 2. DFID staff are also referred to the DFID Office Instructions, which include fuller descriptions of the purpose, structure, and reporting requirements of the eight stages than it is possible to include in this manual. Brief summaries of the process are included here stage-by-stage, to set the context of the guidelines which follow.

A number of basic principles are common to all stages. They are described in Chapter 1 (Section 1.4) and Chapter 2 (Section 2.1) and include:

- Dialogue and joint activities with partners and other stakeholders, including continuously matching project objectives and achievements with the agreed goal of improving services for the poor.
- Promotion of partnership, local ownership, and the empowerment of communities.
- Adoption of the *process approach* in which projects evolve through a continuous learning process and regular review.
- Interlinkages with the broader issues of water resources management, sustainable development, and environmental protection.
- Matching the recognized need to treat water as a scarce and valuable resource which must be paid for, with the priority of the poor for affordable services which meet their basic needs.
- Considering a wide enough range of technical, institutional, and financial options to ensure that stakeholders are not unreasonably

WEDC/Sarah Parry-Jones

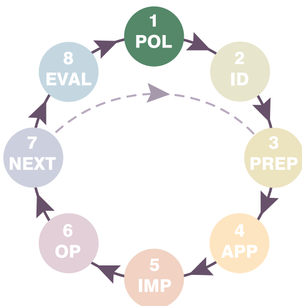
constrained in their choice of service level, management structure, or financing methods.

- Capacity building which enables stakeholders to participate as equal partners in decision-making and to fulfil their subsequent roles effectively.

At the heart of the whole process is the requirement to be responsive to demand. DFID has developed guidance (summarized in the box opposite) on how best to incorporate demand management into the process of project formulation and design. It has implications throughout the project cycle in that care must be taken in planning consultancies and technical assistance to create flexibility in both timing and project options. This argues for a series of consultancies, with each Terms of Reference (ToR) reflecting the emerging picture, rather than one major study. As it may take several years to reach large-scale activity and expenditure, interim measures such as pilot projects may be needed to maintain momentum and strengthen stakeholder partnerships. This increases programme managers' responsibility for maintaining continuity, and detailed attention must be paid to drawing up ToR and briefing information, monitoring consultants' performance, and reviewing their work. The logical framework is a key tool for integrating the different professional perspectives within a single programme or project, and at each stage of the cycle.

Moves towards user-oriented partnerships take time. Institutions and organizations may require training and professionals may feel that they are compromising what they are used to doing. The time and resources needed to bring the whole team with you are worthwhile investments that will reap benefits in programme effectiveness, appropriateness, and sustainability.

Social marketing to promote improved hygiene behaviour is an iterative process, which does not fit easily into the stages of the Project Cycle, the demands of which will vary from project to project. In these guidelines it is assumed that the programme and project preparation will include data collection and planning with stakeholders. The implementation stage will include the training of health promoters and the development of promotional materials; it also covers piloting and scaling up. Revision and refining through consultation run throughout the programme.



3.1 Stage 1: Policy development, sector planning, and programme formulation

This first step in the development of a WS&S programme is where the partnerships are established and the criteria for collaboration agreed with the partner government and other stakeholders. In some cases WS&S may be only part of a package of proposals that are being negotiated. At other times, a WS&S component may be being proposed as an addition to an ongoing programme, or the WS&S intervention may be DFID's first involvement in a particular country.

The different types of negotiations may involve different DFID professional staff, but the WS&S sector principles remain valid for each type.

The ultimate decision at this stage is whether or not the programme goes ahead. That will depend on DFID, possibly other donors, and the partner government committing themselves to a series of common objectives and specific inputs to be made during the following stages. This is the time therefore when it is vital to ensure that the partners' policies are compatible and that all agree on the need to maintain a multidisciplinary approach from the start. Often in the past, hygiene promotion, for example, has been seen as an element to be added in later (if at all). As we saw in Chapter 2 (Section 2.2.8), the long lead time needed for successful hygiene interventions makes it crucial that inputs are made from the start.

Important outputs of Stage 1 will be a comprehensive review of the WS&S sector in the partner country, and a strategy for achieving the agreed objectives. In some countries, this may be a matter of reviewing a national strategy that has already been formulated, and relating it to a range of activities which DFID is interested in co-operating. In others, there may be a need to commission a participatory study to develop a strategy and establish baseline data.

Key issues which will need to be addressed relate to the management of the WS&S sector in the country, and the government's declared policies on sector approaches. The attention will focus on:

- the relevant WS&S institutions;
- how decisions are made and responsibilities shared between governments and communities in a particular country or context;
- NGO and private sector participation, and the regulatory framework;
- policy towards sustainable WS&S for poor people (particularly institutions, finance, the scale and uses of public subsidy, and hygiene promotion issues);
- interaction between WS&S and related sectors or sub-sectors such as health (particularly on hygiene promotion) and irrigation (including integrated water resources management);
- national indicators of need (WS&S coverage and other available indicators); and
- key external support agencies and their programmes.

The discussions are likely to be held at senior levels of government and with high-level representation of all partners. Briefing documents need to make clear the 'non-negotiable' elements of sustainable WS&S programmes.

Figure 3.1 shows the type of steps which may be involved in reaching a satisfactory outcome from the strategy development process.

Participatory processes take time and there may be pressures from various sources to take shortcuts. In particular, some stakeholders may wish to identify and design projects quickly to meet specific demands or electoral promises. In some situations, it is possible that partners may agree to undertake some activities while the sector review is in progress.

The types of questions which need to be addressed during the review are grouped by discipline, matching the headings in Chapter 2.

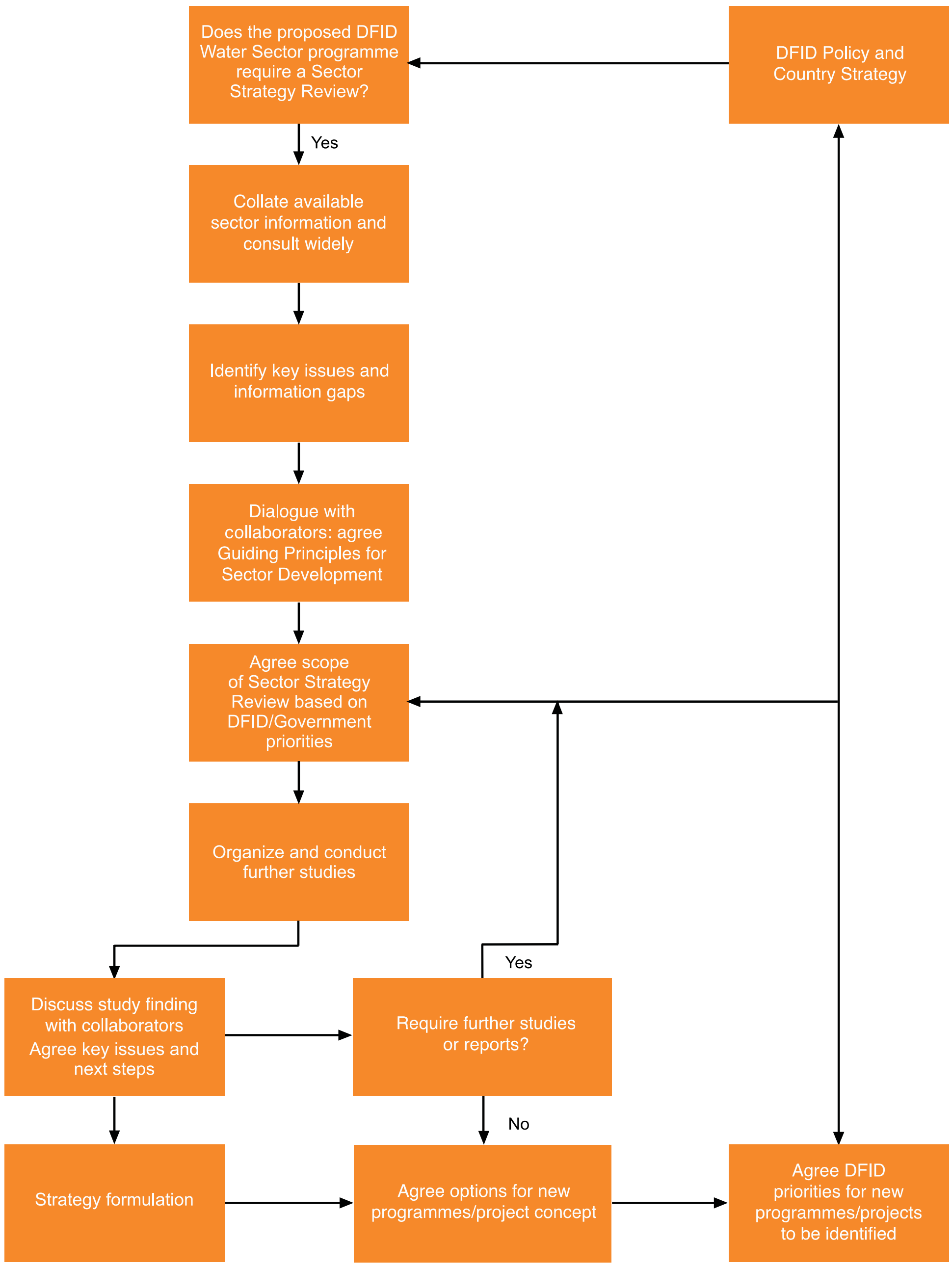


Figure 3.1.1. Sector strategy development — an iterative approach

3

3.1.1 General considerations

Are existing national/state policies compatible with DFID aims and objectives?

Compatibility of policies makes collaboration in programme development easier. However, a willingness to reform and introduce changes can be a good basis for providing support in policy and programme development. 'Consider where is the sector now?' and look at opportunities for making improvements. This implies a thorough understanding of the existing institutional and socio-economic environment. If a proposed project or programme is dependent on policy or institutional changes for its sustainability, there are risks that the policy changes may take a considerable time to agree and operationalize (see Section 2.6 for advice on institutional issues).

Is the environment appropriate for using a Broad Sector Approach in order to develop a Sector Improvement Programme (SIP)?

DFID Institutional and Economic Advisers should be consulted as to whether it is advisable to consider a SIP. Even if it is not appropriate, it may be worthwhile to seek donor and host government collaboration in sector-wide work, including institutional aspects, focusing on DFID's priorities (see Sections 1.6.3 and 2.6.6).

With whom should DFID collaborate in the development of a water sector strategy?

The first contact point is invariably the appropriate national ministries. The collaboration of other key stakeholder institutions who have a primary role in the sector should be sought at an early stage. DFID's *Guidance Note on Stakeholder analysis of aid projects and programmes* (ODA, 1995b) has a comprehensive checklist for identifying stakeholders.

Should field data collection be conducted as part of a Sector Strategy Review?

Existing data on water supply and sanitation service levels is prone to inaccuracies because of reasons such as poor maintenance and rapidly increasing demand. A judgement needs to be made as to whether further field data should be collected either at the sector strategy stage or the project identification stage when a particular area has been identified.

3.1.2 Social development perspectives

The questions here relate to entry points for advancing a social development perspective in policy dialogue, sector planning, and programme formulation. They focus on:

- maximizing the use of existing commitments on social development issues by partner governments and donors;
- evaluating and building on past experience in the sector; and
- identifying secondary stakeholders and their involvement in the sector.

Beijing Platform for Action — Paragraph 252

'In addressing the lack of adequate recognition and support for women's contribution to conservation and management of natural resources and safeguarding the environment, governments and other actors should promote an active and visible policy of mainstreaming a gender perspective in all policies and programmes, including, as appropriate, an analysis of the effects on women and men, respectively, before decisions are taken.'

Do existing national policies on water resource management and sanitation services have a focus on issues of poverty, inequality, and gender?

The task of integrating a poverty or equity focus into policy dialogue and sector planning will be much easier if existing policies on water and sanitation are already concerned with these issues. Some national programmes and investments in water supply and sanitation also take into account gender differences in needs, priorities, and access to and control over resources. This makes it easier, although not automatic, to ensure that benefits and opportunities are extended equitably to both women and men.

What national commitments have been made to poverty reduction, equality, human rights, and gender equality?

In many of DFID's partner countries, even if policies on water supply and sanitation do not have an explicit pro-poor focus, other national policies or the adoption of international conventions may provide a basis and a justification for pursuing social development agendas. For example there may be constitutional guarantees relating to equality and human rights, while partner countries may be signatories to international conventions such as the UN Committee on the Elimination of Discrimination Against Women (CEDAW) and the Beijing Platform for Action which pursue women's rights and gender equality.

What are the policy approaches of other donors involved in the water supply and sanitation sectors to poverty reduction, equity issues, gender equality, and participatory approaches?

A key challenge for DFID is to promote pro-poor, gender-aware, and participatory approaches to water supply and sanitation within the context of co-ordinated support to sector planning. In order to engage in effective brokering and to identify entry points, it is important to understand the concern and capacity of partner agencies in relation to social development in water supply and sanitation. It is important at this stage too, to draw upon the DAC Guidelines (DAC 1997a and b).

Are there lessons from previous water supply and sanitation programmes or other parallel sectors regarding participatory approaches and partnership?

Participatory approaches are not usually enshrined in constitutions or guidelines, but rather gain acceptance through evidence of good practice. It is useful, therefore, to draw on examples of successful participatory projects, ideally from the country or region concerned. This will require exploring the activities of NGOs and local initiatives as well as other donors.

Are there international, national, regional, or local-level organizations that could support the development of poverty-focused, participatory, and gender-aware interventions in WS&S?
Even when they are willing, governments are not always able to engage in participatory processes. It is useful, therefore, to identify and involve intermediary NGOs working in water supply and sanitation or in the target areas which can provide links to community-level organizations.

3.1.3 Water, sanitation, and health

The objective here is to ensure that the national government and all local and national stakeholders understand the issues and the relatively small incremental costs involved in achieving optimum health benefits. Answers to the questions raised here should form the basis of a health improvement component as an integral part of the project formulation.

What are the current national objectives for WS&S-related health improvements?
How significant are water supply and sanitation-related health problems to public health in the country? How large do they figure in the health and/or social welfare policy? Official statistics are probably not reliable for ranking health problems as so many cases and deaths go unrecorded; conversations with those working on health among the poor will often indicate a higher priority for water, sanitation, and hygiene than may be evident from reported statistics. Improved health should not be the *only* objective for WS&S interventions, but it is an important and well-established one.

How is progress towards the health objective measured within the sector?
It is *not* realistic to expect routine health statistics to reflect the health benefits achieved by water, sanitation, and hygiene interventions, *nor* is it worth counting on epidemiological studies in the country to establish the benefits; done rigorously, *measurement* of environmental health will divert a substantial amount of relevant human and financial resources away from the work of actually *improving* health (see Section 2.3). Instead, it makes sense to focus on proxy indicators, such as sales of children's potties and soap, use of latrines, etc. Experience elsewhere has already established the significance of these variables in contributing to health. Not only are they easier to measure; the results have greater diagnostic power as they will suggest concrete steps to improve the project and its prospects of attaining health improvements (see Section 2.3.9).

What, if any, scope is there for linkage between hardware and software in the sector?
What is the current attitude and policy towards the linkage of hardware (water supply investment, latrine construction, etc., with

software (promotion of demand, hygiene promotion, community organization)? To what extent are approaches culturally aware, recognizing local systems of belief and understanding? Are current approaches didactic or based on dialogue? Sector objectives can be expressed in different ways, for example, 'The supply of water to the city through the construction and maintenance of plant and pipe, funded by the sale of water', or 'Creating conditions for the satisfaction of demands for the sustainable provision of clean and palatable water'. Sanitation can be viewed as 'Protection of the environment through the construction and maintenance of sewerage, funded by public taxation', or 'The improvement of environmental health and well-being, especially among the poor, through the promotion of hygienic excreta management'. These differing definitions have different software implications, particularly if health is a major objective, which require development or support of hygiene promotion.

How effective is current interdepartmental collaboration?
To what extent, and at what levels, do relevant government agencies collaborate on environmental health? This collaboration often varies across levels; in some cases stronger at the top than at the bottom, and in others stronger at the bottom than at the top. What works to promote this collaboration, and what are the obstacles?

3.1.4 Environmental sustainability

Under this heading, DFID and partners are seeking to ensure that any WS&S programme which emerges is effectively integrated into a national water resources management strategy and that projects will be designed to contribute to water quality protection and environmental improvement objectives. The Commission for Sustainable Development (CSD) recommends that national water policy should include, among other things:

- an understanding of the quantity and quality of the freshwater resource base;
- principles for allocation of the resource;
- the incorporation of health concerns into freshwater management;
- the protection of the aquatic environment;
- management of demand; and
- the development of appropriate institutions.

The policy also needs to be supported by an appropriate regulatory and legislative framework.

What is national policy towards the environment and environmental assessment?
Most countries have a high-level political commitment to *Agenda 21*, the action programme of the Rio Earth Summit, and to environmental resolutions at other international meetings following on from Rio. Existing national conservation strategies and environmental action plans are a helpful starting point for determining programme objectives and procedures.

Water Resource Control and Review Council (WRCRC) — Tamil Nadu

In 1993, in recognition of the fact that water resource developments were taking place across the state in a piecemeal manner on a scheme-by-scheme basis, the government of Tamil Nadu established a high-level co-ordinating body called the Water Resources Control and Review Council (WRCRC). This council is chaired by the Chief Minister and includes ministers representing all government departments concerned with the development and use of water resources.

The WRCRC was created to handle multi-sectoral water planning and allocation, and acts as the state's principle water policy implementation body. The Council receives support and advice from a technical secretariat on issues such as water policy, strategy, legislation, regulation, and allocation within the state.

Recent institutional reforms in Tamil Nadu

There have been a number of key institutional reforms in Tamil Nadu, many under the auspices of the World Bank-funded Water Resources Consolidation Project (WRCP). The principal changes where the:

- issuing of the Tamil Nadu State Water Policy;
- creation of the specialist Water Resources Organization (WRO);
- creation of a Water Resources Control and Review Council (WRCRC) to oversee multi-sectoral water planning and allocation;
- reorganization of the Chief Engineers of the WRO on a river-basin basis;
- institution of river-basin allocation and planning committees headed by basin Chief Engineers; and
- strengthening of WRO's environmental management capabilities.

In addition, a major component of the WRCP has been directed at planning and institutional strengthening in the water sector. The changes and rationalization of the water sector in Tamil Nadu are consistent with the new international agenda and its focus on integrated water resource management. In particular, the water sector has been given a higher profile via this disaggregation of water sector functions under the newly formed WRO.

Changing roles and responsibilities in Tamil Nadu

One of the changes introduced by the TN-WRCP has been the reorganization of operation decisions on a basin, rather than district basis. Tamil Nadu therefore finds itself with at least three families of institutional structures. District collectors from the colonial period, sectoral departments of the 1960s, and the new river basin institutions headed by basin managers.

Committees comprising the basin managers, local representatives of other sectors such as agriculture, industry, and domestic water supply, and the collectors of the relevant districts will make water allocation decisions at a basin level. Basin managers head these committees, but the changing roles and responsibilities may lead to conflict or resistance from the district collectors. Despite the potential for conflict, the reorganization has generally met with wide approval.

DFID, 1998b

Is there a national procedure for environmental impact assessment which includes public participation?
DFID's own *Manual of Environmental Appraisal* (ODA, 1996b) has details of favoured approaches. There may be a national procedure, or some countries may follow the World Bank's OD 4:01 (World Bank, 1991).

What is the current national environmental picture and how dependable are the data?
Reports and secondary data can be used to obtain an environmental profile. They may also provide a good indication of how serious the issue of environmental sustainability is in the country and how complete the data are. In addition to statistics on historic WS&S coverage and future targets, data on river water and groundwater quality trends will be important. Policies and plans related to wastewater treatment, re-use, and disposal should be assessed in relation to pollution trends.

Is any form of integrated river basin management in operation?
Though this is an institutional issue, it relates also to considerations of environmental sustainability and integrated water resources management (IWRM) as a whole. (See Sections 2.4.1 and 2.4.3.) A river basin or sub-basin base is a very practical unit for IWRM. In relation to WS&S programmes, the basin may also be a useful confining unit when identifying stakeholders.

Is there a mechanism for resolving conflicts over water demands and usage?
Conflict resolution is becoming a bigger and bigger issue as scarcity increases. WS&S is generally specified as a priority use, but that does not help many communities who suffer regular cut-offs and service interruptions, despite the small amount of water that is used for domestic purposes. A logical output of the development of agreed priorities and allocations for water demands is a system of abstraction licences which can include conditions specifying rates of abstraction and constraints related to season and/or river flows or groundwater levels. It is important that such systems be properly funded, to ensure enforcement.

3.1.5 Economic perspectives

The general questions are 'How appropriate is the enabling framework of policies?' and 'What changes are needed?' More specific questions under various policy headings are given below.

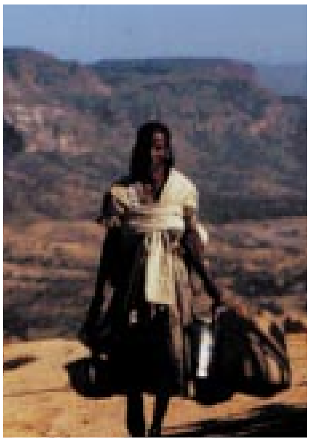
Integrated water resource management
National water sector policies should be cohesive and consistent with efficient and equitable water use for agricultural, industrial, and domestic purposes. Pricing policy should reflect the opportunity cost of water. Although water is an increasingly scarce resource, irrigation water is heavily subsidized in some countries, often to the detriment of the affordability and sustainability of domestic water supply schemes. There should be a framework of incentives for the use of water, based on demand management (using pricing and non-pricing

measures), and reinforced by a public expenditure programme in the water sector in support of these principles. Such a framework is spelled out in the Draft DAC Guidance on the treatment of aid-financed projects in the water sector (Winpenny, 1997b).

Key questions are:

- Are policies (e.g. on water pricing) giving the right incentives to water users to reduce integrated water resources management problems?
- If there is intersectoral competition for water, do prices for irrigation water need to be raised to release water for urban use?
- Is sufficient use made of water demand management approaches?

Policy towards the poor


WaterAid/Caroline Penn

Ensuring the sustainable provision of basic water and sanitation services to those who lack them should be a government's first priority in the water sector. Policy on the use of subsidies, or on reforming utilities or sector institutions, or on increasing the role of the private sector, should be built around this priority. The proportion of the population with access to *functioning* safe water and sanitation services is important. So are trends showing how this proportion has been changing. Coupled with subsidy analysis, they can help to focus attention on alternative uses for available public subsidy and the trade-offs between extending service coverage on the one hand and recovering a higher percentage of costs from those served on the other.

Policies with the best prospects for reducing poverty are likely to be built on principles of:

- recovering overall a high proportion of costs from users;
- ensuring basic services to poor people are available at affordable prices;
- targeting available subsidies on poverty-focused services; and
- adopting a demand-responsive approach which allows consumers a choice between the level of service options.

Key questions include:

- What proportion of poor people currently have reasonable access to safe water and sanitation? (If using official statistics, check what proportion of water systems are actually working.)
- What is the policy on charging poor people for water and sanitation services?
- What do poor people actually pay?
- What are government's plans to extend coverage of services to more poor people?

Policy on cost recovery and financial sustainability of sector institutions

A sustainable extension in the coverage of safe water and sanitation systems among large numbers of poor people, especially in urban areas, is heavily dependent on much stronger cost recovery than has been the norm. It will be difficult for individual projects to attain financial sustainability where tariff setting is politically controlled and tariff levels are kept very low. Agreement is needed at the political and policy level before progress can be made in improving the financial sustainability of sector institutions.

Key questions are:

- What is the financial status of key sector institutions?
- Are they able to cover O&M costs fully?
- How far is failure to recover capital costs limiting the scope for improving the coverage or quality of service?
- What is policy on recovering (a) capital and (b) recurrent costs from:
  - users in small rural schemes;
  - users in urban schemes;
  - commercial and industrial users; and
  - government establishments.
- Are proposals for tariff reform appropriate?

Policy on subsidies

Subsidies are legitimate on income distribution grounds and where significant external benefits are expected, but they should be transparent, equitable, and sustainable. Subsidy analysis (see Section 2.5.10) can reveal who benefits from current subsidies. If cost recovery is low, a reform of utilities will need to form part of any proposed package of DFID assistance to extend the coverage of safe water and sanitation to poor people on a sustainable basis.

Key questions are:

- Are subsidies transparent?
- What is the objective of subsidy?
- Should subsidy policy be more clearly targeted (e.g. on services for poor people)?
- What is the realistic forecast of the future availability of the subsidies, from domestic and foreign sources?
- How could these be used more effectively (e.g. to extend coverage to more people)?

Policy on attracting private investment

Private investment in water and sanitation is needed because the scale of funds required to meet demand is well beyond public sector and donor financial capacity. The private sector has better prospects than the public sector for improving operational and financial efficiency of sector institutions. A range of private sector participation (PSP) options is available.

Key questions are:

- What are the main options for attracting more private investment (private sector participation) into the sector?
- How can more private investment be promoted?

Policy on demand responsiveness

WS&S service providers have rarely been responsive to demand. Consumers vary greatly in what services they want, however, and what they are willing to pay for. There is scope for both increasing aggregate well-being and enhancing the impact on poverty reduction by responding to people's willingness-to-pay for improved services and recovering a higher proportion of costs from users. Demand-assessment surveys can help identify willingness-to-pay for a wider range of levels of service than has been traditionally planned, and can inform policy dialogue about sector reform.

Key questions are:
- What evidence is there of unmet demand?
- How can policy encourage more demand-responsive water and sanitation services, such as by making a range of level of service options available, or showing flexibility on standards of service?

3.1.6 Institutional perspectives

A broad institutional appraisal should be one of the first activities undertaken in a sector strategy review. The aim should be to ensure that the institutional structure is adequate to plan, manage, and sustain a WS&S programme with a fully participatory approach. In most cases, the appraisal is likely to identify a need for capacity building and possible institutional reform, depending on the scale of the planned DFID co-operation in the sector. The focus areas and tools to be used in institutional appraisal are described in Section 2.6.

Is the institutional framework (with any planned changes) able to operate sustainable services for the urban and rural poor?
As we have seen in Chapter 2 (Sections 2.6.2 and 2.6.3), the institutional needs vary enormously both between rural and urban communities and within urban areas, depending on whether existing urban utilities are able to offer services to squatter settlements. Deficiencies need to be identified at this stage, so that capacity-building initiatives can be included if necessary.

What is the history of NGO and private-sector involvement in WS&S?
The right model for any particular country may well involve an enhanced role for NGOs or private entrepreneurs in all aspects of WS&S service delivery. The scope for their involvement should emerge from the participatory appraisal of any proposed programme.

Is there any commitment to decentralization and management at the lowest appropriate level?
Most countries have decentralized in recent years, but in some instances it may be more a matter of passing the buck than equipping and empowering local agencies to manage services autonomously. It is important therefore to assess progress on decentralization both in terms of determining the long term sustainability of any proposed project, and in agreeing the scope of any institutional support.

3.1.7 Technical aspects

Though detailed technical considerations apply later in the project cycle, this initial stage is an important one. It is the time when partners need to agree on both the principles of consumer-led choices of technology and service levels. These principles will have implications for government norms and standards and donor conditionality.

Is there a national or local policy of standardization of engineering practices?
Standardization of equipment, design, and construction methods may be desirable at a country level (see Section 2.7.4). If the government has made any attempts to standardize practices then this should be discussed and built upon at the earliest stage. It may be appropriate to encourage the development of policies and guidelines for the standardization of future projects or programmes in the sector. This will ultimately aid sustainability and replicability. The purpose of standardization needs to be clarified, however, so that it does not constrain innovative approaches.

Are there any policy constraints or preferences which preclude or favour certain technology choices?
There may be political reasons why certain technologies are favoured by donors or governments. These preferences (or constraints) need to be identified at the start of the project cycle and, if appropriate, incorporated into project or programme planning. The Benin and Belize governments specify the use of India Mark II handpumps for example. If it is unacceptable to work within these constraints, alternative technologies must be negotiated with the project partners.

Do all the project partners accept that the choice of engineering hardware must be demand responsive?
The importance of a demand-responsive approach to design must be understood and adopted at the highest level. While technology may be able to address most water and sanitation situations in developing countries, policymakers and engineers must appreciate that the hardware has to match people's desired level of service. If these are mis-matched, the project will not be successful or sustainable. (See Sections 2.7.8 and 2.7.14.)

Are government-specified levels of service too specific?
Some country governments specify precise service levels or norms, for example a minimum supply of 55 litres/capita/day. This can be counter-productive to a demand-responsive process that is based on willingness-to-pay, and may lead to some appropriate technical options being rejected. Partners should be encouraged to take a more flexible view.

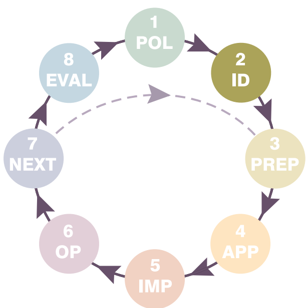
3.1.8 Hygiene promotion and sanitation promotion

How should a consumer-oriented approach to hygiene promotion and sanitation promotion be presented to DFID's partner governments?
The sector is undergoing a major paradigm shift towards consumer orientation. Some new approaches have yet to be accepted; for social marketing, for example, may be a suspect phrase in some circles. The approach described here to hygiene and sanitation promotion draws on social marketing but is less top-down (see Section 2.8). Insisting on a user-oriented approach to hygiene and sanitation promotion may

be too radical a move for programme partners. There is the wider problem that partners may become weary and sceptical of the continual introduction of a succession of supposedly new approaches. It is a mistake to rely on external consultants; rather, DFID needs to offer human resource development to local partners so that they can lead such initiatives from the start. An external consultant might provide guidance and on-the-job training at the formal research stage. If a local group carries out the formal data collection, capacity is created for subsequent projects. Instead of insisting on the new promotional approach DFID should offer it as an option and ensure that there is the capacity for it to be a viable alternative.

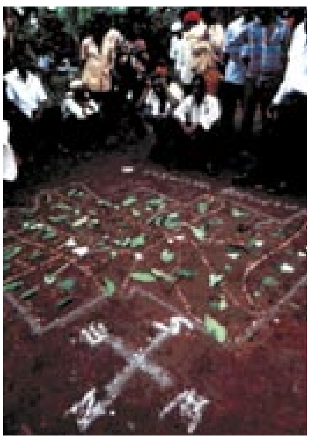
What are the attitudes and policies (formal and informal) towards health and hygiene promotion?

What is the attitude of the government and other potential project partners to a demand-responsive approach? (See Section 2.8.2.) What are the stumbling blocks? How can these be overcome? If the partner government has no experience, then DFID can help reduce the risks of the approach. If they have had a bad experience, the focus needs to be on what made it fail the first time. Are there key individuals within the Ministry of Health, or other responsible agency, who are open to the marketing approach to hygiene promotion, rather than the simple didactic approach based solely on information transfer? Is there experience in the country which can be shown to officials to convince them? (See Section 2.8.5.) Does the capacity exist, possibly among local consultants or NGOs, to implement the approach? Is there room for some experimentation, and is there the possibility that experimentation and piloting may influence policy?



3.2 Stage 2: Programme and project identification

The agreements reached in Stage 1 with project partners on policy and strategic background and on the roles of different stakeholders form the basis for this stage. With most negotiations still conducted at the national level, Stage 2 extends the discussion process to include local stakeholders involved in specific project proposals. Usually, the government partner will have a pipeline of possible projects and a set of criteria for prioritizing them. During Stage 1, these will have been reviewed in general terms, and the criteria may well have been revised to accommodate the principles and approaches agreed by the programme partners.


WaterAid/Jim Holmes

In Stage 2, the criteria need to be developed in detail and then applied to the preparation of an agreed programme of WS&S projects with defined roles for all partners. This stage includes environmental appraisal and its outputs for DFID, including an Environmental Screening Summary as described in the 'Manual of Environmental Appraisal' (ODA, 1996b) and a Project Concept Note, Volume II: D4 (ODA, 1996c). The Concept Note will include an outline of the key features of each selected project in the form of a narrative summary (not the complete log frame). It will also have notes on the Stakeholder Analysis which is the key activity in this stage. It is important that the identified projects are defined in sufficient detail to confirm the multidisciplinary approaches which will be followed and the roles of different partners in the design and implementation stages to come. The definition should not be so precise as to inhibit flexibility of choice in subsequent stages, when the process approach to project development will require discussion of a wide range of options.

Figure 3.2.1 illustrates the process of project identification. In addition to the overall agreements reached in Stage 1 with all partners, DFID may have its own specific criteria, reflecting the UK Government's priority focus on the poor, the involvement of other donors, and DFID comparative advantage. The selection will be influenced too by the dialogue with potential project partners and the climate for innovation and change communicated by the project champions.

Suggested key questions to be addressed in Stage 2 follow.

3.2.1 General

Are the rules for selecting and defining projects clear to all stakeholders?
Selection criteria for inclusion of village/areas should be transparent and based on need and demand. *Project Rules* such as the capital cost contribution, disbursements of funds, and management arrangements need to be agreed and understood by all stakeholders.

Do all partners agree on the approaches to be followed in defining the projects?
A participative process approach is needed, encouraging local institutions and community organizations to take a proactive and leading role in the project. *Demand assessment* is required to confirm a community's commitment to a project and may include willingness-to-pay surveys and beneficiary assessments.

Is there agreement on the institutional and financial implications of project selection?
The right *institutional framework* is crucial in terms of providing adequate support to community management and stakeholder institutions. *Funds and financial flows* are a key feature in project progress and sustainability. Fund allocations and disbursements should be adequate, flexible, timely, and involve simple procedures.

Will there be a flexible approach to enable communities to make real choices in the design stage?
Technology and choice of service level involves spending time with interested communities, working out and explaining to the communities the implications of each viable technical option, thus enabling them to choose the technology and service level.
Are the identified projects clearly linked to an IWRM strategy?
The means of achieving full integration of projects into national sector strategies should have been agreed in Stage 1. It may involve a *master plan approach* or a *learning process* or a combination of the two,

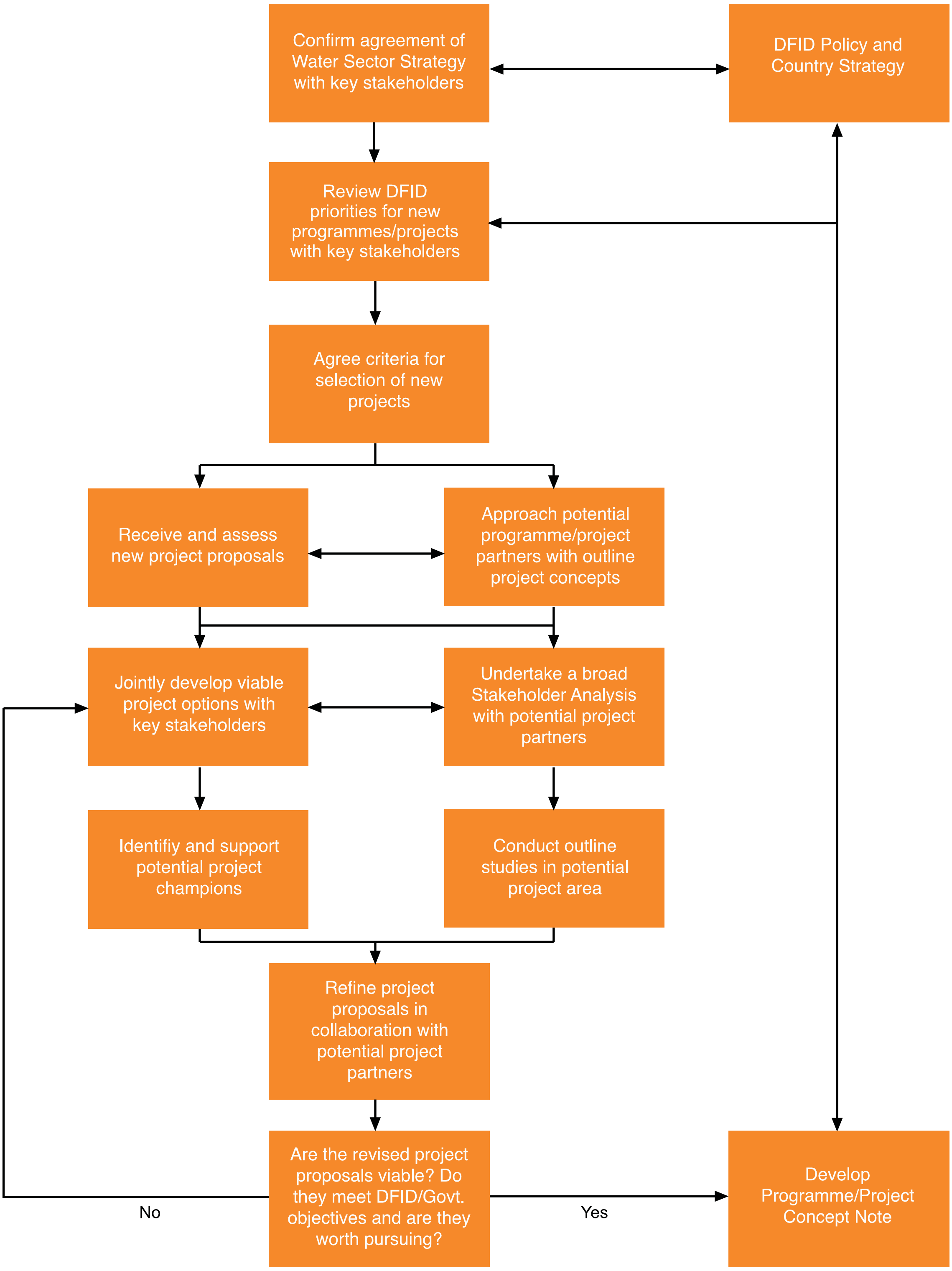


Figure 3.2.1. The project identification process

particularly where there are area-wide problems such as water resources management or contamination problems.

Will there be adequate provision for monitoring progress and assessing the sustainability of selected projects?
Monitoring and evaluation processes need to be spelled out at this point. They should support community management and encourage community self-assessment activities. Participatory evaluations with project partners should focus on progress in achieving the project purpose.

Each of these questions is addressed in more detail in the discipline-specific questions which follow.

3.2.2 Social perspectives

Good programme and project identification depends crucially on social analysis and the two critical tools used are social impact analysis (SIA) and stakeholder analysis. The key questions informing social impact analysis and stakeholder analysis in water supply and sanitation schemes are:

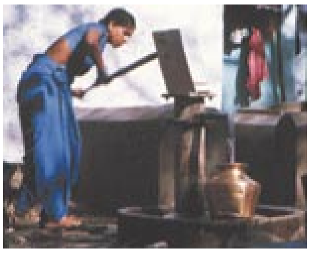
Is the programme or project responsive to the needs of the people affected?

- Is the project culturally appropriate in terms of technology and planning approaches?
- Is behaviour change necessary for the project to have an impact and do primary stakeholders see a need for changes to the practices associated with the new technology?
- Will some groups be excluded from or negatively affected by the project, for example water vendors or owners of land where current water resources are located?
- Have user preferences about feasible technical options, the siting of installations, and the institutional arrangements for operation and maintenance been elicited?

Does the programme or project reach poor and disadvantaged people?

- Are the areas where poorer people live and work included in or targeted by the project?
- Does the project include all members of the target communities, particularly those who may be disadvantaged by poverty or their status in society?
- Does the project take account of the different needs of women and men, of older and younger people, and of people with different abilities?
- What are the financial costs of current water supply and sanitation provision and will they be affordable, for example connection fees and maintenance charges?
- If user charges pose a problem for poorer households what arrangements can be made to facilitate take-up such as credit funds, public standposts, or cross-subsidization?
- Where necessary, what inputs are needed to reform the policy and

institutional frameworks in which water supply and sanitation are delivered, so that they take account of poverty?


DFID/R Lokanadham

Does the programme or project recognize the different roles, needs, and contributions of women and men?

- Will women benefit as well as men?
- Have women and men been consulted about the issues raised, such as the sitings of installations, technological choices, and institutional arrangements, and have their responses informed project design?
- Is hygiene promotion directed towards those most often responsible for it, that is adult women, and are the informal communication networks of women and men used to develop health education messages?
- Are the multiple demands on women's time and the opportunity costs they face recognized when planning to include women in consultation and participation?
- Have women's and men's different responsibilities for household budgeting been taken into account for assessing willingness and ability to pay?

What is the level of demand for water supply and sanitation and where will it be necessary to develop a shared agenda?

- What problems are identified in relation to water supply and sanitation? What causes are discussed? Who sees them as important?
- Are there competing requirements for water use, for example between domestic use and productive activities such as livestock raising?
- Do priorities differ between primary and secondary stakeholders?
- Do priorities differ among different members of a community or among different communities/villages/neighbourhoods?
- What are the existing land and property ownership arrangements and will these be affected by the project?

What institutional relationships exist at the local level and how will they relate to the project?

- Is there a tradition of setting up or maintaining water supplies, waste management systems, or public facilities?
- What institutional structures have been involved and could they be used again? Will women be represented?
- Could existing local institutions or a modification of them be used as channels for dialogue with potential users in the design, implementation, and monitoring of the project?
- Who in the community will make decisions and how will local power structures be affected by the project?

What level of participation and partnership is possible and appropriate among stakeholders?

- Are the professionals and officials involved in the project experienced in taking a participatory approach to water supply and sanitation provision? If not, what capacity-building components could help facilitate this approach?

- Do community members have the confidence and skills to engage effectively in participatory processes and partnerships? Which groups need support and of what kind?
- Is provision being made for community maintenance and how will the project deal with abuse of the system, for example through (a) mobilizing community pressure through existing organizational structures; (b) additional work incentives; (c) public awareness campaigns; (d) disincentives for abuse such as all residents sharing the cost of repairs; and (e) maintenance skills training?
- Who from the community will contribute labour and engage in operation and maintenance? Will this affect their status? Will it contribute to their income?
- Will the project increase the responsibilities and workload of certain groups?

In order to assess the participation of different stakeholders it is important to identify them in the first place. As well as identifying appropriate types of participation by different stakeholders at different stages of a project, stakeholder analysis can help assess different interests in a project, conflict of interest, and the potential for co-operation and coalitions. Examples of what a stakeholder analysis and a summary participation matrix for water supply and sanitation might look like are included for illustration (see Tables 3.1 and 3.2).

A stakeholder analysis helps assess which stakeholders are important for project success. In Figure 3.1, for example, although politicians are not directly involved they are ranked relatively high because they could sabotage the project. Stakeholder analysis also helps assess appropriate and feasible roles for different stakeholders. For example, when is it appropriate to expect primary stakeholders to participate and in what capacity? While DFID has the right to make a judgement on the extent of participation it wishes to see from different stakeholders in a project, other stakeholders may reach different conclusions. This will require discussion and the development of mutual understanding.

3.2.3 Water, sanitation, and health

Because improved health is a key objective of WS&S programmes, comparison of project options has to include an assessment of realistic health benefits which might arise from an intervention. Even where the total numbers are uncertain, the *differences* in health impacts between various options can often be clearly identified.

What is the existing environmental health situation?

To understand the links between water, sanitation, and hygiene, and the possible effects of any proposed intervention, you need to understand the existing environmental health conditions. Ideally, it would be valuable to know something about beliefs and practices concerning hygiene behaviour as well; if this is not possible, formative studies should be included as part of the project preparation

Table 3.2.1 Stakeholders in a water supply project with a participatory approach and cost recovery dimension

Stakeholders	Interests	Potential project impact	Relative priorities of interest
Secondary stakeholders			
Ministry of Water Affairs	Achievement of targets	(+)	
	Co-ordination of activities	(+)	
	Liability for failures and resource misuse	(-)	= 2
Politicians	Timely delivery of visible services	(+)/(-)	= 3
Formal suppliers	Sales and profits	(-)	= 6
DFID	Short-term disbursement of funds	(-)	
	Effective delivery	(+)	
	Evidence of poverty impact	(+)/(-)	= 2
Primary stakeholders			
Low-income communities	Improved access to water	(+)	
	Better health and opportunities	(+)	= 1
Women and children in those communities	More time and energy	(+)	
	Better health and education	(+)	= 1+
Men in those communities	Access to water for livestock and crops	(+)	
	Better health	(+)	= 1
'External' stakeholders			
Private water vendors	Loss of income from water sales	(-)	= 4
Nearby middle-income users with connections	Increased costs on 'ability to pay' principle	(-)	
	Loss of status and income from water sales	(-)	= 5

Table 3.2.2 A 'summary participation matrix' for a water supply project with participatory approach and cost recovery dimensions

Type of participation	Inform	Consult	Partnership	Control
Stage in Project Cycle				
Identification		CBOs Women's groups	DFID Ministry NGOs Other donors	
Planning		External consultants	DFID Ministry NGOs CBOs Women's groups	Ministry
Implementation	DFID	External consultants	Ministry NGOs CBOs Women's groups	Implementing agency/ PMU
Monitoring and evaluation	DFID	Ministry	Ministry NGOs CBOs Women's groups PMU	External consultants

3

(Stage 3). To begin with, however, what are the levels of service available for water and sanitation; which fractions of the population receive what levels? The water and sewerage utilities are aware of the number of formal connections, but this is often only a small part of the story; in many cities the turnover of the informal water sector (i.e. vending) is greater than the revenue of the water authority. It is especially important to focus on the existing situation for the *poor* and *marginal* groups, as they are usually at greatest risk and are the target groups for DFID co-operation. To determine their 'access' to water and sanitation services you need to visit poor communities and look closely at how people get their water and dispose of their wastes. Existing health statistics and studies can sometimes highlight dramatic outbreaks attributable to water and sanitation, but often understate the daily toll of *endemic* disease. Consultation with healthworkers regularly working with the poor may give a better idea of the relative significance of sanitation-related diseases than official statistics.

How plausible are the health benefits of the project?

It is critical to understand how many people will be affected, and in precisely what ways. Health benefits accrue when (a) people use *more* water; (b) *more* people (especially children) *use* sanitation; and (c) hygiene is *effectively* promoted (see Sections 2.3.1 to 2.3.3). The main health benefits of increased water consumption are likely to be in reduced faecal-oral diseases, especially diarrhoea, and reduced skin and eye infections. The main health benefits of sanitation are likely to be reduced faecal-oral disease, especially diarrhoea, and reduced intestinal worm burdens. Health benefits rarely accrue from sewage treatment, with the possible exception of waste stabilization ponds (see Section 2.7.22), in which case downstream beneficiaries using the receiving water should be explicitly identified.

Who will really be affected, in health terms?


WaterAid/Jim Holmes

Health benefits tend to be focused on changes in the household environment (see Section 2.3.8). Will *more* water reach *more* people at the household level? (Note Figure 2.3 showing water consumption as a function of travel time.) Will more households have sanitation coverage? How is the issue of children's health and hygiene promotion likely to be addressed? While centralized investment is also necessary, it is critical to find out what the effects of such investments will be at the household level.

Who can be project partners in health?

Who are the partners responsible for maximizing health benefits from the project, and what are their understandings of the role of health in the project? Do they have resources and an interest in adopting the hygiene promotion approach outlined in Section 2.8? What has been the past experience in health education and hygiene promotion in the project area? Partners with a willingness to try new approaches, and with local credibility with the community, are far more valuable than formally qualified professionals who see no alternative to the traditional educational approach.

3.2.4 Environmental perspectives

Stage 1 will have established the national environmental goals and policies and the institutional, legislative, and regulatory framework under which projects will operate. In Stage 2, the aim is to assess the likely environmental impacts (positive and negative) of proposed projects. An Environmental Screening Summary is a DFID requirement for all projects. It will also be necessary to judge the sustainability of the project itself and its possible impact on the sustainability of the local environment and/or future downstream projects.

Does the scheme have any significant environmental consequences?

River abstraction schemes may involve the construction of weirs or barrages which can prevent the passage of fish and inhibit water transport. Impounded waters may encourage algal growths which can alter the ecology of the water. Wastewater discharges to a watercourse or lake can affect the fish population and may encourage algal growths and eutrophication. On the positive side, improved urban sanitation can significantly reduce the polluting load on rivers. One cautionary note here: sewerage without treatment simply converts scattered pollution into point-source pollution where the sewers discharge. It can actually have a negative environmental impact, by short-circuiting the natural biodegradation of human wastes and so increasing the pollution load.

Is there a guaranteed and sustainable allocation of water for the project?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In some cases, such as where a community is drawing small quantities of drinking water from a well-replenished aquifer, there may be no doubts about the long-term sustainability of good quality water. More frequently, there will be competing uses for the resource, and the modest WS&S needs may be threatened by larger demands from agriculture and/or industry. (See Section 2.4.1.) In such cases, all significant existing and potential uses of water within the area need to be identified and quantified as accurately as possible. Realistic forecasts of future needs for the various uses must also be made in order to assess the longer term sustainability of a scheme. There needs to be an agreed mechanism for allocating water, and an agreed priority of maintaining potable supplies in times of scarcity or drought.

Surface water developments

Is the source perennial?

If the source is perennial it may be able to supply the demand throughout the year, whereas an intermittently flowing river will need an impounding reservoir to maintain supply during periods of no flow. In the absence of a reservoir alternative sources of water must be available if supply is to be maintained.

Are validated flow records available?

In the absence of reliable flow records at the abstraction point it will be difficult in later stages to estimate the likely surface water availability or the yield of a river basin. Precipitation records can be used in conjunction with estimates of direct runoff and evaporation to estimate yield in the absence of flow records. It may be possible to estimate the yield in an ungauged basin by comparison with a similar gauged basin if one exists.

What existing abstractions occur upstream and downstream of the proposed development?

Even though the government or basin agency should have guaranteed the allocation of water for the proposed scheme, its effective sustainability will be governed by the balance between yield and total abstractions. It is therefore important that, as part of a resource management exercise, all significant abstractions are identified and investigated (possibly including gauging), and that estimates are made of likely changes in these abstractions. Upstream uses, if consumptive, will reduce flows at the abstraction point. Downstream uses may not be able to continue if the abstraction means that the river is unable to support the required flow. Diversionary uses which return water to the river system may return most of the abstracted water (cooling water) or relatively little (irrigation). Returned waters do sustain low flows but are likely to have some degree of quality deterioration, and quality also needs to be investigated.

What regulatory or legal mechanisms control abstractions and polluting discharges?

Although collaboration and co-operation between water users should be a target, feelings can run high about water and its availability. The existence of a legal or legislative framework to control abstractions in times of stress is essential. Such administrative frameworks are, however, of little value if the regulatory authority lacks the resources to undertake its duties. They are also ineffective if they ignore or counter informal community-level rules and institutions governing common property. Unless both some form of appropriate pollution prevention and control measures are available it will be difficult to maintain good quality water at an abstraction point. (See Section 2.4.5.) All major effluent discharges should be subject to discharge consents which place limits on the content and volume of the discharge. Where potential pollution risks are present measures should be available to institute remedial or preventative steps. Human and financial resources must be available to implement pollution control measures and ensure compliance without being subverted by corrupt malpractice.

Are other abstractions and/or developments under consideration for the same river basin?

Liaison with other administrative, planning, and commercial organizations within a river basin must be undertaken to ensure, as far as possible, that the project will not be negated by new demands in other parts of the basin.

Groundwater developments

Are validated records of groundwater levels available?

If abstractions from aquifers exceed the recharge, groundwater levels will fall. There are many instances where increasing the number of boreholes to provide a greater yield from an aquifer has resulted in eventual failure of the source. Over-abstraction can cause the ingress of seawater if near the coast, or of poorer quality groundwaters from contaminated sites (see Section 2.4.1). Reliable records of groundwater levels supplemented by pumping tests will give some indication of the potential yield, although the yield of groundwater sources is more difficult to predict than that of surface water sources.

What regulatory or legal mechanisms control potentially polluting discharges to the aquifer?
Groundwater protection policies should prevent the establishment and/or operation of potentially polluting activities in the vicinity of a groundwater abstraction, and should closely regulate such activities over the area of the groundwater catchment. (See Section 2.4.5.)

Are the environmental quality objectives for the scheme derived from appropriate local criteria?
The use of environmental quality objectives from developed countries can sometimes be quite inappropriate for developing countries with very different conditions. For example, a water quality objective approach for environmental management of a receiving water is quite unrealistic for a watercourse which is not perennial. In the absence of natural flow, water quality downstream of a discharge cannot be better than that of the discharge. (See Section 2.4.2.)

3.2.5 Economic perspectives

Questions arise under various policy headings.

Project Purpose

Is the Purpose appropriately specified?

Key questions are:
Does the Project Purpose, and the approach to project development:
- allow consideration of a wide range of technical, policy, and institutional approaches (e.g. demand management) to solving the project problem?
- recognize that provision of the same level of services to some people will be more costly than to others, for technical reasons, because of population density, etc.?
- recognize that some people may be willing to pay the full costs of a higher level of service, so the cheapest project design or level of service option is not necessarily the most desirable economically?

Demand assessment
Demand assessment is central to designing a demand-responsive project. A variety of demand assessment techniques are available (see Table 2.1.2, Section 2.5) and the most appropriate approach will depend on project circumstances. Contingent valuation method (CVM) studies are the best way to assess demand for improved levels of service, especially where users will be required to pay much more than they do at present, but CVM studies are expensive. Revealed Preference surveys are cheaper but only show what people are

currently doing, and are a less reliable guide to how they might respond to new options made available in the future.

Often a multi-stage process using a mix of informal and formal approaches will be appropriate. Demand assessment needs to be co-ordinated with participatory processes undertaken as part of the social analysis.

Key questions are:

- How important will demand assessment be to project design decisions? What will be the most appropriate methods to assess demand?
- How will reliability of demand assessment be assured (e.g. using randomly selected survey sample, using specialist expertise for quality control of contingent valuation studies)?
- What are the present use and consumption patterns: for different groups, from different sources, and for different purposes?
- What signs of unsatisfied demand are there?
- What are projections of demand, and sensitivity to price?

Equity issues

It is inequitable to require poor people to pay more per litre for water than richer people. The main ways to make services more affordable for poor people are through tariff structures (e.g. 'lifeline' tariffs), cross-subsidy, and targeted subsidy (see Section 2.5.11). Given the scarcity of public funds, however, a higher level of subsidy per litre will usually translate into fewer poor people benefiting from it.

Key questions are:

- Who will benefit, and by how much, under each project design alternative or level of service option?
- Which poor people are expected to benefit?
- How much might they be expected to pay for improved services?
- How might this compare with what they currently pay, and with what other consumers currently pay or might pay in the future?
- Could more poor people have access to affordable services if subsidies were restructured?

Prospects for economic justification

The economic justification for alternative approaches to addressing the Project Purpose should be compared. Other things being equal, the approach with the strongest economic case should be adopted. Where possible, projects should be subjected to cost-benefit analysis, using standard economic techniques. Benefit estimates can be derived from demand assessment studies.

Where it is not possible to value demand, cost effectiveness analysis should be used. Comparison of unit costs (capital and O&M) with those from similar projects elsewhere in the same country can help cross-check cost-effectiveness, (although on occasions meeting relatively high unit costs may be justified if there are strong reasons for expecting a similarly high level of benefits).


WaterAid/Caroline Penn

Benefits, which often vary seasonally, can include financial savings, time savings, convenience benefits, health benefits, and sometimes production benefits. Focus group meetings and field observations can help gain a first impression of possible benefits. The scale of water vending and the prices charged, and/or the round-trip time fetching water, can be useful proxies of demand for improved water supplies. However, these rough indications of the current situation will not be sufficient if the options presented by the project will require users to pay much more money than they do currently. In such cases the numbers of people choosing to use the new option and how much water they use will have a big impact on the scale of project benefits.

Without using the contingent valuation method it is difficult to predict benefits accurately. Revealed Preference studies may underestimate demand. Both Revealed Preference and CVM will tend to underestimate the health benefits (both private benefits and externalities) which are likely to be particularly important in sanitation projects, but health benefits are in any case hard to forecast or measure directly. Distance to water and the nature of the disease burden can help identify whether they are likely to be significant.

Key questions are:

- Is a suitably wide range of options being considered?
- Has there been an investigation of the scope for phasing investment more slowly, to match growing demand incrementally?
- What costs — capital and recurrent — are associated with each option?
- From projections of demand, what are the projected benefits?
- What steps will be taken to ensure investment funds are used where economic returns will be high (that is to consider the costs as well as benefits, for instance, in deciding which villages should benefit from public investment in supply systems?)
- What is the economic case for wastewater treatment, versus wastewater collection, treated separately?
- What would the costs and benefits be without the project?
- Are the incremental net benefit flows (i.e. benefits minus costs, relative to the without-project situation) likely to justify investment?

Demand management

Key question:

Have demand-management options (e.g. tariff reform; pricing for non-essential uses; reducing unaccounted for water; leak reduction; use of low-volume flush toilets; tighter billing, enforcement, and collection) been systematically considered?

Prospects for financial sustainability

Key questions are:

- What are the broad financial targets for key institutions?
- What is likely to be the impact of the project on their finances?
- Will they be able to cover at least O&M costs?
- What is the process for reform of cost recovery, tariff structure, tariff levels, etc.?

- What prospects are there for
  - stronger billing, collection, and enforcement (specially important when large increase in revenues are forecast);
  - metering (where this is economic);
  - improving the operational efficiency and lowering the costs of utilities; and
  - recovering installation and connection costs?

Prospects for use of subsidy

Key questions are:

- What will be the project's impact on the public budget?
- What limits will be there on use of subsidy?
- What are the alternative ways in which subsidy could be used?

Options for Private Sector Participation (PSP)

- Is a sufficiently wide range of options for PSP being examined?

Risks and sensitivity

- How sensitive to key assumptions are costs, benefits, poverty impact, financial sustainability, and budgetary impact?
- What measures can be taken to reduce these risks (e.g. building more flexibility into project design)?

3.2.6 Institutional perspectives

The national institutional appraisal undertaken in Stage 1 will provide a basis for comparing project proposals and identifying any institutional strengthening needs. It needs to be supplemented in this Stage with appraisal of local institutional frameworks related to individual project localities (see Section 2.6.8). It is worth noting here that some past DFID WS&S projects have experienced difficulties because institutional and financial appraisals were not undertaken at an early enough stage.

Discussions with stakeholders should include critical assessments of the existing institutional set-ups as they relate to each stakeholder's anticipated role. Almost invariably there will be suggestions for strengthening the capacity of partner institutions to respond to user needs and maintain the participatory approach. The need for strengthening should not in itself invalidate a project proposal. Capacity building is an important part of DFID's co-operation with partner countries and can have knock-on effects in terms of improved sustainability and replicability.

As in Stage 1 (Section 3.1.6) two questions need to be addressed first:

Is the institutional framework (with any planned changes) able to operate sustainable services for the urban and rural poor? And what is the history of NGO and private sector involvement in WS&S?

This time, the assessments are more localized, relating to particular local and regional institutions and their capacity to manage specific proposed projects.

The third question extends the appraisal undertaken in Stage 1 related to decentralization and management at the lowest appropriate level.

Do local agencies have the skilled human resources needed to implement and manage participatory WS&S projects?
Stakeholder participation, gender sensitivity, responsiveness to user demands, and the participatory management of services all demand specialized skills (section 2.6.15). These are not the kind of skills commonly taught in engineering courses, where many sector agency staff received their training. Human resources development (HRD) components are frequently a key part of institutional strengthening. They require careful consideration in the Preparatory Stage (Stage 3). Now the aim should be to ensure that there is scope for HRD to be effective. That means a minimum core staff committed to the WS&S sector principles, working in a utility or agency with autonomy (or a government commitment to achieve autonomy), and incentive structures capable of retaining trained staff.

3.2.7 Technical aspects

At this stage, the engineer should provide a supportive and enabling role for the project partners by assessing the technical viability of outline project options.

What baseline information is available?

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Baseline studies should be carried out in the proposed project area(s) alongside the development of project concepts by the stakeholders. The type of baseline information required includes data on existing infrastructure/levels of service, local skills and resources, potential water sources, and other technical or physical constraints. The exercise will probably be a desk study, making use of available secondary data through information sharing and discussions with partners. Some supporting fieldwork or observations may be required. The potential for rehabilitating or upgrading existing infrastructure should be considered at this stage but is not always the most appropriate solution. Before rehabilitation is adopted, the cause of past failure has to be clearly identified and the means of remedying it judged feasible (see Section 2.7.6).

Are there lessons to be learned from past programmes/projects?
An important part of the desk study will be to establish which technological solutions have been most successful in the past. There will be many lessons to be learned from the successes and failures of previous projects in the region and these must be taken on board and also fed back to sector or programme level.

How is a viable outline project arrived at?
This will be an iterative process with engineers assisting the partners to develop a broad range of options and outline costs. The options proposed initially may be reviewed and refined a number of times with the partners until an acceptable and viable project is arrived at for submission in the Project Concept Note. At this stage, no final decisions should have been made on the choice of technical hardware.

Issues such as replication, incremental improvement, and operation and maintenance are crucial to project sustainability (see Sections 2.7.5 and 2.7.6) and should have been addressed. These issues may already have limited the choice of appropriate technologies.

3.2.8 Hygiene promotion and sanitation promotion

Is there a need for better excreta disposal and hygiene?
Local data on diarrhoeal disease incidence from routine data sources is unlikely to be of much use. Clinic reports, for example, can be underestimates and give biased views which reflect only those cases reported at health facilities, and not those actually occurring in the community (see Section 3.2.3). Extrapolation from studies in similar environments is more useful. It is more important to find out if there are problems of poor hygiene and faecal contamination. If so there is likely to be a diarrhoeal problem.

What is the time scale for these interventions?
While improving sanitation infrastructure house-by-house is a long-term project which can take many years, hygiene promotion can do something about risk behaviour in the short term, and it can create demand for sanitation. Nevertheless, any attempt to by-pass the essential period of formative research and programme design (typically three to six months, if local capacity exists already) will lead to failure of the intervention.

Who are the partner organizations in government for hygiene promotion and sanitation promotion?
Water and sanitation are generally the responsibility of different agencies from those which deal with hygiene. While some degree of co-ordination between them is necessary, this separation may not be a bad thing. Agencies which implement engineering works are likely to be ill-suited to offer the flexible response required by promotion and the resources for promotion need to be ring-fenced to protect them from the vagaries of the (much more expensive) infrastructure construction programmes. Different solutions will fit different countries.

There is little point in going with a project if there is no real government commitment to it, if the relevant ministry is unconvinced or does not have the capacity to take on more projects. Is there potential for other partnerships with NGOs, CBOs, etc., who may have the flexibility to grow, learn, and be motivated? Investing in NGOs has short-term benefits in getting the work done. This, however, will be both a short- and a long-term drain on government capacity. Hygiene promotion is not sustainable if it depends on an externally funded NGO.

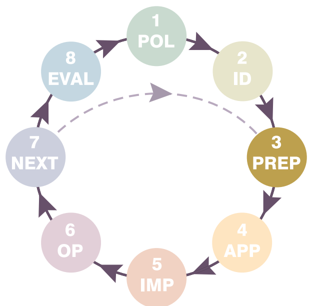
Who will do hygiene promotion and sanitation promotion?
Which organizations will partner the programme team and be responsible for hygiene promotion and sanitation promotion? Are there likely NGOs, CBOs, or social research organizations? Do they have resources and an interest in adopting the hygiene promotion

approach outlined in Section 2.8? What has been the past experience in health education and hygiene promotion in the project area? Are there partners who are willing to try new approaches, and who have local credibility with the community? These will be far more valuable than formally qualified professionals who see no alternative to the traditional educational approach.

What other organizations will be affected by the programme?
What does a stakeholder analysis suggest? What role will the water and sanitation utilities play? This may be important if they are not keen on low-cost sanitation, are not familiar with it, and feel it is not their job.

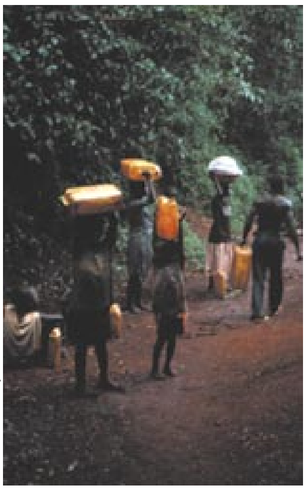
Who pays for hygiene promotion and sanitation promotion?
If there is a choice between funding hardware or software, funds should be allocated to promotion. It makes more sense to create demand than to create supply. In the same way subsidies for hardware should be to manufacturers or workshops as start-up funds to enable the businesses to succeed. If the construction of household sanitation facilities themselves are subsidized then the market is effectively constrained by the programme funds available. If any subsidy is devoted to the promotional activities then the funds required are not linked to the number built and the potential for growth is enormous.

3.3 Stage 3: Programme and project preparation



Stages 1 and 2 relate primarily to discussions about national and regional priorities. We are now entering the project cycle proper and focusing on the detailed requirements for designing the identified projects and the supporting software components. Its outcome will be a clear statement of the goal and purpose of each project with measurable indicators of performance. Except for very small projects, executed for example by NGOs, a full project logframe will be prepared and agreed by all partners.

DFID has its own guidelines for the format and content of a Project Submission (Volume II: D6 Annex 2, ODA 1996c). It includes summaries of the evaluations and agreements from the first two stages documenting the stakeholder consultations. There are separate sections dealing with technical, environmental, economic and financial, institutional, and social issues. Staff also need to identify the management arrangements for implementing the project (Stage 5), the contracting and procurement requirements, and the timing and accounting procedures for DFID inputs.


WEDC/Sarah Parry-Jones

In the past this stage has often meant a feasibility study of the identified project by a consultant. This may be less appropriate in the favoured process approach, in which the project develops over a period of time in dialogue with stakeholders. This is a more iterative process, which may involve DFID staff and consultants working with partners in several separate studies, to consider different options and to develop from these the most acceptable solution. The project components will consist of both software and hardware.

- Typical software components would be: hygiene promotion and sanitation promotion work, including training workers and preparation of materials; training community management teams; institutional strengthening activities, etc.
- Hardware components could include: building of workshops to manufacture sanitation equipment; procurement of equipment (for example handpumps); and construction of water systems and latrines.

Project preparation will include quantification of the outputs and inputs for each component, and time scheduling to ensure that they occur at the right times to maximize the impact on the project Purpose. Note that software components will often need to precede the hardware. This stage also involves agreement with partners on appropriate management arrangements for the project, to meet the time-bound, quantified Output targets.

In addition, the logical framework design requires the selection of indicators at each level and a decision about how these indicators will be measured using a suitable baseline and monitoring framework.

It is during the project preparation stage that technical options are selected, and Figure 3.3.1 illustrates an outline process for water supply and sanitation technical-option selection with the participation of community and support institutions. Many of the activities indicated are likely to be done in the project implementation stage, but project partners need to understand the likely process at the preparation stage. If an agreed process is not developed, there is a risk that the whole process can become too drawn out and stakeholders will lose interest in participation. Processes/action plans also need to be agreed for other project components.

3.3.1 General

Which stakeholders will be appropriate project partners?
DFID's 'Guidance Note on Stakeholder Analysis' (ODA 1995b) has checklists to help identify appropriate stakeholders in different project environments. The analyses and institutional appraisals already undertaken in the earlier stages should have revealed the main institutional stakeholders. This is particularly important where there is fragmentation of responsibilities, which is common in WS&S programmes. The choice of partners could include: government water boards, national, state, or local government departments (for water, sanitation, and health), private firms, NGOs, academic institutions, consultants, or a combination of these partners. Discussions in the target community may identify which are likely to have a potentially influential role on project preparation. Aspects such as implementation capacities and willingness to adopt a participative approach will be among the criteria.

3.3.2 Social development perspectives

It is during this stage that fundamental decisions are made on the design of the programme and the project process. It is therefore

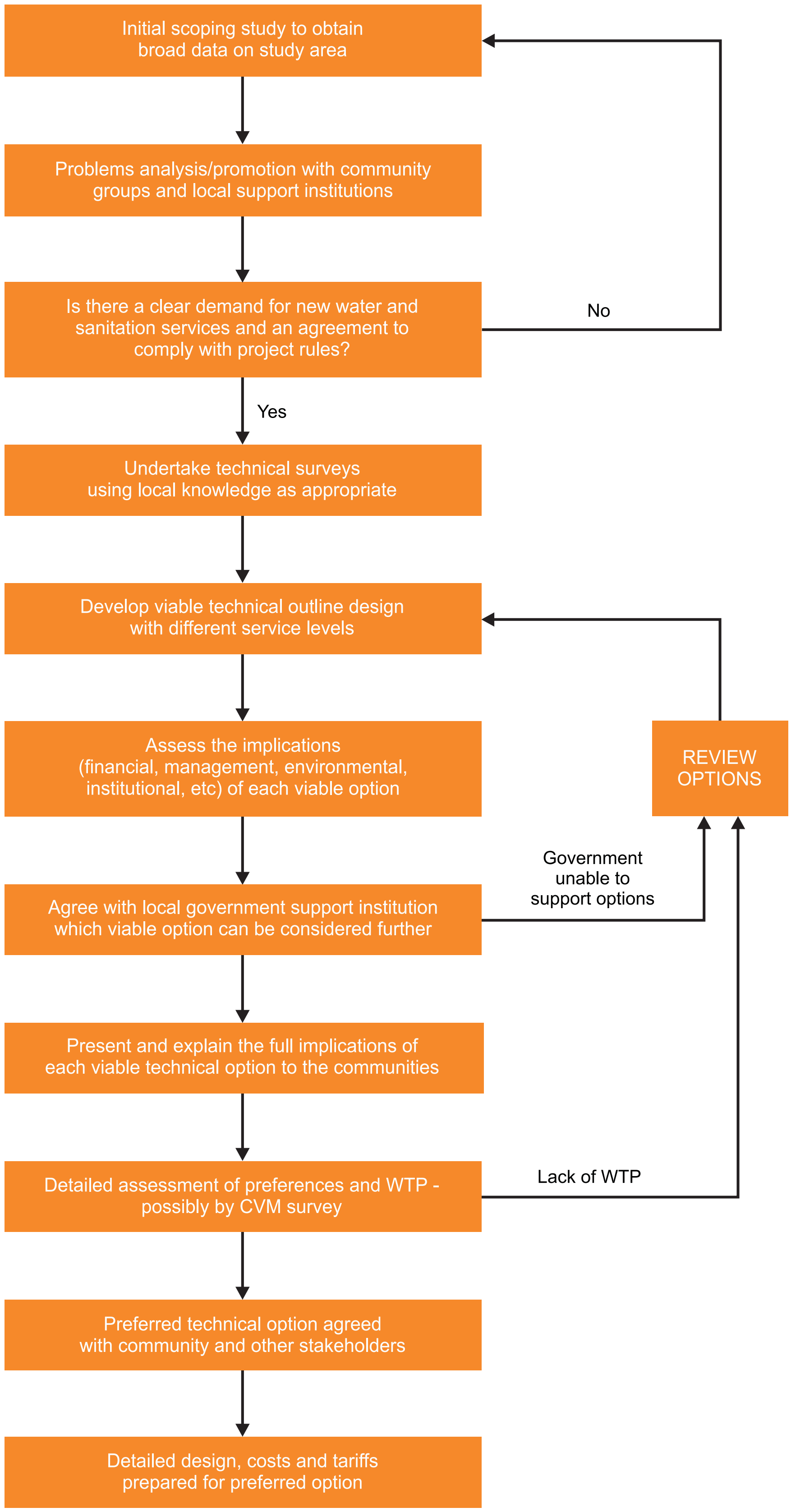


Figure 3.3.1. Project preparation — outline process for WS&S technical option selection

essential for the social development specialists to discuss the potential impact on the poor and other vulnerable groups, the gender approaches to be used, and the need for contingent valuation or rapid appraisal methods for assessing the community's needs and aspirations.

Key questions to be addressed are:

Do secondary stakeholders understand the implications of process projects?
If projects are demand responsive, include cost-recovery measures, and adopt participatory approaches, they will foster more assertive users. They will also require more professional and project time. It is important that secondary stakeholders recognize that this may involve a less familiar approach involving the development of shared agendas and two-way lines of accountability. Partnership may also involve a re-negotiation of roles and responsibilities at different stages of the process.

Are primary and secondary stakeholders familiar with consultative and participatory practices and methods?
Process approaches involve on-going consultation, going beyond assessment exercises to include participatory planning and management. Half-hearted commitment or poorly understood application of participatory approaches on the part of secondary stakeholders or confusion over objectives and goals on the part of primary stakeholders can do a great deal of harm. It can raise unrealistic expectations or lead to suspicion and mistrust. There are capacity-building implications here.

Can primary stakeholders develop and agree objectives and weigh up risks for themselves?
It is important that the people involved in or affected by a project fully understand the implications of any decisions they make. For example, they need to understand in cost-recovery projects that agreement to pay for water supply or sanitation provision may go beyond contributions to capital and construction costs and extend into payment for operation and maintenance.

Have local institutional arrangements and management regimes been identified?
Externally imposed institutional arrangements for water and sanitation projects can interfere with the customary management of common pool resources. It is possible to work with existing informal institutions and it is necessary to identify whether local management regimes can be incorporated into project management. It is also important to identify how they will need to be supported or developed.

Have all primary stakeholders been involved in selecting appropriate objectives, outputs, and indicators?
Monitoring is discussed in more detail in Section 3.5 but it needs to be noted here that the involvement of primary stakeholders in monitoring is often facilitated after the initial project framework has been drawn

up, rather than during preparation. However, stakeholders' involvement at the early stage is crucial, particularly in relation to monitoring outputs and process, and should not be delayed.

For example, if communal latrines are opted for by community leaders on the basis of cost and convenience in an informal urban settlement, the implications of collective management have to be understood by all those involved. While leaders might agree to a roster for the cleaning and maintenance of the latrines, the over-burdened women who are expected to perform this task are rarely consulted and may be unable to deliver.

3.3.3 Water, sanitation, and health

As with the social development considerations, this is the stage in which the principal health-related inputs and anticipated outcomes need to be defined. The questions aim to ensure that DFID staff and partners identify the interventions needed to maximize health impact.

Do you know enough about how many people get sick and how?
Even for a single disease, there may be low-risk and high-risk routes of transmission. Before claiming health benefits for a project, someone must study how people become sick. The first stage of formative research for hygiene promotion (Section 2.8) is critical for identifying major faecal-oral disease transmission routes. A critical review of outbreak reports may also be helpful. Ways in which people currently handle water, their excreta disposal, and hygiene practices are important to understand in order to recognize which issues need to be addressed.


DFID/Eric Don Arthur

What changes are most important to reducing illness?
Is part or all of the project or programme aimed at these changes? If not, can activities aimed at these changes fit within the scope of the project or programme? Is this seen the same way by both DFID and partners, or are there different perceptions about the importance of health and the effect of the proposed interventions upon it? To gather support both within DFID and among partners, a consensus should be reached early in the project design on the importance of health benefits and the ways in which the project will achieve them. Disagreement about this undermines confidence in the project and its credibility.

What means are most suitable for effecting these changes?
If hygiene promotion is needed, which groups are most likely to be involved? If they are unable to be involved now, why? Is it simply an issue of training, or are there issues of policy, power, and political will involved? Can these be overcome? If so, how? What are the best routes to overcome these difficulties? If technical measures are required to improve health (e.g. house or yardtap connections), are these on the agenda of the local water supplier?

How can collaboration with project partners in health be strengthened?
The earlier identification stage focused upon identifying potential partners and allies in achieving health objectives, from government at

3

all levels in the education and health sectors, and from NGOs and CBOs concerned with health. Now the focus must be on developing strong partnerships in project and programme design, so that sound activities for health are developed and integrated into the project, and the health partners are effectively integrated into the project team. Without such team integration, health can become an ineffective final stage bolt-on to the project, which will not withstand serious appraisal.

What is the existing level of service? How will it change?
For water supply, health is most improved when water is delivered at the household or courtyard level, provided adequate drainage is part of the package. Some improvement in health can also be expected from increased water consumption when return travel time is reduced to below 30 minutes, or when particularly heavily contaminated sources are replaced. For sanitation, service at the household level is by far the best arrangement. Where this is not possible, sharing facilities among a small number of households may be viable for maintenance; in such arrangements, children's access to sanitation remains critical. Public latrines are usually unhealthy because of poor maintenance, and they never fully meet people's needs. They are therefore not recommended as an intervention.

Where wastewater treatment is part of the project, how effective is the technology in removing disease-causing organisms?


WEDC/Michael Smith

Most conventional sewage treatment is good at removing organic matter, solids, and nutrients, but almost completely ineffective at removing bacteria, viruses, and parasites. 90 per cent bacterial removal by conventional treatment as reported in many textbooks has little value for public health where wastewater contains between 10^6 and 10^8 *E. coli*/100 ml. Waste stabilization ponds (Mara,1992 and 1997) are a low-capital, low-maintenance alternative that are very effective in removing disease-causing organisms; where adequate land for the site is available, they are by far the most effective treatment technology from a public health perspective.

Who is at risk from untreated wastewater? In what ways?
Wastewater, combined with freshwater, is often re-used for crop irrigation. The risks of such practice depend very much both on which crops are irrigated, and on how the wastewater is applied. Investigation of the practice of wastewater re-use, as described in the *WHO Guidelines for Wastewater Re-use* (Mara and Cairncross, 1991), may identify opportunities to reduce health risks.

3.3.4 Environmental perspectives

The Project Submission document needs to identify all the potential adverse and beneficial environmental impacts of the proposed project. Precautionary and mitigation measures must also be described. A useful way of presenting the required information is to compare a series of design alternatives with each other and with the 'do nothing' situation.

Depending on the outcome of the earlier environmental screening and on the agreements reached with partners, this stage may require any of three progressively more detailed approaches: Environmental Analysis; Environmental Audit; or Environmental Impact Analysis. These three options involve significantly different levels of data collection and analysis. They are each described in the *DFID Manual of Environmental Appraisal* (ODA 1996b).

If a full Environmental Impact Analysis is needed, there are comprehensive checklists and standard procedures for impact identification, quantification, and valuation including provision for public participation.

Some of the main environmental impacts of WS&S interventions were described in Section 3.2.4. In this stage, they need to be addressed in a project-specific context and comparisons drawn with development alternatives. The end product of this stage is an Environmental Management Plan which describes how positive impacts can best be achieved and negative ones mitigated. It is also necessary to:

- draw up environmental criteria for engineering design and environmental management clauses for construction contracts;
- carry out pre-construction baseline surveys for monitoring and evaluation;
- check national environmental acts and design appropriate monitoring protocols; and
- establish or reinforce an interdisciplinary institutional structure for environmental issues.

Key questions to be addressed are:

Surface water

Will the proposed abstraction together with any existing abstractions be less than the reliable yield of the river basin?
If this is the case the management of the river basin should be sustainable but the yield and demands must be assessed on a probability basis to determine the likely return period of failure to satisfy all demands. Prioritization of demands is essential in times of limited resources to avoid collapse of the system.

Is the river basin vulnerable to pollution from existing or future planned activities within the catchment area?
River basins which have within them industrial activities likely to give rise to polluting discharges or accidental releases of pollutants will require additional water quality monitoring provisions and possibly the provision of bank-side storage and/or additional treatment processes. Communities without effective sanitation can pose major threats to water quality in a river basin as can grazing cattle and intensive agricultural activities. Solid-waste disposal practices can sometimes generate serious water pollution problems. A land-use study of the basin above the abstraction point is therefore recommended.

Groundwater

Has an assessment been made of the potential yield of the aquifer?
Evidence should be sought as to whether the yield of the aquifer has been determined by pumping tests and/or groundwater modelling procedures. Estimates of recharge can assist in this assessment.

Will the proposed abstraction together with any existing abstractions from the same aquifer be less than the long-term recharge?
It is normally considered that, over a period of say three years, total abstractions should not exceed 95 per cent of the recharge of an aquifer for sustainability. For short periods it is permissible to abstract at a rate in excess of the long-term recharge, but abstractions must be reduced at other times to maintain the permitted average abstraction rate.

Is the aquifer vulnerable to pollution from existing or future planned activities in the source catchment?
The catchment of the aquifer needs to be defined and land uses within the area determined. Particular attention needs to be given to solid-waste disposal sites and to industrial or agricultural activities which may give rise to soluble pollutants.

Processes

Are water treatment project proposals based on reliable information about raw water quality?
In the absence of water quality data covering at least 12 months, and preferably longer, any decision as to the location of intakes and type of treatment required can only be tentative, although it may be possible to draw on information from similar basins.

Will potentially hazardous chemicals be used in the treatment process?
Disinfection using gaseous chlorine or liquid chlorine requires the provision of safe transport and handling arrangements to reduce the risks of a release of chlorine caused by leaks, breakages, or faulty handling. Since chlorine gas is heavier than air it can escape from a leak and reach areas beyond the treatment plant site. Chemical coagulation often needs acid or caustic reagents to control pH and here again care is necessary to ensure that leaks and spillages do not contaminate the treatment plant or the surrounding locality. Coagulants are normally added as strong solutions which can be corrosive and potentially harmful if misused. Potential hazards should be subjected to risk analysis to avoid the situation where the perceived existence of a hazard results in the abandonment of a process which brings with it clear benefits. Reducing chlorine usage because of the formation of disinfection by-products or possible accidents in handling the gaseous form cannot be seen as a fair exchange for increasing the risk of supplying water containing cholera or typhoid bacteria.

Have provisions been made for the satisfactory treatment and disposal of residues from the treatment process?
Sludges and residues are produced by the clarification and filtration stages in the treatment of surface waters. Much of the material used is inorganic silt from the water to which chemical coagulation adds metallic hydroxides. If the bacteriological quality of the raw water is poor the residues may contain large concentrations of micro-organisms. It is not good practice to return these residues to the source of raw water since they cause problems for downstream users. A treatment plant which will produce significant quantities of residues must make provision for their dewatering and ultimate disposal.

Sanitation

Does the sanitation component pose any significant threat to water quality in local watercourses?
Surface soakaways and sewerage schemes, even with some form of treatment, are capable of significantly contaminating nearby waters with bacteria. (See Section 2.4.2.) Such discharges must not be made to watercourses upstream of nearby abstraction points and ideally not to sources used for water supply. The effects on water quality required by other uses of the receiving water should also be assessed since water supply considerations may not always be the most demanding.

Could the scheme cause significant pollution of local groundwater sources?
Wet latrine systems, septic tanks with soakaways, land treatment, and lagoons are all potentially capable of contaminating groundwaters depending upon the local soil and geology (but see Section 2.7.20 — these risks may be exaggerated). Groundwater protection policies should be implemented to monitor and reduce these risks.

If soakaways have been proposed for the disposal of wastewaters is there evidence that the percolation capacity of the soil is sufficient to absorb the volumes expected?
With low percolation rates wastewaters will accumulate in the soil and may waterlog the surrounding area, creating unhealthy conditions and encouraging insects. High percolation rates will ensure that wastewaters are rapidly dispersed but may result in dangers to local groundwater quality.

If wastewater is to be discharged to a watercourse is there evidence that possible effects on the watercourse have been assessed in a rational way?
The effects of conservative pollutants like salts and non-conservative pollutants such as organic matter and micro-organisms can be estimated by simple mass balance and decay calculations to predict the downstream effects of wastewater discharges. The consequences of the wastewater discharge on water quality objectives for the receiving water can then be determined and the quality of the discharge regulated accordingly. The possible beneficial effects of treated wastewaters in supplementing natural flows in dry weather should be assessed.

Have provisions been made for the safe treatment and disposal of sludges from any treatment process?
The sludges from wet latrines, septic tanks, and conventional wastewater treatment processes are potentially very polluting because they contain organic matter and large populations of faecal micro-organisms. The nutrient content of wastewater solids is of considerable value in developing countries, but its use in agriculture must be carefully regulated to prevent contamination of the food chain. Has consideration been given to the possible beneficial uses of the sludges? (See Section 2.7.12.)

3.3.5 Economic perspectives

Questions arise under policy headings as follows:

Demand responsiveness

- What is the mechanism for allowing users to choose between levels of service?
- What is the estimated demand for different levels of service at the anticipated tariffs?
- How is this demand expected to change over the project time frame or life of the facilities (say 20 years), taking account of increases in coverage, shifts to improved service levels, and population growth?

Equity issues

- What is the predicted impact on the poor of the chosen project option?
- What specific measures are to be used to meet the basic needs of poor people at affordable prices?
- How are cross-subsidies to work?

Project economic justification

- Relative to the without-project situation, what is the economic justification (using cost-benefit analysis if possible, otherwise cost-effectiveness analysis)?

Demand management

- How are opportunities for demand management to be realized?

Financial sustainability of key institutions

- What are the financial targets for key institutions?
- How will the financial sustainability of these institutions be assured? (What are the financial projections?)
- What are the specific targets and mechanisms for reform of cost-recovery levels and processes?
- What are targets and mechanisms for improving utility operational performance and efficiency improvements?

Subsidy

- How will subsidy be kept transparent, targeted, and limited in scale?

Private sector participation

- What are the specific measures for promoting PSP?
- What regulatory provisions will maintain quality and protect users?

Risks

- What mechanisms for flexibility have been built into the design? For example, is there scope for the system to be incrementally upgraded over time, depending on demand, and for individual households to upgrade the level of service they access over time?

3.3.6 Institutional perspectives

In this stage, the institutional appraisal is more detailed and relates especially to the institutions which will be charged with the long-term management of the facilities installed through the selected project (Section 2.6.8). The appraisal results will also need to be placed in the context of the overall sector and the external environment. A priority is likely to be the collection of essential institutional performance data. That may take time to obtain. Decisions will need to be made concerning how much of the appraisal work and institutional development (ID) design can be left to the implementation stage, bearing in mind that ID work is best done as part of a process approach. On the other hand, an early activity may be longer term training to develop the necessary capacity to undertake the project.

In developing any institutional strengthening/development proposals, aspects to be considered include:

- Project support to local training institutions as HRD is likely to be a key component.
- Working with project champions in host government organizations, to identify who owns the project at the various stages and to provide appropriate encouragement and support.
- Ensuring that where new institutions are created as part of the project or where there are significant changes proposed, legitimacy and legal aspects are dealt with. Changes to legislation or regulations can be time consuming and delay the project. In general terms new institutions such as Village Water Committees (VWCs) require a lot of support if they are to be sustainable. The alternative of working through existing institutions should also be assessed.
- Encouraging options for piloting institutional strengthening, with a view to replication elsewhere, so maximizing potential benefits.

How can commitment to the ID project design and process best be promoted among project partners?

Project partner participation should be encouraged in the process of institutional analysis, in promoting ID ideas, and in the development of institutional strengthening options, with the use of workshops, consultants, and core groups (Section 2.6.7). The level of commitment will need to be continually assessed in order to assess the planned pace of change or to consider whether change is achievable. The prospect of significant capital funds may lead to conditions being agreed without real commitment. Look for progress indicators on things that the organization could do from its own resources (DFID, 1995).

What are the potential benefits of including project conditions?

Conditions included in the Project Agreement can be used to establish the minimum institutional/financial arrangements for project implementation and operation. Further dialogue can then proceed with project partners on the adequacy of arrangements for sustainability. Conditionality should support commitment rather than be a substitute for it and hence back those promoting change (DFID, 1995). Conditions can also be included as minimum benchmarks for community participation and management. For example on the DFID Maharashtra Rural Water Supply Project, a condition stipulated that VWCs shall be formed, trained, and established before the village pipe distribution network was agreed. That ensured that construction organized by the State Water Board did not take place until the condition was met and community participation took place. Project partners may also find project conditions useful in terms of providing a lever in obtaining support for government approvals or changes in policy.

What are the key considerations in agreeing project management and support arrangements?

It is important to establish effective arrangements for delivering all of the project software and hardware components with co-ordinated timing. This may be through local government structures or a dedicated Project Management Unit (PMU). For reasons of sustainability after the donor has withdrawn, it is preferable not to establish PMUs as part of a new project. PMUs often are established in water and sanitation sector projects, however, for a number of reasons:

- Water, sanitation, and health projects normally involve a number of government departments, parastatals, etc., so a PMU provides an opportunity to co-opt people from the various departments into the PMU and thus enable more project integration.
- Larger projects, particularly those involving participatory approaches, are usually time consuming and involve substantial co-ordination. Capable staff within existing institutions are invariably busy with a multitude of duties and are not able to devote sufficient time to the co-ordination of such participatory projects.
- A wide variety of skills are invariably required on projects in the sector, including: HRD/communications, women's development, social development, technical, finance and administration, health promotion, sanitation, etc. The PMU provides the opportunity to assemble experts in these fields, in order to ensure that adequate attention is given to each of these important disciplines.

A key issue is the level of autonomy a PMU should have from government. It is generally preferable for the PMU to be within government, although this depends on how restrictive bureaucratic procedures are on project implementation. Obtaining agreement/ commitment to placement/replacement of key project staff is particularly important where there are skill shortages.

What technical support can DFID offer to help the PMU develop the skills to do its job?
Appropriate inputs need to be quantified, scheduled, and costed. These may include technical assistance and/or external training.

What arrangements should be considered for phasing, sequencing, monitoring, and evaluating project components?
The introduction of a pilot phase to a project can be beneficial where there are doubts about institutional arrangements. It provides an opportunity to test and agree processes, as well as time for further appraisal and dialogue. Activities such as hygiene promotion, HRD for project preparation and implementation, and institutional data collection should commence as early as possible in the project to enable other activities to proceed satisfactorily. It is preferable to agree arrangements for: piloting/phasing, stakeholder participation, reviewing, and incorporating lessons learned into the project. A process approach entails focusing on key project milestones rather than construction completion dates.

Project proposals should include arrangements for participative monitoring, evaluation, and impact assessment, including baseline surveys where appropriate.

3.3.7 Technical aspects

The flowchart in Figure 3.3.1 (page 259) illustrates technical option selection at the project preparation stage for a typical water supply project.

Many of the important principles which need to be considered are detailed in Section 2.7. These include: linkages between technology and hygiene promotion, standardization of technology and management, sustainability, operation and maintenance, convenience, incremental improvement, design life, gender in technology, and choice of water supply and sanitation technologies. Some additional issues to bear in mind at this stage are discussed briefly below:

Confidence on water source selection will aid the consultation process. The choice of source will affect the range of technical options available. It is therefore important to try and obtain reliable hydrological/hydrogeological information as early as possible. This will ensure that the stakeholders only have to consider viable options, For example, there is no point in going through a lengthy consultation process for a new deep borehole scheme, only to find at a later date that the water is too saline. Sections 3.2.4 and 3.3.4 describe the main criteria for water source selection.

Speed is not of the essence in a participatory approach
The participatory approach means that options or outline designs may have to be revisited a number of times until all the stakeholders are

happy with the final design package. This will clearly take time, and the engineering team must be prepared to match its pace with the consultation process.

Choices of levels of service must be clearly explained

The different levels of service on offer to the community need to be well understood so that they can make informed choices. The example in Figure 3.3.2 proposes three alternative design packages. Each package will offer water at a different cost for its particular level of service. The three levels of service offered to individuals are private house connections, private (or shared) yardtaps, and communal standposts.

Photographs, diagrams, or pictures are useful to communicate, in simple terms, the levels of service potentially on offer to communities.

Project cost estimates need to be as accurate as possible

At this stage of the cycle preliminary cost estimates need to be made for the proposed design packages (see Section 2.7.7). Although these packages will change and evolve throughout the consultation process, it is important that early cost estimates are reliable. They will be used as the basis for discussions with stakeholders on potential capital charges and tariffs, and it would be inadvisable to base these discussions on tenuous estimates. Also, willingness-to-pay surveys need to be based on accurate estimates of the likely range of costs for different services. Cost data should be obtained from similar, completed projects in the same area if possible.

How can arrangements be made for spare parts to be available during the operation stage of the project?

This may require provision of spare parts during the implementation stage or working with private-sector suppliers to set up supply channels.

Case study to illustrate technical aspects in the project cycle

Figure 3.3.2 represents the decision-making process at project preparation phase for a typical water supply project. The scenario is as follows:

Community X is a peri-urban community situated some five miles from a significant urban centre which has a centralized water supply system, Community X currently has no access to a piped supply and relies on traditional sources such as protected springs or shallow wells. There is perceived, by the local government, to be a strong need and desire for a more convenient and safer water supply. The average consumption is 15 l/c/d and some women take up to three hours a day to collect water. The wealthier people pay vendors to transport water from the distant sources. Although most households rely on subsistence farming, there is a certain amount of expendable income available in families where the males work in the informal sector in the town.

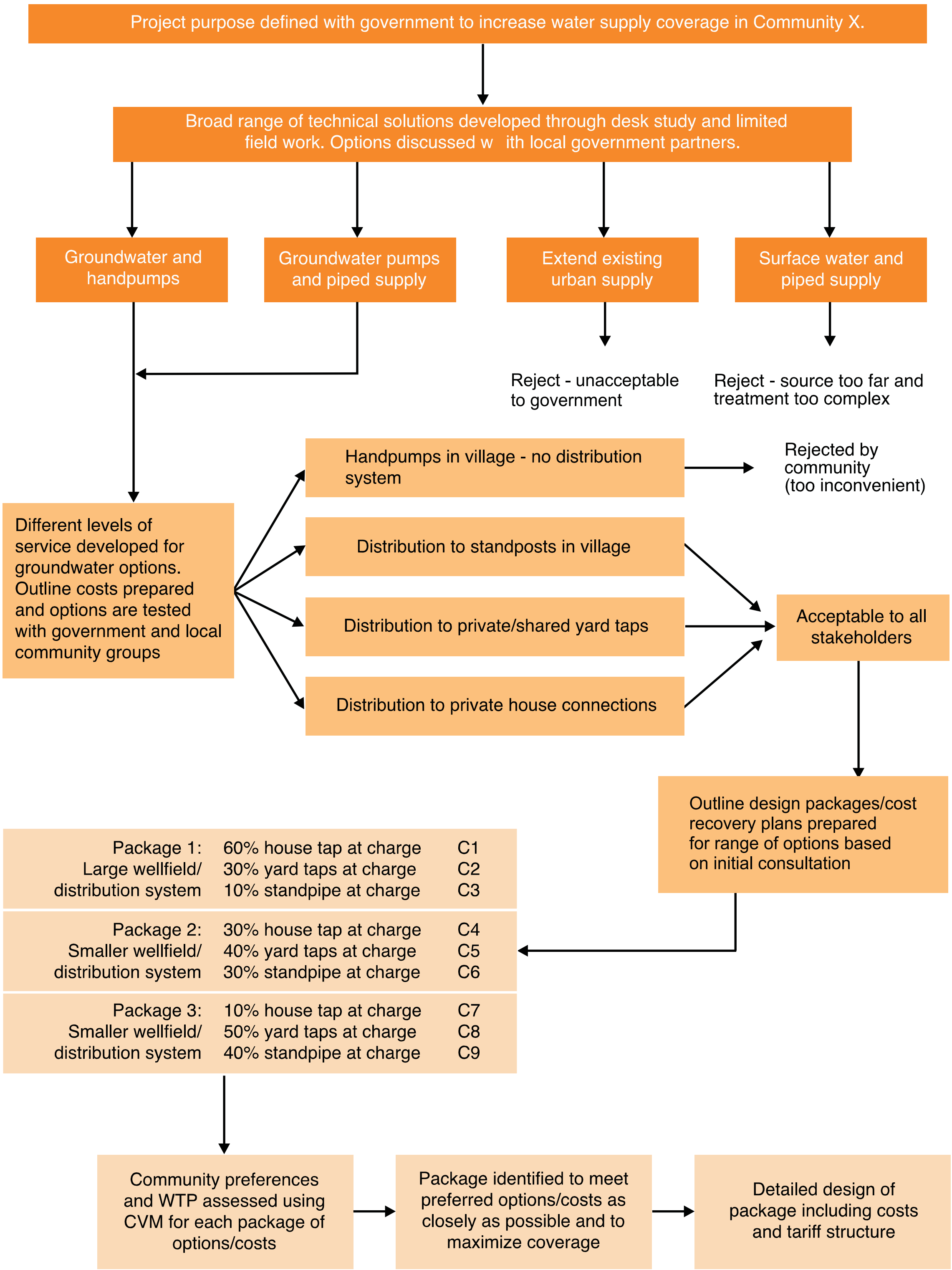


Figure 3.3.2. Case study to illustrate technical aspects in the project cycle

3.3.8 Hygiene promotion and sanitation promotion

By the end of this stage the Ministry of Health, or its local equivalent, should have agreed if they will contribute and, if so, in what capacity. The roles of the different institutions will be laid out, defined, and harmonized.

Data collection for hygiene promotion and sanitation promotion

This stage is analogous to the Feasibility Study of a major engineering programme. In the same way that baseline data are collected before the rehabilitation of a sewer system, or before a borehole programme proceeds, so must baseline data be collected on the population (see Section 2.8.9).

If water agencies do not have enough engineers to conduct a Feasibility Study, they hire in expertise by contracting out to consultants. If there is not a government department with capacity for collecting data pertinent to promotion, it is advisable to use NGOs or local consultants.

When the data have been collected the programme must not be rushed — sustainable demand takes time to create and even longer to translate into sales (see box opposite). This is a common problem between hardware and software projects. Avoid short cuts. Hardware and software projects have different rhythms and it is disastrous to allow the promotional activities to be rushed by the impetus to pour concrete (see Section 2.8.6).

How should terms of reference for good data collection for hygiene promotion and sanitation promotion be drawn up?

The ToR for data collection should ask questions on the specific behaviours which allow diarrhoeal microbes to be transmitted, which of these behaviours are most widespread, and which are most amenable to change. It is vital to ask how existing hygiene and sanitation practices differ according to gender. Who socializes children about hygiene-related practices?

There are a number of questions as to who should form the cadre of marketers/trainers/mobilizers. What is their social status in the community? Some people might not accept a message from women or from young women, for example. Would they be accepted and at what opportunity cost (e.g. time) and with what benefits (e.g. improved status)? Are there existing roles or positions in society which could be used — e.g. traditional story tellers? Is there a role for those already involved in selling and installing sanitation equipment?

If there is no existing market for latrines, this must be investigated and the reasons why not determined.

How will the data be collected for hygiene promotion and sanitation promotion?

What local partners have the necessary capacity and experience? What experience do they possess? Do they have experience of the promotional approach or are they wedded to the didactic educational approach? Is there a need for training and if so, how much? Is this feasible within the time-frame of the project? How far afield should

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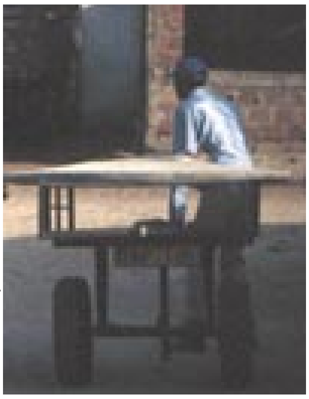


WEDC/Darren Saywell

Urban sanitation in Maputo, Mozambique

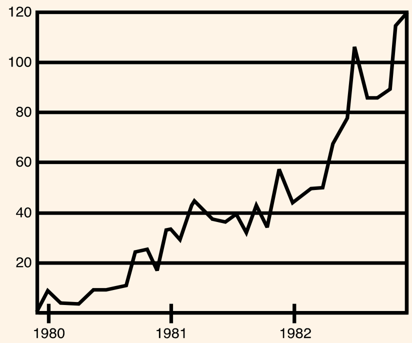
A pilot sanitation programme in Maputo set up a workshop to sell prefabricated concrete slabs to place over existing pits. Care was taken to put no more effort into the marketing than could be replicated on a city-wide basis.

Sales built slowly. Neighbourhood surveys found that many people were waiting for their old latrine pit to fill before purchasing a slab for the new one. Some people did not know the purpose of the slab while others had difficulty in transporting them. However, everyone who was interviewed was interested in buying a slab. An information campaign was organized to explain the use of the slabs. Handcarts were acquired to help with transport.

The pilot was replicated. Slab production co-operatives were formed in each of the peri-urban neighbourhoods. The members, who were predominantly women, were also trained in accounting and advertising techniques, such as puppet shows.

The project has now been replicated in other towns in Mozambique and there is a total annual production of over 10,000 latrines a year.

Monthly sales of latrine slabs in Maputo, Mozambique



Cairncross, 1992

the project look if there appears to be no capable research organization locally?

How much demand needs to be created for hygiene promotion and sanitation promotion?

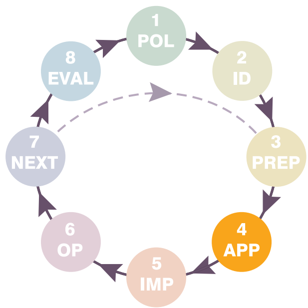
What facilities for sanitation promotion exist? What kind of market exists already? Are there competent contractors who can cope with an increased demand and carry out the work satisfactorily? Is the project unrealistic in assessing the logistical necessities? Is there a distribution system and are there points of sale for the materials, e.g. builders' yards or sanitary marts?

How are hygiene and sanitation promotion linked?

Funds are often committed with undertakings to 'co-ordinate the hygiene and sanitation promotion closely to ensure complete demand creation, cost recovery, and sustainability'. The problem, in reality, is that if the hardware is brought in before the software the demand for the products will be small. If the software is introduced too early, or by itself, then the health promoters may be encouraging people to change their behaviour but not offering the means. The effectiveness of the programme is reduced if there is no possibility of recommending hardware. Health promoters should be able to refer people in the project area to somebody who can answer their questions, and supply the technologies. Is there a realistic low-cost sanitation option to which the health promoters can turn?

What are the key steps in a hygiene promotion plan?
The box in Section 2.8 has examples of how to formulate objectives, to pick out key questions, and to develop an appropriate mix of methods for developing answers. Remember that the focus is on only a few key issues and that results are returned to stakeholders for discussion and collaborative programme design. The key questions for both hygiene promotion and sanitation promotion are: what are the target practices (or product)? Who and where are the target audience? How do the beliefs and practices differ across groups within the target audience? What attention has been paid to message positioning and, through which communication channels will the message, or messages, pass?

These results are used, collaboratively, to develop an intervention which is imparted along appropriate channels. The chief characteristics of the message are that it is positive, simple, repeatable, feasible, affordable, attractive, and memorable.



3.4 Stage 4: Project appraisal and approval

In this stage, the Project Submission Document is reviewed by high-level DFID staff to make the final decision as to which projects DFID will seek to participate in.

Clearly, the issues elaborated in Section 3.3 related to project preparation remain valid for the Appraisal stage. They are not therefore repeated here. In this stage, the decision-makers will wish to check particularly:

Possible alternatives: Is this the best way (effective, equitable, sustainable, efficient, replicable) to achieve the project Purpose?

Impact: Is the project well targeted? Are water supply, sanitation, and hygiene promotion components appropriately designed to maximize health and other benefits? What will be the impact on the poor? On women? Have these been realistically assessed in project preparation?

Risks: Have the risks and assumptions been correctly identified and recorded in the logframe? Can any of the risks be reduced through additional project activities?

Sustainability: Is government policy supportive and will the project's institutional, financial, and technical provisions ensure sustainability? Has the project been developed in consultation with key stakeholders, including users, with a realistic package of technical options and charges tailored to demand?


DFID/C.J.Oxlee

Project programme and milestones: Are these agreed with partners, realistic, and providing a reasonable combination of targets, review, and flexibility?

Focusing of programme investments: Software needs as much investment, if not more, in a promotion programme, and judgments may be needed on the likely ratio of inputs to impact.

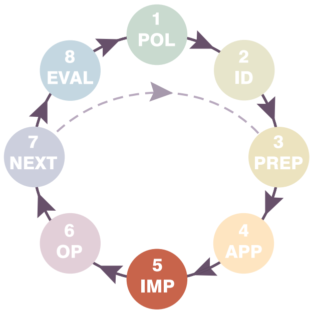
Long-term commitments: Are partners likely to continue activities after cessation of external funding?

Social development v. social marketing: The proposals for hygiene promotion and sanitation promotion may need to come under special scrutiny, as this is an area where there could be a danger of DFID seeming to exercise undue influence on community development. The compatibility between social development and social marketing aims should have been made clear in the Project Submission Document and verified by the logframe, but a few extra checks are merited (see box below).

Once approval is given, the logframe becomes the key tool for assessing progress on the project.

Appraisal of social marketing component: Some key questions

- What steps were taken in the preparation of the hygiene promotion and sanitation promotion components to ensure that the partnerships will be fruitful?
- Will the projections from the preparation stage hold good when the project is scaled up? Have the projections been based on a short visit to the area of interest or has a pilot project already been run? How was the pilot project assessed? By whom, and on what basis? Did the success of the pilot project rely on a high degree of intensive one-to-one work or is it replicable? Was the positioning of the message such that demand was created?
- What did DFID's partners make of the promotional approach?
- Is the scheduling of the programme for hygiene promotion and sanitation promotion realistic and flexible?
- It can take a long time for demand to translate into sales. While people may well be interested in, and tempted by, the advertized latrines, they may also want to wait for their old pit to fill before changing to a new slab or a new design. They may also want to see the performance of similar latrines installed by their neighbours before investing in their own. Can the programme cope with this time span and with the need to continually refine and check the way the promotional efforts are being received? How will the promotional activities be reviewed?
- At an institutional level what partnerships were built and what interest was shown in the promotional approach?
- Urban sanitation programmes often face the seemingly intractable problems of land tenure and drainage. Have the programmes been considered in the wider context of sanitary infrastructure and urban planning? Did the demand-led and consumer-oriented focus minimize these, and other, difficulties? Did it spread beyond the boundaries of the project? What role did partner organizations play? Was there any interest in the promotional approach at a ministerial level or were the relevant ministries involved more as passive observers? Which other organizations helped?
- What assumptions are being made about the target population? Did the project have any adverse effects? What are the costs, be they social, psychological, or financial, of the proposed behaviour change? Do the changes affect different groups disproportionately? How was the message received by the target audience? Is the message perceived as being relevant to all people and not morally stigmatizing?



3.5 Stage 5: Programme and project implementation and monitoring

3.5.1 General

The implementation stage extends to the end of DFID-funded involvement in project activities, and will include operation of facilities and institutional development, where this is part of the DFID support.

Implementation focuses on the Activities and Outputs levels in the logical framework. It includes:

- assembling packages of interventions based on the implementation philosophy;
- detailed design of components;
- procurement;
- preparation and delivery of community development, hygiene promotion, and institutional strengthening activities;
- construction of facilities; and
- preparation for transition to the operating stage of the cycle (operation and maintenance procedures, training of staff, etc.).

Table 3.1 summarizes DFID management and monitoring activities at the implementation stage. With the general use of the process approach to projects, the setting of annual workplans and the review/revision of logframes will be particularly important. Section 3.3 gives guidance on planning Outputs to achieve the project Purpose. It is important not just to monitor that Ouputs are achieved as planned, but also to review their contribution to the project Purpose.

3.5.2 Social development perspectives

The implementation of process projects in WS&S is complex. It requires the co-ordination of a wide range of activities, diverse institutional arrangements, and different time frames. It is important that social development perspectives do not get lost in this complexity.

Are the engineering and the social development components of the project well co-ordinated and synchronized?

Implementation is often driven by the engineering components of a project; the social development dimensions, such as developing local ownership or capacity to manage water supply and sanitation facilities, can get left behind. This can happen either because social development takes longer and is seen to hold the process up, or because new actors who are unfamiliar with the process approach and social development issues become involved at the implementation stage.


WaterAid/Jim Holmes

There are differences between water supply projects and sanitation projects in terms of how engineering and social development perspectives impact on each other. For example, water supply tends to be technically complex from an engineering point of view, while sanitation projects are often viewed as community self-help activities

Table 3.5.1 DFID management and monitoring activities at the implementation stage

Outputs	Key issues/Activities
Annual workplans	co-ordination of inputs planning for future years
Revisions to the logframe	review of the logframe
Baseline surveys	
Project reports (progress on planned Activities and Outputs)	
Monitoring reports (progress to achieving Outputs and Purpose)	monitoring techniques (including participatory process monitoring)
Reviews (Mid-Term and Output to Purpose reviews) or informal snapshots	achievement ratings progress ratings against Purpose issues which may influence progress remedial action to be considered
Completion report (at end of implementation)	lessons learned

ODA, 1996c Vol II, GI

(White, 1997). From a social development perspective, however, water projects can achieve social acceptance more easily than sanitation projects, where changing people's attitudes and behaviour, or generating demand for improved sanitation facilities, is a slow process.

Are there mechanisms in place to share information collected within monitoring systems with all project partners?

Within process projects monitoring systems are set up to provide systematic and continuous assessment of progress for all project partners, not only donors and governments. It is important to identify who should be involved in monitoring, including data collection, maintaining the system, and analysing the data. If joint responsibility for achieving programme or project objectives is to be established, information needs to be shared. A key factor during the implementation and operation stages is feedback. It is important to provide the opportunities to discuss findings with all people who are interested in or affected by a project and for the results to be incorporated into the analysis of the monitoring data.

Are social development perspectives evident in both impact and process indicators?

Impact monitoring provides information on progress towards achieving social objectives, such as sustained improvements in water supply. Process monitoring helps track the use of resources, the progress of activities, and the way these are carried out. In other words, the information collected should provide an ongoing picture of progress towards meeting objectives, as well as a picture of the process of development, analysing, for example, whether it is developing local capacity or increasing gender awareness among project staff or partners.

Are both women and men involved in identifying indicators, in monitoring change and impact, and in feedback processes?

Participatory methods can be used to find out how different groups, including groups of women and men, are involved in or affected by a programme, and how they view its progress. To ensure that all are able to participate in feedback processes, it is necessary to be aware of the timing and location of meetings so that they do not interfere with key income-earning activities, domestic tasks, and childcare responsibilities. The methodology used and the way meetings are run should reflect the different ways in which women and men participate in these processes.

Is qualitative information necessary to monitor progress?

On-going monitoring is usually undertaken through filing checklists and reports. When it includes qualitative information it is useful to use other methods. For example, diaries or reports written up after attendance at meetings and based on observation can be used to assess levels of participation. In order to measure behaviour change as a result of hygiene promotion, case-studies of particular households or lanes can be undertaken to assess changes over the longer term.

Indicators of social development in a community-based rural water supply and sanitation project

Impact indicators:

- new sources or improved quality, quantity, and reliability of water
- new installations in working order and being used appropriately by all groups
- improvements in living environment
- reduced workload and time spent collecting water by women and children
- reduced reliance on local élites such as landowners controlling access to water sources

Process indicators:

- higher level of participation of primary stakeholders
- increased involvement of women in decision-making
- better understanding of technical constraints and costs
- improved ability to cope with conflict over water sources
- greater willingness to approach officials
- continued inclusive organization after project completion

Environmental units — Tamil Nadu, India

An environmental action plan (EAP) has been drawn up with the aim of fully integrating environmental management in planning, investment, and management of the state's water resources. A key element of the EAP was to strengthen WRO's environmental monitoring and analysis capabilities via the creation of specialist Environmental Units/Cells. Two such units have been established in the main planning departments — basin- and project-level — with responsibility to:

- prepare environmental plans for all river basins in Tamil Nadu;
- provide policy advice to WRO on environmental matters and establish state-wide planning standards;
- perform environmental reviews of projects to comply with Environmental Protection Acts and Regulations;
- provide expert advice on environmental matters to WRO management units;
- plan for environmental mitigation and enhancement;
- provide environmental clearance from Government of Tamil Nadu; and
- undertake periodic (environmental) reviews during operation and maintenance.

DFID, 1998b

3.5.3 Water, sanitation, and health

Are the timing and co-ordination of health-related components on track?

Scheduling and co-ordination issues are critical for all project and programme implementation. They may be more complex on the health side, however, because of the need to work across multiple sectors (e.g. public works, social welfare, health, and education sectors in government; assorted NGOs and CBOs). One problem could arise if hygiene promotion creates demand for sanitation or improved water supply that cannot be met in a reasonable time; alternatively, if major infrastructure works proceed quickly, but sanitation promotion drags behind, critical public demand may be lost.

How are working relations between sectors and partners?

Much of the 'monitoring' of collaboration and co-operation must be informal. Field management staff must make time to establish an atmosphere of candour and trust with partners during implementation so that concerns may be raised (and often resolved) informally. Examples of suitable indicators are included in the sample logframe 3 in the Appendices.

3.5.4 Environmental perspectives

Environmental monitoring

It is important to continue environmental monitoring during the implementation period to determine whether initial assumptions, which are almost always necessary, have been confirmed. Such monitoring can provide valuable information and assistance for use in later projects in similar situations. (See Section 2.4.3.)

3.5.5 Economic perspectives

The key issue at the implementation stage is to ensure co-ordination of project components, and ways to do this are considered in the section below. Implementation in the past has been largely driven by the engineering components of projects, which dictated the speed and direction of events, and prevented health, hygiene, and sanitation components from being fully integrated into the whole (see para 4.14 of DFID's *Rural water and sanitation evaluation synthesis study*, White 1997). Points to monitor are noted below:

Revealed demand

- Are communities responding as expected in contributing to the investment phase and in preparing (e.g. making cash collections) for O&M?
- What is the evidence of demand for improved levels of service (e.g. new connections)?

Equity

- What progress is being made in improving access by the poor to basic services at affordable prices (coverage, use made of new facilities, prices paid, etc.)?

Economic justification

- How are costs and benefits (demand) diverging from design projections?
- Why? How can economic performance be improved? How can programme be modified to match demand?

Demand management

- How well are demand management targets being met?

Financial viability

- What is progress in reform of cost recovery and financial reform?

Subsidy

- How well are arrangements for transparency, targeting, and limiting of subsidies working?

Private sector participation

- What progress has been made in increasing PSP?
- How far has the private sector complied with contractual requirements?
- How well are regulatory arrangements working?

3.5.6 Institutional perspectives

This is the time to encourage the final formulation and operationalizing of ID plans within the organizations eventually responsible for providing support to or managing the facilities. This is best done with inputs from competent consultants/NGOs including facilitators to guide the process. This should be discussed briefly, taking note of the importance of co-ordination of components; Section 2.6.8 identifies the likely focus areas. Activities which need to be co-ordinated in a comprehensive ID programme may include:

- assembling inter-disciplinary project teams/committees at the various levels, and selling and reviewing the project concepts and plans;
- encouraging good stakeholder participation from the outset;
- reviewing key indicators for monitoring and developing a monitoring/evaluation system for the project process, activities, and outputs;
- encouraging the development and operationalizing of ID plans within the organizations eventually responsible for providing support to or managing the facilities. This is best done with inputs from competent consultants/NGOs including facilitator(s) to guide the process (see the guidelines on institutional development in Section 2.6.11);
- encouraging interlinkages with other concerned organizations;
- ensuring that key posts are filled early in the process;
- promoting policy dialogue and further institutional appraisal to take into account the changing institutional environment, being opportunistic as new staff or information becomes available;
- exploring options for collaboration with other able local consultants and institutions; and
- promoting 'learning by doing' and reviewing the project design and project management arrangements in the light of experience, and adapting the project plans and logframe as appropriate.

The focus should be on critical path activities such as HRD, institutional changes, community mobilization, and planning activities. Institutional change takes time and may experience setbacks before substantial progress is achieved. If necessary, consider reviewing construction targets, in order to allow adequate institutional and community development to be completed.

Generally water and sanitation projects experience their most serious problems with operation and maintenance and with cost recovery aspects. The proposed arrangements for these need particular attention. If they are not likely to be sustainable, how can they be amended? Consideration should be given to providing project support during these stages, with a planned withdrawal of support as local ownership builds.

Plan well in advance for project evaluation and impact assessment. Participatory evaluations with project partners should be encouraged, with agreement on key indicators, particularly at the Project Purpose level.

Seek to develop good project documentation and disseminate lessons learned to a wider audience.

3.5.7 Technical aspects

The detailed design, tendering, and construction of the project will take place during this part of the cycle. There are therefore many engineering aspects to be considered. Most of the issues are covered in Section 2.7 and the previous sections of Chapter 3. Some further issues are specific to the implementation stage as discussed below:

What choices of technology and level of service can be offered to each household?

Work at previous stages (Section 3.3.7) will have closed down some options and settled on a limited range of technologies and levels of service (with corresponding tariffs) which could be offered. It will be necessary to decide whether each household can make an individual choice from the available options (as should be possible for latrines), or whether small groups of households need to make a common choice (as is probably necessary for handpumps). (See Sections 2.7.20, 2.7.21, and 2.7.26)

What is an appropriate process for choice of technology?

In the past, choices have often been made by engineers exercising technical judgement, but ignoring the need to secure the necessary recurrent funding, which usually has to come from user tariffs. Following a demand-responsive approach, a simple form of agreement could be prepared, setting out the choices (technologies and tariffs). The issue of future changes to the tariffs needs to be considered, as does the question of who in the household decides (or is approached) and how the agreement is signed? Clearly this will require liaison with other specialists (social development, economics, or institutions). The timing of householders' choice should preferably be after they have been exposed to hygiene and sanitation promotion activities.

How can the system design provide for future growth in population and per capita demand for water?

Although the system design needs to be based on supplying water to meet individual households' current choices, it should have the flexibility to meet future demand, especially to facilitate the increased use of water, which brings important health benefits and increases in the number of private connections (see Section 2.7.16).

What is the estimated demand for different levels of service at the anticipated tariffs?

How is this demand anticipated to change over the project timeframe or life of the facilities (say 20 years), taking account of increases in coverage, shifts to improved levels of service, and population growth?

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WaterAid/Jim Holmes

Does the detailed design incorporate local practices and standards?

It is not appropriate to design works to a British Standard if these are not used in the project country. In some countries the quality of concrete work is very poor, while masonry skills are excellent. These local practices and skills should be exploited in the design and construction of the infrastructure. Similarly, local standards for water treatment and effluent disposal should be specified wherever possible.

Is there potential for introducing new skills to the community?
It may be appropriate to use the project to improve the local skill base, for example by involving the local labour force in construction, which develops skills which may be useful for O&M (see Section 2.7.10). Another example is by specifying the use of simple pre-cast concrete units. The local labour force can then be trained to use this technique, which may prove useful in future projects.

Has the use of local materials and plant been specified wherever possible?
Local materials and construction methods should be employed wherever possible. This may not always be possible, for example if rotary drilling in rock is required, but the community should be consulted because they may have their own ideas. In some cases the use of local materials is unacceptable to the partners if it is of a very low quality; it would probably not be cost-effective to purchase local asbestos cement pipes with a design life of five years, if imported ones have a design life of 30 years.

Have the end-users been consulted on the detailed design of services?


DFID/R Lokanadham

Consultation is particularly important for the location of facilities. The end-users of water supply projects are often women and children. The height and strength of these users also needs to be taken into account when specifying the height of well headwalls, washing stands, and borehole plinths for example (Section 2.7.9). It is not uncommon to see handpump outlets which are too low to fit a 20-litre jerrycan underneath — consultation with the end-users would have avoided this sort of mistake.

Have standard designs been used wherever possible?
Sections 1.5 and 2.7.4 discuss the merits and pitfalls of standardization. Standard designs for project components have important implications for sustainability.

What written agreements or contracts are needed to implement the project?
In many cases it may not be appropriate to have a formal engineering contract between parties, particularly if the construction work is to be undertaken by the community (see Section 2.7.10). However, there has to be some guarantee of quality and an understanding of the scope of the work. It is useful to have a written agreement between the primary and secondary stakeholders (community and government, say) defining roles and responsibilities and also agreeing the scope of the works. This will avoid confusion or disagreement later on in the project.

Formal written contracts are required where specialist construction or installation work is being undertaken by external contractors. This work should be awarded through a competitive tender process to ensure value for money.

WaterAid/Caroline Penn

How much supervision of construction work will be required?
The level of supervision required will naturally depend on the complexity of the construction work. However, if the design includes any engineering specification, then qualified staff should be available on a full-time basis to oversee construction of the works. The quality of work will suffer if supervision is inadequate because corners may be cut, inferior materials used, and safety compromised.

3.5.8 Hygiene and sanitation promotion

How are hygiene promotion and sanitation promotion monitored?
Monitoring a hardware intervention involves checking that it stays on time and on budget. The procedure for installing a water supply or sewer system is well established, and it is unlikely that the design will alter at this stage. On the other hand, the messages which promote changes in behaviour cannot be standardized. The methods of promotion are drawn from a wide range. While these methods themselves are standardized, both the implementation of the intervention, and the intervention itself, are likely to change as a result of monitoring. Promotion marketing demands a continual rechecking of the design and should include qualitative data collection, for instance from focus groups, to ensure that the messages, their positioning, and the communication channels continue to be the most suitable. Allowance should be made for more re-design of the programme than would be acceptable in an engineering intervention simply concerned with hardware.

Field managers need to ask questions of partners to ensure good practice. For example if government co-operation is deemed essential, is the NGO or project team receiving support?

How is the scheduling of the hygiene promotion and sanitation promotion proceeding in practice?
If sanitation provision lags too far behind, should resources be diverted to hygiene promotion or should sanitation promotion be delayed? This can be monitored by checking project 'sales', or by unscheduled visits to find out if people are behaving in a way that is compatible with the original design. It is important that monitoring should be done by someone who has no axe to grind with either the project or the implementing body.

What should be monitored in hygiene promotion and sanitation promotion?
It is a reality of project management that it is always difficult to get totally objective data about who has done what. There are many conflicting interests to negotiate. It is important to answer questions such as: Did everybody do what they were supposed to do? How many home visits were conducted? How many questionnaires were completed? What level of programme coverage has been achieved? Have the targets for the numbers of people having had one, two, or three exposures to the programme messages been met? What other targets for the programme outputs have been achieved? These might

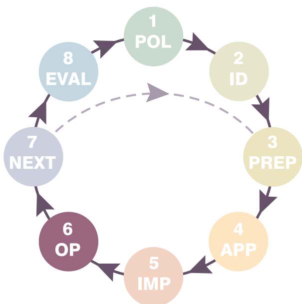
include behaviour changes, sale of potties, sale of soap, latrine construction, and so on. (See Section 2.8.8 for a more detailed list in *Implementation of a hygiene promotion programme* and *A product-based social marketing plan for sanitation.*)

What useful distinctions can be made while monitoring?
Those engaged in social marketing and hygiene and sanitation promotion should be distinguished from those in the target groups — e.g. number of people trained, or staying on as trainers, is a different type of indicator to the number of people attending street theatre/ puppet shows, etc. (see Section 2.8.6).

It is also useful to distinguish between those directly affected (target audience) and those indirectly affected (neighbours who might adopt practices through observation/demonstration effect) (see Section 2.8.4).

Finally achievement indicators, such as changed behaviour or the number of applications received, and process indicators, e.g. readiness of people to participate, degree of user participation in design of message, communications, etc.

What should not be monitored in hygiene promotion and sanitation promotion?
Health change (see Section 2.3.9). There are too many variables and confounding factors which intervene in the relationship between water and sanitation and health. It is better to concentrate on behavioural and environmental factors which are measurable and achievable.



3.6 Stage 6: Programme and project operation and monitoring

3.6.1 General

This stage of the cycle follows the end of DFID support, and continues for the life of the services or facilities put in place by the programme, until they need replacement. This stage covers the delivery of the benefits of the intervention. Both the level of benefits and also the period for which they are enjoyed are crucial for assessing the success of the project. Sustainability issues come into prominence at this stage, particularly any related deficiencies which have not been overcome in the earlier stages.

3.6.2 Social development perspectives

Continuous training, support, and supervision are all essential to ensure successful monitoring of social impact and participatory processes. This is best achieved when close contact is maintained at the local level and when primary stakeholders are consulted and informed on a regular basis.


WEDC/Sarah House

Do those involved in operation and monitoring understand why they are undertaking their assigned tasks?
For example, people collecting monitoring data on the use of newly installed tubewells or latrines need to understand why they are doing it and how the information will be used, otherwise they might see

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themselves or be seen as 'policing' the community on behalf of government agencies or donors.

What is the impact of involvement in operation and maintenance on social relations?

In the post-construction stage careful attention needs to be paid to those responsible for operating and maintaining water supply and sanitation systems. It is just as important to identify how involvement in operation and maintenance activities affects social relations as it is to provide the right sort of training. The impact on social relations might only be possible to observe during the operation stage itself. For example, the following sub-set of questions might present themselves:

- If women are involved in pump maintenance, does this challenge the existing gender division of labour?
- In the case of on-going hygiene promotion, does this compete with or complement the work of community healthworkers?
- Are those who are delegated to clean around latrines or public standposts willing to do it and what effect does it have on their status in the community?
- Do those who collect user fees have sanctions they can use in the exercise of this task? Do they face resistance or conflict?
- Does the management of operation and maintenance activities fit in with the overall system of governance at the village or settlement level?

3.6.3 Water, sanitation, and health

How sustainable are any long-term health interventions in practice?

The main health-related monitoring issues will be the growth or decline of activity in hygiene promotion. Is this activity increasing or decreasing during project operation? Why? Are there unanticipated stumbling-blocks to growth in this activity? What can be done to overcome them? At what level do difficulties arise, and what can be done about them? Do these suggest another project, or a revision of the current project/programme?

How effective are long-term health interventions in practice?

Part of the 'sustainability' issue is the quality of the work being done, and the quality of its monitoring by local institutions. Is there regular local monitoring? How is it done? To what extent does such monitoring reflect changed *behaviour* as opposed to repetition of learned *knowledge?* Does this monitoring focus on the issues of the most vulnerable groups (children and adolescents) and the most influential groups (women, especially mothers)? Effective monitoring of behaviour change can lead to truly sustainable improvements in the hygiene promotion programme; without effective local monitoring, there is a danger that the work will become overly formal and ritualized.

3.6.4 Environmental perspectives

Performance monitoring

This should be aimed at monitoring the performance of the project against quantifiable environmental objectives such as the:

- provision of the design yield without undesirable environmental consequences like lowered groundwater levels, or reductions in flora and fauna; and
- achievement of the intended water quality in receiving waters below effluent discharges.

In addition, the performance of the project with regard to its environmental impact should also be assessed. In particular, whether there have been impacts as anticipated in the Environmental Analysis, and whether these have been controlled as indicated in the Environmental Analysis.

If any of the targets are not being met, this is a serious issue and the question has to be asked, why not? Is it a short-term deficiency, which can be rectified later (e.g. construction of an earth dam may be causing temporary water quality problems which should cease once construction is complete)? It may be a more serious problem, with longer term implications. In such circumstances, the environmental objectives and practices need to be reviewed. Aspects to consider include:

- Are the objectives as set realistic and attainable, in the light of the project experience?
- If not, do they need to be reviewed (for example, effluent discharge standards may have been set which are too strict and unattainable)?
- Were the assumptions made at the beginning of the project valid? If not, do they need to be reviewed?
- If the objectives and assumptions are still valid and monitoring reveals a serious problem, action needs to be taken. How can the effects be minimized? What is the effect of any minimization proposal itself? Is the problem so big that the initial project as undertaken should be stopped — either temporarily or permanently? Is there a need for another project to mitigate the negative impacts that have become apparent?

It is important to state that Environmental Analysis and monitoring programmes are there to serve a purpose. If measurement of performance against them reveals that the objectives are not being met, and after review it is recognized that the objectives are still valid, then this is a very serious issue and action *must* to be taken. It is for these reasons that environmental issues and the tools for monitoring need to be rigorously considered at the very early stages of project planning and preparation. Also, it is crucial to recognize when mistakes are being made, and to take action.

3.6.5 Economic perspectives

Questions at this stage are essentially the same as at the previous stage. Key issues are (a) the extent of and (b) the reasons for divergences between appraisal projections and observed performance in relation to:

- the impact on poor people;
- demand;
- supply;
- level and use of subsidy;
- O&M expenditure; and
- adequacy of cost recovery.

Adoption rates of new facilities
It is important at this stage to monitor who actually uses the new facilities and to what extent, that is the number of connections to a new system or users of new facilities and, for water, their consumption levels. The adoption rates determine the financial sustainability and economic justification for the project. The sustainability of benefits is in turn crucially dependent on the operational performance of the utility, or the robustness of the O&M arrangements put in place for community-managed schemes. It is also dependent on the project having met peoples' needs.

Are funding arrangements for the O&M of projects working satisfactorily?
A major weakness in past projects has been the lack of funding for O&M. Actual O&M expenditure should be monitored closely against that forecast, and compared with what is required. For community- or village-level managed projects there may be issues of lack of trust in the accountability and transparency of user committees, which should be investigated in tandem with social monitoring.

Has the utility achieved its cost-recovery targets?
Financial and operational weaknesses are the main cause of low standards of service of water and sanitation utilities, and so progress made by the utility in reforming its financial and operational performance provides a key indicator of project sustainability. Points to establish are: is the utility meeting all capital and operating costs, except those met by transparent public subsidy? Has the tariff structure been reformed in line with revenue objectives? Are collection rates improved sufficiently? Is subsidy policy clear in its objectives and strategy? Are households receiving regular and reliable water supplies?

Are the new facilities in working order and being used?
It is important to check the number of new water points that are in operation *and in use*. Where water-points are functioning, not all people will use them for all of their needs, all of the time. Conversely they may be forced to use malfunctioning water-points in the absence

of alternative sources. A possible classification of functioning and use is shown in the box below. For details of approach and indicators of use see White, 1997. Where water points are not in use it is important to distinguish between those where people chose to return to their traditional water sources and those which are broken down.

Improved water supplies functioning and in use: Borehole rehabilitation programme in Uganda

Boreholes	Total	Percentage
No. rehabilitated	215	100
In heavy use	75	35
In moderate use	53	25
In light use	26	12
Not in use	61*	28
Functioning satisfactorily	132	61
Functioning satisfactorily and in moderate or heavy use	118	55

** of which 48 (22 per cent) were abandoned, not broken down*


SCF/Alan Nicol

Have the poor benefited from the project?
Are poor households receiving a minimum level of water to meet their basic needs at an affordable price? What measures have been put in place (possibly within the context of reform of a utility's cost-recovery programme) to protect the poor, e.g. lifeline or block-level tariffs, and have they had the intended effect? Have the poor benefited in other ways, e.g. in the form of cost savings? Have some opted for private connections or individual latrines?

3.6.6 Institutional perspectives

How can institutional support be encouraged to ensure sustainability after DFID has withdrawn from the project?
All institutional project initiatives should be working towards this phase when DFID withdraws its support. This implies that those initiatives should be realistic and not over-ambitious, to avoid donor dependence. There are means of developing longer term on-going institutional support, particularly for new or weak institutions, and these include:

- encouraging the use of local consultants, NGOs, and the private sector by the concerned organizations on an ongoing basis, providing guidance as appropriate;
- promoting better linkages between key institutions by such measures as joint reviews of the allocation of responsibilities, management agreements, and the use of benchmarking;
- support to nearby training institutions during the project who can continue to provide appropriate support during the operation phase; and

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- promoting the development of an appropriate monitoring system that will produce information for and maintain the interest of other key institutions. Good institutional monitoring information will also be invaluable for the Evaluation phase.

Sections 3.6.5 and 3.6.7 on the economic and technical perspectives of the Operation & Monitoring Phase also address institutional-related issues.

3.6.7 Technical aspects

Monitoring of appropriate indicators must continue throughout the operational period. Narayan (1993) provides a comprehensive list (Table 3.6.1) which includes many technical indicators. In addition, specific indicators may be developed for the particular circumstances, as described in the following paragraphs.

Are the facilities being operated in the way they were designed to function?

It is important to monitor the mode of operation that is being employed for the new facilities, because this may affect the quality of the service being provided and the long-term sustainability of the infrastructure. For example, if a new borehole pump was designed to run for twelve hours continuously each day, this regime should be adhered to. If the pump is run more erratically then increased mechanical wear and tear will reduce the design life of the pump, and storage reservoirs will not be fully used. The root cause of this problem needs to be investigated: it may be that the original regime was not designed in agreement with the future operators. The situation should be reviewed so that an acceptable and sustainable mode of operation can be achieved.

Is the design level of service being achieved in practice?

The facilities should be monitored to ensure that they are being used and are providing the design levels of service to all users. Depending on the complexity of the scheme, this may involve checking operating pressure and discharge at standposts, checking water quality, or ensuring that communal water points are draining properly. Monitoring of on-site sanitation facilities could include smell, flies, and stability of construction.

Are technological constraints preventing people from using the facilities?

There may be simple design reasons why users, especially women and children, are not using the facilities: headwalls may be too high, handpumps hard to operate, latrines considered unsafe, etc. These constraints must be identified and rectified if possible.

Is routine preventative maintenance being carried out?

Routine preventative maintenance will include changing washers in handpumps and taps, greasing bearings, and other straightforward tasks that would probably be the responsibility of the community. If these jobs are not being done regularly, then the life of the installations will be reduced and the system will eventually fail.

Table 3.6.1 Indicators of progress in water and sanitation programmes

Sustainability		
S.1	**Reliability of Systems**	
	S.1.a	Quality of water at source
	S.1.b	Number of facilities in working order
	S.1.c	Maintenance
S.2	**Human capacity development**	
	S.2.a	Management abilities
	S.2.b	Knowledge and skills
	S.2.c	Confidence/self-concept
S.3	**Local institutional capacity**	
	S.3.a	Autonomy
	S.3.b	Supportive leadership
	S.3.c	Systems for learning and problem-solving
S.4	**Cost-sharing and unit costs**	
	S.4.a	Community contribution
	S.4.b	Agency contribution
	S.4.c	Unit costs
S.5	**Collaboration among organizations**	
	S.5.a	Planning
	S.5.b	Activities
Effective Use		
E.1	**Optimal use**	
	E.1.a	Number and characteristics of users
	E.1.b	Quantity of water used (all purposes)
	E.1.c	Time taken to use facilities
	E.1.d	Management of water resources
E.2	**Hygienic use**	
	E.2.a	Water quality at home
	E.2.b	Water transport and storage practices
	E.2.c	Home practices to improve water quality
	E.2.d	Site and home cleanliness
	E.2.e	Personal hygienic practices
E.3	**Consistent use**	
	E.3.a	Pattern of daily use
	E.3.b	Pattern of seasonal use
Replicability		
R.1	**Community ability to expand services**	
	R.1.a	Additional water/latrine facilities built
	R.1.b	Upgraded facilities
	R.1.c	New development activities initiated
R.2	**Transferability of agency strategies**	
	R.2.a	Proportion and role of specialized personnel
	R.2.b	Established institutional framework
	R.2.c	Budget size and sheltering
	R.2.d	Documented administrative/implementation procedures
	R.2.e	Other special/unique conditions

Narayan, 1993

WEDC/Sarah Parry-Jones

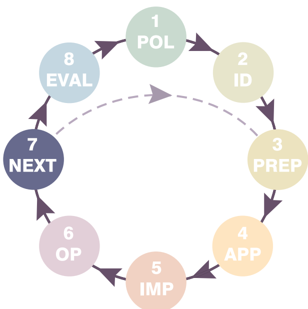
The reason for failure to maintain the system must be identified. It may be due to a lack of spare parts or tools, or because the people originally trained under the project have moved on without passing on their knowledge and expertise.

Have any external changes taken place which are affecting operation?
Physical conditions may have changed during the life of the project to make the system less efficient (for example: change in groundwater level or flow of river, new developments or settlements, political problems, change in water quality). These changes should be monitored and the need for modification or upgrading may need to be considered.

3.6.8 Hygiene and sanitation promotion

Operation, for a software intervention, does not have the same meaning as ensuring that the hardware is working and is being maintained. But this is the stage at which the impact of social marketing should be evident in behavioural change, as people become accustomed to having the improved WS&S services available. We can look too at the longer term on a more institutional level: have hygiene promotion and sanitation promotion and other consumer-oriented methods been adopted by the Ministry of Health and other departments?

Has the Ministry of Health, or other partner responsible for hygiene promotion and sanitation promotion, developed standard operating procedures for promotional projects and for checking the reliability of such approaches? Are these procedures used?



3.7 Stage 7: Programme and project extensions or next phase programme and project identification

3.7.1 General

This stage in the cycle does not strictly follow Operation, but rather occurs at about the time of the Implementation/Operation transition, when possibilities for replication of the project are considered, taking account of lessons learned in the previous work. If the project has been successful, there are likely to be opportunities for building on the partnerships which have been established and expanding the successful approaches to wider areas as part of a continuing programme. With the partnership approach, this process may become expected as a normal part of the cycle and the long-term programme.

3.7.2 Social development perspectives

It is often at the review stage of the programme cycle that a social development perspective, gender issues, or participatory approaches can be revisited. Renewed efforts can be made to introduce or extend these approaches in the process of reviewing the first phase of a programme or project and of identifying extensions or subsequent

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phases. It may be that while DFID is wedded to gender awareness and participatory approaches, other stakeholders in water supply and sanitation may be less familiar with these agendas or hostile to them. In this case discussion is needed to build consensus and decide a mutually satisfactory approach.

Have all stakeholders been identified and involved?

At this stage it is valuable to do a further stakeholder analysis. On the one hand this can identify whether additional affected populations have emerged as a result of the project, and on the other, whether some stakeholders have changed their level of involvement in participatory processes. Even if the project was initially identified by donors or government institutions without any commitment to participation, it is possible at this point to rectify this by detailed consultations with users or affected groups.

Is the project being informed by the priorities and views of user groups?

The views of poor and marginalized people are important in ensuring that the visions and priorities of the public sector and of donors supporting the water supply and sanitation sector match those of user groups. At the level of policy, experience from first phases can be used to illustrate the benefits of participation or to show what can go wrong if user groups are not involved in decision-making from the outset.

Have there been any changes in institutional roles and relationships affecting the project?

Changes in institutional roles and relationships can be identified at this stage. For example, local organizations might be more robust and engaged, or those working in ministries or parastatals may have learned the value of wider consultation and participation by the end of the first phase of the project. There may be extraneous influences as well, such as the formation of a new women's organization or the impact on a project area of other development projects and their structures.

What changes affecting the policy framework have taken place?

At this stage it is also useful to identify important changes relevant to social development issues since project inception or the last review. For example, have there been changes in government policy relevant to water supply and sanitation? This could include new legislation regarding land tenure which might improve access or rights to water sources, or community-based finance initiatives which could be used towards funding water supply or sanitation facilities.

Has capacity building at the local level influenced sector policy?

Where the capacity of primary stakeholders has been strengthened through participation in the design, implementation, and management of projects, this may be built on to strengthen their capacity in contributing to policy debate. It is at this stage in the programme cycle that the involvement of local representatives beyond the project and at policy and programme level can be considered.

3.7.3 Water, sanitation, and health

What has been learned during the project or programme about how to increase health benefits?

Do these lessons suggest further projects or programmes? If work to date has been successful, the task of identifying new projects is simplified, as effective project partners will be quick to point out bottlenecks that may be amenable to change. If work to date has been unsuccessful, this begs the question of 'why has the work failed?' which may (or may not) identify further work to be done.

3.7.4 Environmental issues

The process of setting up environmental monitoring practice will have raised capacities and expertise in the planning and implementing team. As environmental impact assessment and monitoring is a specialist process, it makes great sense to seek to take advantage of this raised level of capacity on other projects.

Environmental monitoring is not an exact science, as the 'environment' is a complex and diverse entity. Procedures and practices should be continually under review, and the implementers should not be afraid to act on the results — even if they are not as expected and even not popular. Environmental degradation may take a long time to reverse, and may be irreversible in some circumstances.

Replication of lessons learned may naturally lead to development of a integrated national or regional policy on some aspects of the environment, such as the development of Integrated Water Resource Management policies as discussed in Section 2.4.4 — if they are not already in place.

3.7.5 Economic perspectives

The same steps will need to be gone through as at the preparation and appraisal stage, but informed by the monitoring and evaluation stage.

3.7.6 Institutional perspectives

Is there willingness and capacity for replicating or scaling-up institutional arrangements for the next phase?

While institutional arrangements may not be totally established for the long-term management of the facilities on the current phase, a decision needs to be made concerning if and how it is advisable to move to the next phase. Factors to be considered include:

- The progress on the design and implementation of institutional and financial arrangements, assessing reasons for any delays;
- Are there sufficient key project stakeholders participating in the development of institutional arrangements on the current phase and advocating their use elsewhere?
- What are the lessons on the current phase for replication elsewhere, and are the lessons generally agreed? What changes are required for a more effective next phase?

- Are there signs of a willingness to replicate elsewhere regardless of whether the next phase will be supported by DFID?
- Are there viable plans for replication/scaling-up institutional arrangements for the next phase?
- Should project rules or conditions be amended for the next phase?

Institutional aspects are also discussed in Section 3.7.2.

3.7.7 Technical aspects

Is it appropriate to promote replication or expansion of the chosen technology to other project areas?

Even if the technology choice has proven to be popular and sustainable in a given project area, it may not be suitable for replication and standardization in other areas. This will depend on the physical characteristics of the new project area (topography, hydrology, distance from existing infrastructure, etc). However, as already discussed in Section 2.7.4 and 2.7.5, replication and standardization are desirable. If the technology is to be replicated it is essential to examine lessons learned and carry these forward. Particular lessons will be identified through monitoring (Section 3.6.7) and evaluation (Section 3.8.7).

3.7.8 Hygiene and sanitation promotion

One of the aims of social marketing is to develop an inbuilt impetus for communicating key messages within the target communities. In some cases, this may be transferred to neighbouring communities and contribute to the demand for further improvements. We must, though, be aware that the effects of social marketing may be transitory.

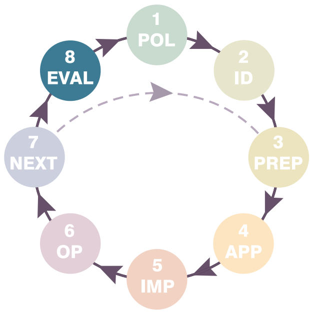
What are the main limitations of social marketing in hygiene promotion and sanitation promotion?

The main limitation to the success of consumer-oriented projects is the persistence of habit. There is some evidence that, with the right message positioning, new behaviours such as hand-washing with soap may be sustained for six months or more. Continuous reinforcement depends on how well established hygiene education becomes within the community concerned.

How long does it take to create demand?

It is a long process to transform a behaviour or establish a household good, which may at first be alien, into an integral part of everyday life. Even when this status has been achieved, it must be maintained by promotion and marketing. The curve representing the adoption of innovations has a long slow start (see Rogers, 1983 and the introduction to Section 2.8). If the message is appropriate and the intervention attractive it will rise steeply. Coca-Cola is an oft-quoted example of the continual need for reinforcement by promotion. After nearly a hundred years of promotion, the manufacturer continues to check message positioning and invest heavily in selling the brand.

What is the geographical scope of hygiene promotion and sanitation promotion?
As the project or programme increases in size there will be some trade-off in direct relevance to particular groups and communities. This can be compensated for by the degree of endorsement and support the messages received from other areas of society.



3.8 Stage 8: Evaluation

3.8.1 General

Evaluation is undertaken after several years of operation, and should make use of material in the previous sections to analyse project performance at the earlier stages. Additional issues arising at this stage concern the assessment of impact, the drawing of appropriate lessons, and feedback of these lessons into both DFID's programme and project cycle management, and the country's own sector planning processes. Evaluation focuses on the Outputs, Purpose, and Goal levels of the logical framework. Table 3.6.1 can be used as a guide to suitable indicators, and both Narayan (1993) and WHO (1983) are valuable references for the evaluation stage.

3.8.2 Social development perspectives

Evaluation is important for process projects and for a learning approach to water supply and sanitation provision. A key question for DFID staff looking to integrate social dimensions into water supply and sanitation provision, is whether the terms of reference for the evaluation clearly specify the social development issues and questions to be addressed in the evaluation, and whether they clearly identify what DFID and its partners want to know about the social impact of the project. As with other stages of the project cycle, clear and acceptable terms of reference can be formulated once there is agreement on what should be learned.

Evaluations provide the opportunity to assess whether the aims and objectives of DFID's White Paper have been followed and the extent to which a project has contributed to the achievement of poverty reduction, gender equality, and partnership. However, evaluations frequently limit themselves to assessing the objectives stated in the project logframe, rather than broader issues of DFID policy. Thus it is important to specify that an evaluation should also review project design and implementation in terms of how it has contributed to the achievement of DFID's broad development objectives.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Particular methodologies best provide information on social issues. It is important, therefore, to specify that the evaluation team includes a member with the requisite skills to undertake social analysis. Support should be provided to the people with responsibility for social development issues, who in turn should have clearly defined roles so that they can effectively carry out their responsibilities. This task cannot be relegated to a junior team member.

Finally, the terms of reference for the evaluation should include a section on ‘lessons learned’ and this should include lessons learned with respect to poverty reduction, equality issues including gender equity, participation, and partnership. This will avoid losing the opportunity to learn social development lessons from experience. There may also be scope for communicating and discussing the lessons learned through feedback seminars and other forms of meetings. To be consistent with information-sharing approaches in monitoring and review, the evaluation should be shared with primary stakeholders who may also be involved in the evaluation process.

What follows are some questions deriving from a social development perspective that might inform evaluation of water supply and sanitation projects. The list is indicative rather than exhaustive. Questions on project design and implementation:

- Was the project concerned with poverty reduction through water supply and sanitation?
- Did the project consider issues of equity in design, including technological choices and cost-recovery mechanisms?
- Was the project based on an understanding of gender issues, particularly how women and men use water for productive and domestic uses?
- Was the data collected adequate and sufficiently disaggregated to allow an assessment of change or improvement as it affected different groups in the community?
- Was the project planned specifically to include community-level participation and to involve women and men equally?
- Did primary stakeholders participate in project design and planning, including siting of installations, technological choice, and decision-making regarding cost sharing? Did women participate to the same extent as men?
- Were project implementers able to respond to social issues that arose during implementation?

Questions on resources and activities:

- Were sufficient resources allocated to social impact and stakeholder analysis during the project cycle?
- Were resources allocated to local capacity building used appropriately?
- Were both women and men involved in community-based organization and structures and were their respective priorities included in final decision-making?
- Was the technical assistance provided supportive or undermining of a participatory approach?
- Were activities included to enhance the understanding of social development perspectives among secondary stakeholders?

- Do new technologies introduced by the project reflect the priorities of different groups at community level, associated with domestic and productive water use?
- Have the specific needs and priorities of women and men been taken into account in the design of water supply and sanitation facilities?

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Questions on socio-economic impact:

- Has the intervention met the immediate needs of poor groups and has it recognized the different needs of women and men?
- Has the intervention affected patterns of land use, access to, and control over water resources and other productive assets?
- Are the benefits of the project reaching all the people targeted?
- Has the project provided income-generating opportunities for micro-entrepreneurs or local employment opportunities?
- Has the project improved the status of poor and marginal groups and of women?
- Has the project affected the ability of people at the local level to participate in the management of water resources and sanitation facilities?
- Are governments responding more effectively to the immediate needs and expressed priorities of communities?

3.8.3 Water, sanitation, and health

How have hygiene behaviour, water consumption, and use of sanitation changed over the course of the project/programme?

These three ‘indicator groups’ are critical to establishing health benefits. The most appropriate indicators will vary from project to project, and, in the case of hygiene, will themselves be a product of project preparation. These three areas, however, will be the key to health improvement in water and sanitation projects.

How have conditions changed at the household level?

This question is implicit in the above, but is restated to make clear that, for most projects, health benefit evaluation must focus on changes at the household level. Some project components may address system-wide problems (e.g. water treatment for urban water supply) but even these must be translated into changes at the household level. If, for example, drinking water leaving the waterworks is free of contamination, but most household samples remain significantly contaminated because of contamination due to the intermittent water supply, then few if any health benefits can be claimed.

3.8.4 Environmental perspectives

The environmental consequences of any action in a project may not become apparent until several years after the project is completed —

many environmental aspects are very long term in their nature. Therefore it is important that a long-term review is undertaken to gauge the lessons that can be learned. This is important for replication of projects, as discussed in Section 3.7.4.

At this stage, environmental monitoring at every stage of the project cycle should have revealed:

- how the project has performed against the environmental objectives;
- whether the objectives as set were realistic;
- what unexpected environmental implications have arisen, and how these have been dealt with; and
- what positive as well as negative environmental impacts have occurred as a result of the project implementation.

Long-term evaluation should consider such aspects as:

Were all the environmental factors correctly identified and considered in the execution of the project?

Have the environmental effects of the project been essentially as predicted?

Have there been unexpected environmental consequences of the project which, with hindsight should have been foreseen?

The responses to these questions should be fed back, so that the experience can be used for future projects. At this stage, implementation of the project will have developed environmental capabilities of project staff. All lessons can be used to feed directly into wider environmental policy making which is an integral part of any developmental strategy.

3.8.5 Economic perspectives

Did benefits exceed costs?

This requires quantification of benefits, as identified at project appraisal, or modified during subsequent stages of the project cycle, plus unforeseen benefits. Were benefits of the right magnitude forecast at appraisal, and if not, was this because demand was not adequately met? This will require fieldwork. Costs are relatively easy to obtain from engineering figures.

Is the project financially sustainable?

Was the project cost-effective?

This is best done by comparison with costs of similar projects in-country.

Is the project financially sustainable?

This requires a repeat of the approach adopted at the preparation and design stage, informed as necessary by work done at subsequent stages.

3.8.6 Institutional perspectives

How to evaluate institutional project components?

Participatory evaluations with project partners should be encouraged, with prior agreement on key indicators, particularly at the Project Purpose level. This requires early agreement on the scope of the evaluation at the project operation and monitoring stages. Institutional indicators can cover areas such as the reliability, adequacy, operation and use of the facilities, cost recovery, HRD, staffing, and management systems.

Much of the institutional evaluation information should hopefully come from on-going monitoring data gathered by the institutions concerned with O&M, cost recovery, regulation, and facilitation.

When assessing project management systems, it matters less whether the systems differ from those originally conceived, but more emphasis should be placed on the extent to which the stakeholder institutions are using systems that address the objectives relating to sustainability.

A key indicator of the effectiveness of institutional initiatives during a project is the extent of replication of those initiatives. This is particularly true with government implemented projects. This may entail moving outside the logical framework, exploring how project initiatives have been used elsewhere.

The social development, economic, and technical sections dealing with the Evaluation phase also address institutional issues.

3.8.7 Technical aspects

Are the design assumptions used to develop the project valid?

The technical data and design assumptions used to develop the project need to be assessed. Any impacts resulting from poor quality data or inaccurate assumptions should be identified to benefit future project development. The importance of baseline data may be crucial to the sustainability of a chosen technology.

Has coverage of water supply and sanitation increased?

If the purpose of the project as defined in the logframe is to increase coverage of water supply and sanitation, then the physical hardware element of this needs to be measured during evaluation. A number of indicators on outputs can be used, including: number of water points in use, per capita consumption of water, number of latrines in use, number of leaks reported, etc. (See also Table 3.6.1).

Was the choice of technology driven by the community?

The reactions and attitudes of all the end-users need to be assessed in order to evaluate the effectiveness of the demand approach. If a community is unhappy with an installed technology they will tend to customize or modify the facilities to suit their needs. Such changes should be noted and any feedback loops should be evaluated to ensure that stakeholders views are known.

Is there an adequate training programme for ongoing O&M?
The training of operators must continue throughout the life of a project in order to ensure sustainability. The systems in place to provide the appropriate level of training to the relevant stakeholders should be assessed.

Did changes to project budgets unduly constrain technology choices?

3.8.8 Hygiene and sanitation promotion

Was the output achieved?
The project must be evaluated by somebody who was involved in neither the preparation nor the implementation of the project.

What impact can be identified from hygiene promotion and behaviour change?
It takes skill and sensitivity, but these behaviours can be evaluated. A number of tools are available for evaluating hygiene behaviour, see Almedom et al. (1997).

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1. Urban water, sanitation, and hygiene promotion project

Narrative summary	Objectively verifiable indicators	Means of verification	Risks/Assumptions
GOAL			(GOAL to SUPERGOAL)
	Water consumption at household (HH) level increased to 40 lpcd in 2,000 low-income HHs converted from public taps to yard connections by year Z	Use of building water meters plus interviews with consumers (meters unreliable in intermittent supplies)	
	Average price of water sold by vendors reduced by X% (1998 prices) by year Z	Market survey	
Sustainable improvement in health and well-being for N,000 poor people in City X	In peri-urban fringe areas supplied by distant taps, water consumption at HH level increased from <10 lpcd to 15 lpcd among 8,000 HHs by year Z. Among the population with travel times now >30 minutes, average travel time reduced to 20 minutes by year Z	Interviews, observation at HH level	• Socio-economic and political conditions provide supportive environment for expansion of community-based demand-led approach to WS&S in other cities
	Safe hand-washing practice, as identified in project outputs, increased x% among adults, and increased y% among school-age children in service population by year Z*	Observation by local social scientists, for comparison with baseline survey	• Sufficient effort is made to document and disseminate results in City X so that they can be applied elsewhere
	Hygienic use and maintenance of sanitation facilities by S% of the households involved by year Z*	'Spot checks' during household visits by local healthworkers, checking for cleanliness of slab, access to soap and water, evidence of use	• Infrastructure improvement does not lead to further displacement of poor from where they live to sites with worse environmental health conditions
	Safe management of children's stools practised in q% of households with children within service population by year Z*	Observation by local social scientists, for comparison with baseline survey; Coverage: HH survey	

* Values for these indicators, and details of target behaviours, to be determined as part of Hygiene Strategy output. Alternatively, if Hygiene Strategy output is performed as part of sound project preparation, these values may be included here.

Narrative summary	Objectively verifiable indicators	Means of verification	Risks/Assumptions
PURPOSE Establishment of sound, sustainable environmental services for N,000 poor people in • water supply, • sanitation, and • hygiene promotion in City X by year Y	85% coverage of target population by competent hygiene promoters by year Y	Competence of promoters: interviews and field observation by external consultant Review of behaviour in communities already served, for comparison with baseline	Experience from pilot studies ensures correct positioning and appropriate messages to change behaviour to improve health Necessary WS&S interventions keep pace
	• 80% of installed public water points, and • 80% of installed latrines are in good working order (Y - X) years after completion	Field inspection of sample	Water utility is in financial position, with management commitment, to continue maintenance to low-income areas
	80% of population are within two kilometres of a commercial sanitary mart by year Y	Mapping, demographic data, surveys	Population growth is mostly within service area, not outside it
	Services for N,000 people require <10% subsidy of recurrent cost by year Y	Accounts from public utilities, service providers	Government policy and economic conditions permit sustainable growth
	Utility investments for extended coverage for the poor increased by 20% by year Y	Accounts from public utilities, service providers	As above
	Demand for services from sanitary marts increases by at least 5% p.a. by year Y	Accounts from sanitary marts	As above

Narrative summary	Objectively verifiable indicators	Means of verification	Risks/Assumptions
OUTPUTS TO INCLUDE:			
Build 2,000 yardtaps in low-income households on a sustainable basis by year X	No. of yardtaps built by End of Project No. of taps in good working order two years after installation Receipts from billings for these taps	End of Project survey Inspection Financial records	Water utility is in good financial position, with management commitment, to continue services for low-income areas
Establish effective low-income HH task force in water utility by year X Establish N* competent and sustainable hygiene promotion (HP) teams by year X	Targets and investment budgets established by year X for extending yard connections to the poor, consistent with financial status of utility	Interviews with water utility, task force members, meeting minutes	As above
Establish N viable and sustainable sanitation promotion (hardware) teams by year X	Promotion strategy and tools are sound Pre- and post-hygiene behaviour in target areas meets strategy targets by year X Future funding assured by mix of Ministry of Health (MoH) budget and sanitary mart profit by year X Staff levels meet strategy targets by year X Sanitation promotion teams require only 10% financial subsidy by year X and three out of five are entirely self-sufficient	Programme review by external consultant with HP team members, community leaders, residents Budgets of state government Review of past, current, and future programme of work, management, and financing arrangements Sales figures and costs, management practices, materials and approaches used, sources of funding	Experience from these teams provides sound basis for HP expansion Necessary WS&S interventions keep pace Sanitary marts successful enough to defray some HP costs Government policy is consistent with demand-led approach, and allows teams and marts to make a profit
Establish N viable and sustainable sanitary marts to produce latrine slabs, sell sanitary goods, and assist in latrine installation by year X	No. of latrine slabs sold per month No. of latrines installed per annum No. of sanitary goods sold Revenues	Field surveys Review of records, tests Review of accounts	As above
Construction of N viable, fully functioning and adequate community-managed water supplies, serving Z,000 poor people by year X	No. of enquiries about franchise No. of hours/day of water in poor HH areas Water quality meets criteria 85% of time Supplies meet operating costs X% of water points achieve design discharges		Government policy encourages expansion of community-managed approach
Community based O&M and cost recovery system established and functioning	Routine and preventative maintenance undertaken satisfactorily on X% of water systems X% of adequate water charges collected each year	Evaluation reports CBO accounts	Adequate supple of spare parts by private sector Back up support provided by government

Narrative summary	Objectively verifiable indicators	Means of verification	Risks/Assumptions
ACTIVITIES TO INCLUDE:			
Develop area-wide Hygiene Promotion Strategy, materials, and programmes	Draft and final versions of material by year X-2	Quarterly progress reports, interim reports, review meetings	Agencies and partners in health, water, and hygiene sectors are supportive of approach
Hygiene Promotion workers trained and functioning	*m** complete training courses by year X Hygiene promotion completed in Y h/hrs	Quarterly progress reports, interim reports, review meetings	Incentives are sufficient to keep hygiene workers in sector; stability of employment
Pilot hygiene promotion among population of X,000	Videos and reports of activities up to year X (for effectiveness of promotion, see Purpose indicators for year Y)	Quarterly progress reports, interim reports, review meetings	Pilot areas, as selected during project design, are representative of overall target communities
Water utility HRD in • Distribution & HH connection • revenue collection	*p* finish Distribution training courses by year X *q* finish accounting courses by year X	Quarterly progress reports, interim reports, review meetings	Utility permits expansion of HH connections among low-income groups
Sanitation promotion NGOs trained and functioning	*n** complete training courses by year X Sanitation promotion completed for Y households	Quarterly progress reports, interim reports, review meetings	Incentives and policies (e.g. subsidies) of other donors, government agencies do not conflict
Build five sanitary workshops	five workshops built by year X	Project Completion Survey	Continuity and stability of funding base and consumer demand permit sustainability of workshop
Build latrines	1,000 built by year X	Project Completion Survey	Hygiene promotion is effective in encouraging appropriate use
Public water point and yardtap sites agreed to serve population of X*,000	Community representative's sign water system construction and management agreements for population of X'000	Project Completion Survey	Economic and political conditions, including demand, permit community management of WS
Train Community Management Teams	10 trained by year X	Project Completion Survey	Economic and political conditions, including demand, permit community management of WS
Participative demand assessment studies completed	X no. of households agree to project rules including community contributions		
Develop and agree long term management arrangements with local government	Agreements documented		

* Values for these indicators to be determined as part of the Hygiene Promotion Strategy developed in this project's preparation.

Narrative summary	Objectively verifiable indicators	Means of verification	Risks/Assumptions
PROJECT PREPARATION TO INCLUDE:			
Data collection and pilot strategy development for hygiene promotion	Study Report on Hygiene Strategy re: water use, sanitation, and hand-washing	Quarterly progress reports, interim reports, review meetings	Project is approved by both DFID and host country government Sites chosen for formative research are suitably representative
Review of existing health and hygiene promotion and water sectors	Study Report on existing players in the sectors, examining MoH, educational, and other government players as well as NGOs and CBOs	Quarterly progress reports, interim reports, review meetings	No sudden shifts in sector policy or priority re: hygiene promotion
Hygiene promotion training workshops	Participant involvement and learning in workshops	Participant evaluation forms, participant products, outputs	Sufficient financial incentive and stability to make continued participation viable
Technical Assistance (TA) to NGOs/CBOs in planning hygiene promotion pilot programme	NGO/CBO willingness to participate in pilot programme NGO/CBO understanding of requirements for pilot work	NGO/CBO plans and proposals for further involvement	Funding for hygiene pilot programme is assured, and disbursed rapidly enough
Review of existing channels for sanitation promotion	Study report on sanitation promotion, describing who does what and how for how much in sector	Quarterly progress reports, interim reports, review meetings	Sector is open to ‘poverty focus’ and demand-led approach
Review of high priority areas for improved water supply services	Well-argued case for areas of highest priority for water supply improvements, including quantitative estimate of no. of people benefiting and in what ways	Quarterly progress reports, interim reports, review meetings	Sector is free to investigate needs of informal, illegal residents
TA, materials for pilot water supply extension	Construction progress reports compared with plans, specifications and schedules (contracts)	Quarterly progress reports, interim reports, review meetings	Water agency willing to give project work priority for completion
TA, materials for NGOs/CBOs on pilot sanitation promotion	NGO/CBO willingness to participate in pilot programme NGO/CBO understanding of requirements for pilot work	NGO/CBO progress reports, and plans and proposals for further involvement	Sewerage agency/city government support ‘poverty focus’ and demand-led approach

2. Rural water, sanitation, and hygiene promotion project

Narrative summary	Objectively verifiable indicators	Means of verification	Risks/Assumptions
GOAL Sustainable improvement in health and well-being for N,000 villagers in Region R	Water consumption at household (HH) level increased from <10 lpcd to 15 lpcd among 8,000 HH by year Z	Interviews, observation at HH level	(GOAL TO SUPERGOAL) • Public works department continues commitment to maintenance support for larger systems in disadvantaged areas • Political conditions remain favourable for governmental support to these and other target communities • Economic conditions remain favourable for continuation and expansion of community-based demand-led approach to WS&S • MoH continues support for extension work on hygiene promotion • Economic conditions and demand foster viability and growth of sanitary workshops • Ministry of Education can and does maintain support for, and expansion of, hygiene education and demonstration in schools
	80% of installed water supplies are in good working order and use 10 years after installation	Inspection of random sample of x systems	
	80% of latrines constructed are in use (or upgraded) five years after project completion	'Spot checks' during HH visits by local healthworkers, checking for cleanliness of slab, access to soap and water, evidence of use	
	Regular maintenance and emergency repairs as necessary are achieved on 80% of the handpumps and spring systems five years after project completion	Inspection of a random sample of systems Maintenance records, interviews with villagers	
	Safe management of children's stools practised in q% of HHs with children in target population by year Z	Observation by local social scientists, for comparison with baseline survey	
	Safe hand-washing practice, as identified in Hygiene Strategy, increased x% among adults, and increased y% among school-age children in target population by year Z	Observation by local social scientists, for comparison with baseline survey	
	80% of water and sanitation facilities at schools in the project area are in satisfactory condition five years after project completion	Inspection	

Narrative summary	Objectively verifiable indicators	Means of verification	Risks/Assumptions
PURPOSE Establishment of sound, sustainable environmental services for N,000 poor by year Y in: • water supply, • sanitation, and • hygiene promotion	85% coverage of target population with water supplies requiring <30 mins round trip travel time by year Y. Capacity of system from source to public waterpoints adequate water to ensure 20 lpcd for year 2010 population	Field survey	Increase in irrigation demand is met without prejudice to safe yield for village water supply
	80% of installed public waterpoints, and 80% of installed latrines are in good working order (Y-X) years after project completion	Field surveys Evaluation reports	Department of Public Works maintains political commitment to continue repair services for low-income areas
	85% coverage of target population by competent hygiene promoters	Coverage: HH survey Competence of promoters: interviews and field observation by external adviser Review of behaviour in communities already served, for comparison with baseline	Experience from pilot studies ensures correct positioning and appropriate messages to change behaviour to improve health Necessary WS&S interventions keep pace
	Services for N,000 people require <10% subsidy of recurrent cost by year Y	Accounts, records of local committees	Government policy maintains 'ring-fence' of funds for WS&S, and suitable cross-subsidy within sector
	Demand for services from sanitary marts increase by at least 5% a year by year Y		Government policy and economic conditions permit sustainable growth and expansion of marts

Narrative summary	Objectively verifiable indicators	Means of verification	Risks/Assumptions
OUTPUTS TO INCLUDE:			
Establishment of N viable and sustainable hygiene promotion teams within the MoH to cover target population of Y,000, by year X	Promotion strategy and tools are sound Pre- and post-hygiene in target areas meets strategy targets by year X Future funding assured by mix of MoH budget and sanitary mart profit by year X Staff levels meet strategy targets by year X	Review of past, current, and future programme of work by consultant with HP team members, community leaders, and residents Hygiene evaluation procedures Budget, staffing, and financial plans	Relevant authorities continue to support hygiene promotion approach Experience from these teams provides sound basis for HP expansion WS&S interventions keep pace Sanitary marts successful enough to defray some HP costs
Establishment of five viable and sustainable sanitation promotion (hardware) teams which sell no less than x	Sanitation promotion teams require only 10% financial subsidy by year X Three out of five are entirely self-sufficient	Sales figures and costs, management practices, materials and approaches used, sources of funding	Government and other External Support Agency (ESA) policy re: subsidy of promotion, not the product, supports viability of demand-led approach
Construction of N viable,fully functioning and adequate community-managed water supplies in low-income villages by year X	Sufficient revenue is generated from the community to cover running costs, with 10% margin set aside for repairs X% of water points achieve design discharges Beneficiaries within 1000m of water point No of days without supply <X days in first year	Field surveys Review of records, tests Review of accounts	Socio-economic conditions permit wider use of community management approach
Establishment of N viable and sustainable sanitary workshops for sale of latrine materials, sanitary goods, and assistance with latrine construction, by year X	No. of latrine slabs sold per month No. of latrines installed per annum No. of sanitary goods sold Revenues No. of enquiries about franchise	Sales figures and costs, management practices, materials and approaches used, sources of funding	Government and other ESA policy re: subsidies supports viability of demand-led approach
Community based O&M and cost recovery systems established and functioning	Routine and preventative maintenance undertaken satisfactorily on X% of water systems O&M budgets produced in X% of villages X% of adeuate water charges collected each year	Village accounts Independent evaluation reports	• Adequate supply of spare parts by private sector • Back up support provided by local government

Narrative summary	Objectively verifiable indicators	Means of verification	Risks/Assumptions
ACTIVITIES TO INCLUDE:			
Strategy, materials, and programmes for hygiene promotion developed	Draft and final versions of material by year X-2	Quarterly progress and interim reports, review meetings	Health, water, and hygiene sectors are supportive of approach
Hygiene promotion workers trained and functioning	No. completing training courses Hygiene promotion completed in X villages	Quarterly progress and interim reports, review meetings	Adequate incentives to keep workers in sector; stability of employment
Piloting of hygiene promotion among population of X,000	Videos and reports of activities (for effectiveness of promotion, see Purpose indicators)	Quarterly progress and interim reports, review meetings	Pilot areas are representative of overall target communities
Sanitation promotion NGOs trained and functioning	No. completing training courses Sanitation promotion completed in Y villages	Quarterly progress and interim reports, review meetings, training evaluation forms	Incentives and policies (e.g. subsidies) of other donors, government agencies do not conflict
Sanitary workshops built	Five built by year X	Project Completion Survey	Continuity, stability of funding base, permits use as intended
Latrines constructed	N built by year X	Project Completion Survey	Hygiene promotion is effective in encouraging appropriate use
Public waterpoint sites agreed within 1000m / construction commenced in villages	Community representatives sign water system constructional management agreements in X villages	Project Completion Survey	Economic and political conditions, including demand, permit community management of WS
Community management teams trained	p finish technical training course by year X q finish accounting course by year X	Quarterly progress and interim reports, review meetings, training evaluation forms.	Economic and political conditions, including demand, permit community management of WS
Participative demand assessment studies completed	X no. of communities agree to project rules including community contributions		
Institutional Dev. assistance to government departments in support of their new roles in Hygiene Promotion and Community Management	Government departments agree to establish new teams		

Narrative summary	Objectively verifiable indicators	Means of verification	Risks/Assumptions
PROJECT PREPARATION TO INCLUDE:			
Data collection on hygiene behaviour	Study report on hygiene practices re: water use, sanitation, and hand-washing	Quarterly progress and interim reports, review meetings	Sites chosen for formative research are suitably representative
Review of existing health and hygiene promotion Sector	Study report on sector, examining MoH, educational, and other government agencies and NGOs, CBOs involved in HP	Quarterly progress and interim reports, review meetings	No sudden shifts in sector policy or priority re: hygiene promotion
Hygiene promotion training workshops	Participant involvement and learning on workshops	Participant evaluation forms, products, outputs	Sufficient financial incentive and stability to make long-term participation viable
TA to NGOs/CBOs in planning hygiene promotion pilot programme	NGO/CBO willingness to participate in pilot programme NGO/CBO understanding of requirements for pilot work	NGO/CBO plans and proposals for further involvement	Funding for hygiene pilot programme is assured, and disbursed rapidly enough
Review of existing channels for rural sanitation promotion	Study report on sanitation promotion, describing who does what and how for how much in sector	Quarterly progress and interim reports, review meetings	Sector is open to ‘poverty focus’ and demand-led approach
Review of high priority areas for improved water supply services	Well-argued case for which areas are highest priority for water supply improvements, including quantitative estimate of no. of people benefiting and in what ways	Quarterly progress and interim reports, review meetings	Sector is free to investigate needs of informal, illegal residents
TA, for rural water supply planning	Definition of suitable technical options for water supply in selected communities	Quarterly progress and interim reports, review meetings	Water agency willing to give project work priority for completion
TA, materials for NGOs/CBOs on sanitation promotion	NGO/CBO willingness to participate in pilot programme NGO/CBO understanding of requirements for pilot work	NGO/CBO progress reports, and plans and proposals for further involvement	Sewerage agency/city government support ‘poverty focus’ and demand-led approach

3. Institutional capacity building for developing participatory approaches in the water and sanitation sector

Narrative summary	Objectively verifiable indicators	Means of verification	Risks/Assumptions
GOAL Sustained improvements in community managed water supply and sanitation services	X% of total population with access to reliable water supply and sanitation facilities at end of project X% of those with access regularly using facilities at end of project Number of new installations still in working order by end of project	Project records; no. of connections per head of population Participatory monitoring and observation Participatory monitoring and observation	(GOAL TO SUPERGOAL): Socio-economic and political conditions provide supportive environment for participatory approach to WS&S

Narrative summary	Objectively verifiable indicators	Means of verification	Risks/Assumptions
PURPOSE			(PURPOSE TO GOAL):
Increased involvement of primary stakeholders, (including marginalized groups) in decision-making and management of water supply and sanitation and other services, supported by WS&S staff and other secondary stakeholders	X% and spread of primary stakeholders reporting satisfaction with water supply and sanitation	Project records End of project participatory evaluation report	Primary stakeholders have sufficient confidence in government officials to work with them on water supply and sanitation project
	X% and spread of primary stakeholders who decide upon or manage (a) siting of installations (b) design and technology choice (c) decisions on cost sharing (d) operation and maintenance (e) cost recovery and (f) monitoring and evaluation	Project records End of project participatory evaluation report	
	X% and spread of primary stakeholders reporting having influenced project and having an improved understanding of official and professional constraints	Project records End of project participatory evaluation report	
	X% and spread of primary stakeholders involved in provision of or demand for other services	Ex-post evaluation survey	
	X% and spread of secondary stakeholders reporting satisfaction with project effectiveness	Project records End of project participatory evaluation report	Government statutory and professional bodies adequately resourced to develop and take up participatory approaches
	X% and spread of secondary stakeholders reporting learning from primary stakeholders and having an improved understanding of community perspectives	Project records End of project participatory evaluation report	
	Officials and professionals adopting participatory approaches in further programmes and projects	Ex-post evaluation survey	

Narrative summary	Objectively verifiable indicators	Means of verification	Risks/Assumptions
OUTPUTS TO INCLUDE:			(OUTPUT TO PURPOSE):
Leadership training programmes completed for all community members to be represented in decision-making	X% and spread of community members and leaders taking up training X% and spread of trainees taking part in decision-making fora	Project documents Participatory monitoring through semi-structured interviews, focus group discussions, feedback sessions with facilitators End of project participatory evaluation report	Primary stakeholders want to be involved and represented
Skills training completed for community members to engage in maintenance and management of installations and hygiene promotion activities	X% and spread of community members taking up training X% and spread of trainees taking up positions and staying in positions	Project documents Participatory monitoring End of project participatory evaluation report	Suitable NGOs exist with the facilitation skills to enable community members to participate
Government implements policy of adopting a facilitatory/regulatory role for community based watsan services	New policy document distributed and agreed Relevant legislation amended X% of government staff in project area adopt new roles		
Capacity building completed for professionals and officials to engage in gender-aware, culturally sensitive, and participatory water and sanitation projects	X% and spread of professionals and officials receiving training X% and spread of trainees participating in joint decision-making fora with communities and including representatives of all user groups	Project documents Participatory monitoring End of project participatory evaluation report	Secondary stakeholders committed to adopting participatory approaches Suitable institutions available and willing to take up capacity-building role in participatory approaches for official and professional training
Development of participatory structures and processes for sustained management of water supply and sanitation	Frequency of meetings between primary and secondary stakeholders Monitoring of different groups and individuals attending meetings Monitoring of different groups and individuals speaking and being silenced at meetings Monitoring of issues discussed and ignored at meetings	Project documents Participatory monitoring End of project participatory evaluation report Participant observation by facilitators	User groups and members have time and resources to engage in capacity building and participatory processes Time and resources are made available for officials and professionals to engage in capacity building and participatory approaches

Narrative summary	Objectively verifiable indicators	Means of verification	Risks/Assumptions
ACTIVITIES TO INCLUDE: Identify and consult primary stakeholders Conduct participatory needs assessment Provide information sharing, confidence building, and communication skills for all interested groups Provide training in communication, organization, and management for selected representatives			
Conduct information-sharing exercises with primary stakeholders on operation and maintenance and hygiene promotion Invite people to participate in training for operation and maintenance and hygiene promotion Provide training and invite trainees to apply for positions			

Support development of training in participatory approaches in water supply and sanitation Provide a programme of ‘learning-by-doing’ training for officials and professionals Support workshops for follow up and feedback, including sessions with primary stakeholders Feedback sessions between trained officials and professionals and other secondary stakeholders in water supply and sanitation			
Implement representative structure for local-level management of water supply and sanitation Assist Government departments in developing and implementing their facilitatory/regulation roles Implement regular project meetings with all stakeholders Develop participatory monitoring and evaluation methods Set up processes for ex-post evaluation			

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List of acronyms

BGS	British Geological Survey
BOD	Biochemical oxygen demand
BOOT	Build, own, operate and transfer contract
BOT	Build, operate and transfer contract
CBO	Community-Based Organization
CEDAW	Committee on the Elimination of Discrimination Against Women
CEMIS	Community-based Environmental Management Information System project
CO	Community organization
COD	Chemical oxygen demand
CSD6	Commission on Sustainable Development — Session 6 after the 1992 UN Conference on Environment and Development held in Rio (The Earth Summit)
CVM	Contingent Valuation Method
CV	Contingent Valuation
DAC	Development Assistance Committee
DESA	Department of Economic and Social Affairs (United Nations)
DFID	Department for International Development
DO	Dissolved oxygen
DRA	Demand-Responsive Approach
DWAF	Department of Water Affairs and Forestry (South Africa)
EAP	Environmental Action Plan
EC	European Commission
ECA	Economic Commission for Africa (United Nations)
ECLAC	Economic Commission for Latin America and the Caribbean (United Nations)
EIA	Environmental Impact Assessment
EOP	End of Project
ESA	External Support Agency
ESCAP	Economic and Social Commission for Asia and the Pacific (United Nations)
ESCWA	Economic and Social Commission for Western Asia (United Nations)
EU	European Union
FAO	Food and Agriculture Organization
GRP	Glass-fibre reinforced plastic
GWP	Global Water Partnership
HDPE	High density polyethylene
HH	Household
HP	Hygiene promotion
HPD	Health and Population Division
HRD	Human resource development
IAEA	International Atomic Energy Agency
ID	Institutional development
IDWSSD	International Drinking Water Supply and Sanitation Decade

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INSTRAW	International Research and Training Institute for the Advancement of Women (United Nations)
IWRM	Integrated Water Resource Management
JMP	Joint Monitoring Programme
lcpd	litres per capita per day
LIC	Low income country
MAPET	Manual pit latrine emptying technique
MDPE	Medium density polyethylene
mg/l	milligrammes per litre
MoEd	Ministry of Education
MoH	Ministry of Health
NGO	Non-governmental organization
NPV	Net present value
O&M	Operation and maintenance
ODA	Overseas Development Administration (now DFID)
OPP	Orangi Pilot Project (Karachi, Pakistan)
ORS	Oral rehydration salts
PAM	Poverty Aim Marker
PIMS	Policy Information Marker System
PLC	Public Limited Company
PMU	Project Management Unit
PRA	Participatory rapid appraisal
PSP	Private sector participation
PV	Permanganate value
RPS	Revealed preference survey
RP	Revealed preference
SIA	Social Impact Analysis
SIP	Sector Investment Programme
SSA	Strategic Sanitation Approach
STEP	Social, Technical, Economic and Political analysis
SWAp	Sector-Wide Approach
SWOT	Strengths, Weaknesses, Opportunities and Threats analysis
TA	Technical assistance
TOR	Terms of Reference
UN	United Nations
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNHCR	United Nations High Commissioner for Refugees

UNICEF	United Nations Children's Fund
UNIDO	United Nations Industrial Development Organization
UNU	United Nations University
uPVC	unplasticized poly vinyl chloride
VIP	Ventilated improved pit latrine
VLOM	Village-level operation and maintenance management
VWC	Village water committee
WASH	Water and Sanitation for Health programme
WC	Water closet (i.e. flush toilet)
WELL	Water and Environmental Health at London and Loughborough
WHO	World Health Organization
WMO	World Meteorological Organization
WRM	Water Resource Management
WS	Water Supply
WS&S	Water Supply and Sanitation
WSSCC	Water Supply and Sanitation Collaborative Council
WTP	Willingness-to-pay
WWC	World Water Council

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