Wetlands and Water, Sanitation and Hygiene (WASH)

Understanding the linkages

WETLANDS INTERNATIONAL

Wetlands and Water, Sanitation and Hygiene (WASH) – understanding the linkages

Wetlands International

January 2010

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Cover picture: Villages at Lac Debo, Inner Niger Delta, washing their clothes and collecting water. By Sander Carpay

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Preface

We won't get to the water world we need to create without new forms of collaboration. In most places, water supply is going down, and demand is going up. For this simple reason we particularly need to build stronger links and co-operation between organisations involved in the vital water using WASH sector (drinking water supply, sanitation and hygiene) and those working on the equally vital supply related field of wetland conservation and management.

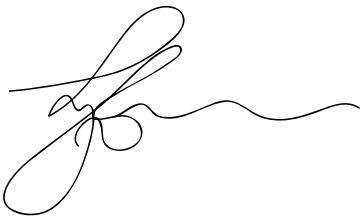
It is very good news that extensive consultation across Wetlands International networks, working with WASH professionals has led to the identification of a range of common issues. They have explored cross-sectoral initiatives that would profit from further exploration. The dialogue that developed between practitioners and organisations in the two *'sectors'* has created mutual acknowledgment of the need for a synthesis of the links.

This publication is the result. It aims to present the issues linking wetlands and WASH in a concise manner. These new Partners have jointly decided upon the aim, role, format, criteria, target audience, outreach, content and structure of the publication.

What will you find within? First, the baseline information that sets out how WASH provision and wetland conservation are connected. Second, read on to learn why these linkages are vital. Next, how they can these be better managed? Finally, you will find a set of principles for sector professionals to guide the way forward to integrate wetland management and WASH approaches.

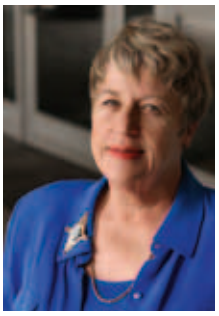
These principles and management precepts can bring clear benefit to the health and development of people in rural, peri-urban and urban areas. And - of primary importance - such benefits can be achieved without compromising ecosystem functioning.

As a long time advocate for pragmatic approaches to the integration of various facets of water management, it is my pleasure to invite you to read this book to get inspired. Then look beyond your normal boundaries to see how integration of your efforts can bring added value and greater impact. Work well!



Margaret Catley-Carlson

Patron, Global Water Partnership;
UN Secretary General Advisory Board on Water



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The text of this publication is based on an earlier working version prepared by Frank van Steenbergen and Marleen Schiereck of MetaMeta, which was subsequently developed by Matthew Simpson of Wetlands & Wildfowl Trust Consulting (WWTC) and Katia Leber formerly of Wetlands International (WI). In drawing on their own experience in the field these authors have also incorporated the comments and inputs of staff from other partner organisations. We want to express our appreciation to them for treating the development of this publication as much more than an ordinary assignment and for investing so much time, dedication and personal interest in it. We are also very thankful to numerous staff members from the different contributing organisations WASTE, IRC the International Water and Sanitation Centre, Netherlands Water Partnership (NWP), Simavi and the International Water Management Institute (IWMI) for showing their interest in this publication and for giving so freely of their time to review and comment on the different draft versions. The individuals concerned are listed in the *'Contributors'* section.

Within Wetlands International Chris Baker has provided the strategic and technical direction to the content of this publication, including a thorough essential final editing check. Susanne Boom has provided process support throughout by co-ordinating the development of this publication, as well as drawing on her own experience of working in the two sectors to provide invaluable technical input.

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1. Introduction

Millions of people around the world live in or adjacent to wetlands. This has been the case for millennia. They choose to do so because of the abundant resources within wetlands that provide them with many of the basics of life including food, water and shelter. However, a significant proportion of these people and particularly the poor in developing countries also suffer, or are at risk, from poor health related to water borne disease or disease related to water dependent parasites or carriers. As a result wetland dependent communities are an important target group for health initiatives in the developing world. There are many opportunities and risks involved in tackling water-related health problems in wetland areas. Wetlands can often be part of water supply and waste disposal systems. However when over-burdened with these roles they can become degraded, worsening health problems and negatively affecting the livelihoods of communities.

People's health and well being are influenced by water supply, sanitation and hygiene (WASH). Interventions to improve these have long been an important aspect of the development agenda. Such interventions are normally based on a community's needs and local conditions, but in the past they have generally not taken into account linkages with and effects upon the surrounding natural environment and its water sources. Yet WASH interventions interact with natural water sources, such as wetlands in a number of ways:

1. water resources, of a certain quality, are tapped as a source of water inflow;
2. waste flows, usually in the form of lower quality water, are produced and discharged;
3. the natural system receiving the discharge is often either the same as, or connected upstream or downsteam, to the original water resource.

These complex issues demand innovative integrated approaches to safeguard both the health of wetland dependent communities and the health of the environment. However, to date this integration has received only limited attention. The areas of wetland conservation and management, and access to safe water, and sanitation, and hygiene are normally dealt with separately through sectoral interventions; this, and this is a missed opportunity for securing sustainable development and ecosystem stability.

Why this book?
This book provides a baseline understanding of how people and wetlands are connected, why these linkages are vital and how they can be better managed. It calls for action to integrate wetland management and WASH approaches, so as to benefit the health and development of people in rural and peri-urban areas in developing countries without compromising ecosystem functioning. It has been written predominantly for the core staff, planners and coordinators of international organisations and their implementing partners dealing with either wetlands conservation and management or WASH provision.

After reading this book, we hope that you - practitioners within these different disciplines - will be inspired and encouraged to look a little beyond your normal boundaries of implementation. We trust that the book will provide insights into the effects that your interventions have, and how integrated joint efforts can lead to enhanced livelihoods, improved human health and enhanced biodiversity in the wetland settlement areas in which you work.

How this book can be used

This publication provides an introduction to the linkages between WASH and wetlands. In doing so it is hoped that this will stimulate sector professionals to develop ways to address them. It is envisaged that publication could inspire professional dialogue, exchange visits, teaching, capacity building, advocacy, training, project development or fundraising. In the longer term the organisations connected with this publication hope that it will support the process of mainstreaming wetland issues into the planning and implementation of WASH interventions, and vice-versa, at both the policy and practice level.

In this light, we are particularly keen to receive feedback from the readers and users of this book about the value of this publication to their work and suggestions for developing this initiative further in the future.

What is in this book?

This book is divided into 6 chapters (including this introductory chapter) with boxes presenting essential additional information and case studies.

- Chapter 2 describes the special circumstances of communities that are dependent on wetlands, what this means in terms of their access to WASH and why this is of concern;
- Chapter 3 is about understanding common issues among target audiences and the aims and approaches within the wetlands conservation and management and WASH sectors;
- Chapter 4 identifies and describes the vital linkages between wetlands and WASH and the associated risks and benefits.
- Chapter 5 discusses key issues and approaches regarding how these vital linkages can be sustainably managed.
- Chapter 6 presents a way forward by providing guiding principles for the conceptual integration of wetland and WASH issues to increase the effectiveness of current and future interventions.

2. Why be concerned about WASH in wetlands?

2.1 Introduction

Looked at from sectoral perspectives, it seems that professionals involved in wetland conservation and WASH in developing countries have little in common. However, if one takes a local perspective that places wetland dependent communities centre-stage, the linkages and the need for joint approaches to problems become clear. This chapter looks at community livelihood and health problems and shows the linkage between these issues, WASH and wetland conservation.

2.2 What are wetlands?

Firstly it is helpful to clarify what the term *'wetlands'* means in order to better understand why they have such a close relationship with people. However, this is not easy because as a term 'wetland' is not very precise. They are neither terrestrial nor aquatic ecosystems, often sitting between the two in the landscape. They can be located in saline, brackish and freshwater environments and can be found along coastlines, within estuaries, river and lake systems and topographic depressions. These *'in-between'* and dynamic ecosystems support specific plant and animal communities. Wetlands can be all over the world, in tropical, temperate and Polar Regions. It is estimated that they cover approximately 6% of the earth's surface. They can be found in every inhabited landscape. Figure 2.1 illustrates a range of examples of common wetland types that can be found in tropical regions, while Box 2.1 provides a useful way of categorising different wetland types.

Box 2.1 Categorisation of different wetland types

Coasts	- areas between the land and open sea that are not influenced by rivers (e.g. shorelines, beaches, mangroves and coral reefs)
Estuaries	- where rivers meet the sea and water changes from fresh to salt as it meets the sea (e.g. deltas, mudflats, salt marshes, mangroves)
Floodplains	- land next to the permanent course of a river that extends to the edge of the valley (e.g. floodplains, including features such as ox-bow lakes, river islands)
Marshes/swamps	- land where water is more or less permanently at the surface, and/or causing saturation, of the soil (e.g. papyrus swamp, fen, peatlands)
Lakes	- areas of permanent or semi-permanent water with little flow (e.g. ponds, salt lakes, volcanic crater lakes)

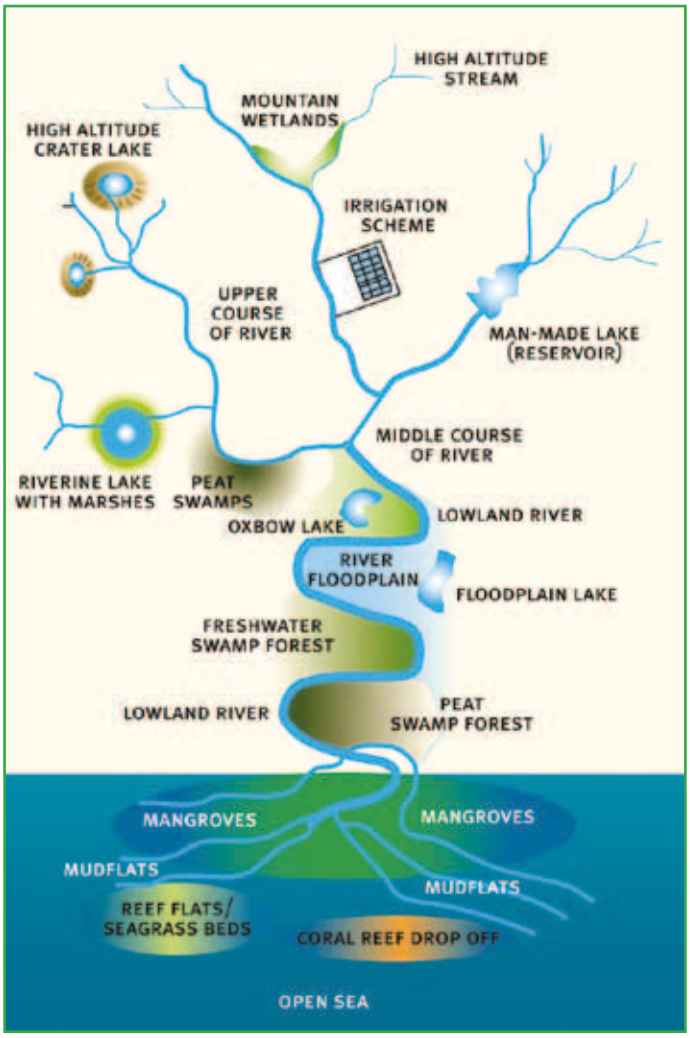

Figure 2.1. Common wetland types in tropical regions. Source: Adapted from Davis and Claridge, 1993

2.3 Why are wetlands so important for people?

Access to water, food, a source of income and shelter are critical for human survival. In developing countries people often obtain these resources directly from the natural environment they live in. Wetlands are productive ecosystems that are breeding grounds and nurseries for many animals including fish, birds and mammals. Whether it is through the harvesting of food such as plants or fish, the use of reeds and timber for household construction, the provision of safe drinking water or the use of wetland plants for medicinal purposes, wetlands can provide most or all of the natural resources required for survival. Wetlands also frequently form the basis for many income generating activities and provide an important contribution to local and national economies. Growing rice and aquaculture are two important wetland activities that

The Inner Niger Delta is an enourmous floodplain providing livelihoods to some 1 million people in Mali. By Leo Swarts

Box 2.2 The Millennium Ecosystem Assessment (MA)

What is it?
The Millennium Ecosystem Assessment (MEA) was called for by the United Nations Secretary-General Kofi Annan in 2000. Initiated in 2001, its the objective was to scientifically assess the consequences of ecosystem change for human well-being and the actions needed to conserve and sustainably use those systems so they can continue to contribute to human well-being. The MEA has involved the work of more than 1,360 experts worldwide. Their findings, contained in five technical volumes and six synthesis reports, provide a state-of-the-art scientific appraisal of the condition of, and trends in, the world's ecosystems and the services they provide (such as clean water, food, forest products, flood control and natural resources) and the options to restore, conserve or enhance their sustainable use.

Ecosystem Services
The MEA enhanced our understanding of what wetlands do for people and provided a standardised categorisation of the services that wetland ecosystems provide to people; which are summarised in Table 2.1. This terminology is adopted throughout this publication.

Source: www.millenniumassessment.org; Millennium Ecosystem Assessment, 2005.

Table 2.1. Ecosystem services from wetlands

Ecosystem service	Description
Provisioning	
Food	Production of fish, wild game, fruits and grains
Fresh water	Storage and retention of water for domestic, industrial and agricultural use
Fibre and fuel	Production of logs, fuelwood, peat, fodder
Biochemical	Extraction of medicines and other materials from biota
Genetic materials	Genes for resistance to plant pathogens, ornamental species, and so on
Regulating	
Climate regulation	Source of and sink for greenhouse gases; influence local and regional temperature, precipitation and other climatic processes
Water regulation (hydrological flows)	Groundwater recharge/discharge
Water purification and waste treatment	Retention, recovery and removal of excess nutrients and other pollutants
Erosion regulation	Retention of soils and sediments
Natural hazard regulation	Flood control, storm protection
Pollination	Habitat for pollinators
Cultural	
Spiritual and inspirational	Source of inspiration; many religions attach spiritual and religious values to aspects of wetland ecosystems
Recreational	Opportunities for recreational activities
Aesthetic	Many people find beauty or aesthetic value in aspects of wetland ecosystems
Educational	Opportunities for formal and informal education and training
Supporting	
Soil formation	Sediment retention and accumulation of organic matter
Nutrient cycling	Storage, recycling, processing and acquisition on nutrients

Source: Millennium Ecosystem Assessment, 2005

play a significant role in providing many people in developing countries with an income and contribute to household food security. Furthermore, wetlands often provide mitigation against floods and shelter coastal zones from storms and inundation, protecting people against disasters. These - and other different ways in which wetlands deliver benefits to people - have been categorised into a range of different *"services"* by the Millennium Ecosystem Assessment (MA). The MA terminology (Box 2.2) will be used later in this book because it provides a readily understandable way to link what wetlands do with the issues that WASH seeks to tackle.

2.4 Wetland dependent communities and development

Wetland communities are often from low income groups and have little or no land access rights. Wetlands are often common-lands under no ownership and their resources and land are relatively freely available. This serves as a big attraction to poor people in both rural and urban areas who can come to rely on them, with their welfare becoming intimately tied to the status of the wetland itself. If properly managed, this relationship can form the basis of stable, reliable livelihoods keeping these communities out of poverty and providing the basis for

Box 2.3 What is WASH?

For a number of years it has been generally accepted that the provision of safe drinking water alone does not improve human health. This recognition came from the realisation that a supply of safe water can still be contaminated when there is poor sanitation or unhygienic circumstances. Examples are unsafe storage of water within the house, open defecation around the house or inadequate hand-washing after defecation. Inadequate access to safe water and sanitation services, coupled with poor hygiene practices, kill and sicken thousands of children every day.

The targets of WASH interventions are commonly three-fold:

i. Providing access to safe water of sufficient quantity
ii. Breaking transmission routes for water related diseases through providing sanitation facilities
iii. Facilitating behaviour change through hygiene education

sustainable development. However wetlands are commonly not viewed as a valuable resource. More often than not, they are regarded as ecosystems with little or no value for development. As a consequence when development does occur, it usually seeks to change or remove them or disregards the impacts it will have on their functioning. The Millennium Ecosystem Assessment (2005) highlighted that the primary direct drivers of wetland degradation were *"infrastructure development, land conversion, water withdrawal, eutrophication and pollution, over-harvesting and overexploitation, and the introduction of invasive alien species."* In many parts of the world more than 50% of wetlands have already been degraded (Millennium Ecosystem Assessment, 2005). The specific processes involved in degradation depend on the factors driving change and the type of wetland.

WASH organisations need to consider their role in this complex equation. Their work promotes the use of water and the separation and disposal of waste. The Millennium Ecosystem Assessment (2005) identifies pollution, including waste disposal as a significant cause of wetlands degradation. The interactions between wetland communities and their wetland surroundings should be carefully considered, since the latter are a potential source of water and a destination for waste. The effects of this use and any proposed changes must be carefully considered in terms of how it will impact on the wetland and the livelihoods dependent on it. For instance how will waste disposal affect fishery production or domestic water use? Will sourcing water from wetlands have any implications for water quality and or even on the water regime (which will depend on the scale of water abstracted in comparison to the ecosystem's needs)?

2.5 Health in wetland communities

WASH is imperative for health, and is also an important part of the livelihood of any household - if people are healthy they can work, if they are not, it will take extra effort and possibly expense to care for them. In poor households in developing countries and especially in, wetland dependent communities this relationship may be more critical as there are fewer safety-nets and livelihoods are often highly reliant on labour. Communities living in or around wetlands are often amongst the poorest and therefore amongst the most vulnerable. Lack of access to safe water and poor sanitation and hygiene make water related diseases one

of the main health problems among the poor worldwide (see Box 2.4). Work in four major wetland areas around the world showed that quality and quantity of water in wetlands are among the main factors determining the health of wetland dependent communities (Wetlands International, 2009). Communities that depend on wetlands are particularly vulnerable to water-related diseases. These include bacterial, parasitic and vector borne diseases.

The disposal of domestic and other water borne wastes is the cause of many water borne diseases such as diarrhoea. For many poor people, wetlands provide the only free source of water they can access, which results in them fetching water directly from open water bodies such as lakes and rivers. Contamination of these water sources by human and animal faeces is a common problem, which is not always recognised in water supply planning, sanitation provision and waste disposal. WASH practitioners need to better understand this linkage as it can affect sections of the communities that they are targeting or wetland dependent communities (i.e. those downstream) not included in a planned intervention.

Health is also affected by environmental management. Diseases such as schistosomiasis (bilharzias) and malaria, are water and wetland related. Their prevention is complex and multi-dimensional. However, good management of the ecosystems in which the vectors of these diseases live is often a critical part of any strategy. This is further explained in Box 2.5.

1. WASH influences various aspects of development within wetlands.
2. WASH directly affects the health of wetland dependent communities.
3. WASH influences various aspects of the ecology of wetlands.

Communities that depend on wetlands are highly vulnerable to water-related diseases. These include bacterial, parasitic and vector borne diseases. Because of a lack of access to safe water and poor sanitation and hygiene water related diseases are one of the main health problems among the poor worldwide (see UNICEF, 2008 and WHO, 2004).

Wetland dependent communities are no exception to this. Work in four major wetland areas around the world showed that quality and quantity of water in wetlands are among the main factors determining the health of wetland dependant communities (Wetlands International, 2009).

Box 2.4 Some facts on water related diseases

In developing countries, cholera, diarrhoea, typhoid and hepatitis are estimated to be responsible for 70-80 % of all health problems. Water-related diseases cause 3.4 million deaths per year; diarrhoea alone causes 1.8 million deaths annually and malaria another 1.3 million, 90% of these being children. It is estimated that one out of every five children borne does not live beyond the age of five, largely because of these diseases. Eighty eight percent of diarrhoeal disease is due to unsafe water supply, inadequate sanitation and hygiene. WASH interventions can lead to a reduction of diarrhoeal cases by up to 45 %. Better management of water resources reduces transmission of malaria and other vector-borne diseases.

Source: UNICEF, 2008 and WHO, 2005

Wetlands provide abundant water for rice cultivation, in this case in Southern India. By Pieter van Eijk

These issues are a reason why so many organisations are involved in WASH activities, seeking to provide core services to communities at risk. The disposal of domestic and other water borne wastes is the cause of many water borne diseases such as diarrhoea. For many poor people, wetlands provide the only free source of water they can access, which results in them fetching water directly from open water bodies such as lakes and rivers. Contamination of these water sources by human and animal faeces is a common problem, which is not always recognised in sanitation provision and water supply planning. WASH practitioners need to better understand this linkage as it can effect sections of the communities that they are targeting or wetland dependent communities (e.g. those downstream) not included in a planned intervention.

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Consequently, WASH potentially has significant implications for wetland areas and their inhabitants in terms of the health, livelihoods and development of wetland dependent communities.

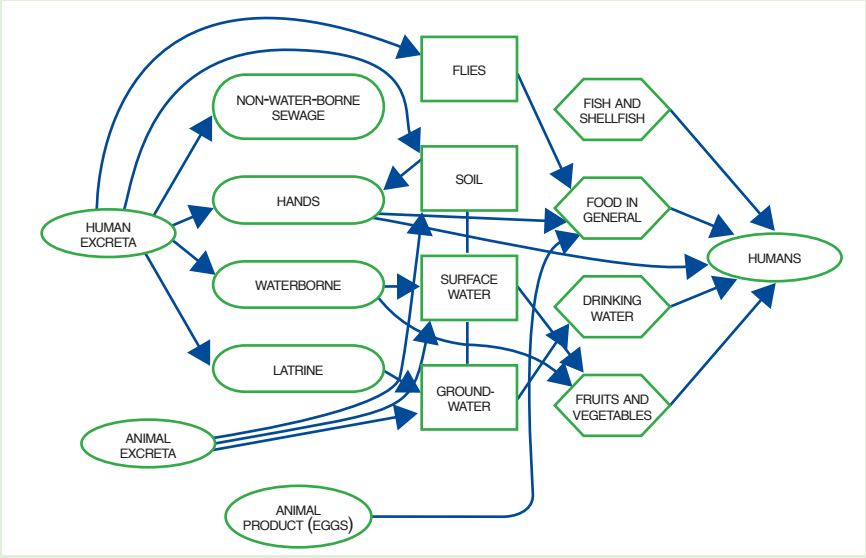
Box 2.5 How people's health is affected by water-related diseases in wetland areas

Water related diseases can roughly be divided into two groups, namely those caused by poor water supply, sanitation and hygiene and those caused by poor environmental management (see table):

Diseases caused by poor WASH
Water plays a crucial role in daily household activities as it is used for bathing, drinking and cooking, but it can be contaminated and transmit disease. One common problem is contamination by pathogens from human faecal matter. When such water is drunk without being boiled, or is used in food preparation, this contributes largely to the faecal-oral transmission route for diseases (see Figure).

The inappropriate use of safe water, unhygienic conditions within a household or unhygienic personal behaviour can lead to contamination of water which was collected from a safe source. Water provision, sanitation and hygiene therefore need to be addressed together to achieve a positive impact on human health. If domestic wastewater is discharged into the environment in an unhygienic way this provides another potential transmission route for water borne diseases.

Diseases related to poor environmental management
The faecal-oral transmission route does not fully take into account the role of the environment in transmitting water related diseases. Some of these diseases are caused by aquatic organisms and their prevalence is caused by improper water management stimulating the proliferation of the responsible organisms or their carriers. It is possible to control them by assessing and manipulating the environmental factors that cause the parasites or insects to flourish.



Water related disease type	Diseases	Cause	Transmission route
Water-borne diseases	Diarrhoea Cholera Typhoid	Poor WASH	Infections spread through the intake of water contaminated with faecal matter and unhy faeces and wastewater
Water-washed diseases	Roundworm (*Ascariasis*), Trachoma, Typhus, Scabies	Poor WASH	Infections spread through a lack of sufficient clean water for proper hygiene and the reuse of polluted water within house holds due to water shortage
Water-based diseases	Bilharzia (*Schistosomiasis*), Guinea worm (*Dracunculiasis*)	Poor environmental management	Infections transmitted through aquatic invertebrate organisms living in wetlands that enter the human body through direct contact with the water (for fishing, fetching water, bathing, swimming etc.) or eating insufficiently cooked aquatic species
Vector-borne diseases	Malaria, River Blindness, Sleeping Sickness	Poor environmental management	Infections spread through the bites of insects that live and breed in or near wetlands

Source: Adapted from Cairncross *et al.*, 1981

2.6 Wetland dependent communities and access to WASH services

Water contamination can be due to poor WASH practices locally, poor water and waste management upstream or a combination of both. In many places throughout the world, wetland dependent communities lack access to WASH services. The reasons can differ between rural and urban communities. Rural wetland dependent communities are often physically isolated from access to government support and information. This leads to poor health practices, such as fetching water from open water bodies where animals drink, where laundry is done, where people bathe or even defecate. Many of these marginalised communities lack sanitation facilities and open defecation is a common practise. Where water and sanitation facilities are in place, the nature of the wetland environment can present challenges. High water tables make it difficult to build hygienic toilets and safe waste storage systems. Where floods occur, boreholes can easily become polluted and no longer function as a source of safe domestic water.

Case 2.1: Figures from Uganda

A study in two fishing communities around five major wetlands in Uganda showed that:

- Only 6 out of 21 communities had easy access to safe water
- Only 5 communities had a borehole, but most are non functional
- Average water supply coverage is 50 %, which is lower than the national average (55%), however around 3 of the 5 wetlands, the communities had no access to clean water
- Where boreholes are absent or non functioning people fetch directly from the lake
- Sanitation coverage was lower than national average of 79 %
  - Less than 20 % of the communities had more than 3 accessible toilets
  - Public latrines can only be used against payment of a fee. Open defecation around houses, lake shores and landing sites are common

Outbreaks of cholera, diarrhoea, bilharzia and malaria occur on a frequent basis. In addition, there is a loss of income, as there is a ban on the sale of fish products from affected communities.

In the city of Kampala, several water quality surveys have shown that 95% of spring water sources are highly contaminated by faeces (from surface and pit latrines) yet for nearly half of the urban poor it is the only source of free water

Source: JMP Survey, 2008 and Grellier *et al.*, 2004

Wetland degradation can be particularly acute in urban and peri-urban areas where human settlements are located alongside wetland systems. Such areas are often the focus of unplanned urban development, giving rise to 'slums'. These settlements, and often their inhabitants, are not acknowledged by the government. Often there is an intense local usage of wetland resources which, combined with a low provision of waste management, greatly affects and influences wetland ecosystems and related livelihoods.

Traditionally governments deal with domestic sanitation in urban areas through the central collection of wastewater flows which are later discharged, either raw or partially treated, into natural wetlands. Settlements near these wetlands rarely have access to clean water for domestic use and these polluted wetlands serve as the main source of domestic water. The lack of sanitary facilities further contributes to poor hygiene and health conditions among these communities.

To improve the health of wetland dependent communities, the transmission of water related diseases needs to be reduced. The principles of this are the same as anywhere else but the practicalities of working in, or adjacent to, a wetland environment and the complex relationships between people's welfare and the wetland need to be taken into account. Better integration of wetland conservation and WASH can help achieve this. However, at present this only rarely happens. To understand why this is the case and what is required to benefit the health of wetland communities the following are needed:

i. An understanding of the motivations and principles that guide professionals within in conservation and WASH organisations that can shed more light on where there are barriers to better collaboration;

Case 2.2 Point-source pollution and disease problems in the Inner Niger Delta, Mali

The Inner Niger Delta (IND), Mali is home to 1 million of Mali's 14 million people. These people are heavily dependent on the wetland area which supports rice, fish and meat production which are significant for local livelihoods and national food security.

Due to this heavy use the IND receives large volumes of domestic, industrial and irrigation wastewater. Overall, the fauna and flora in the IND ecosystem as a whole show little indication of serious water pollution. The IND is a huge area with large volumes of water that can dilute the effects of the pollutants. Its natural wetland processes have a huge capacity to process pollutants and organic waste inputs probably play a positive role in supporting the wetland ecosystem.

However, much of the pollution can be characterised as point-source pollution with much waste being directly disposed into the Niger River adjacent to local water sources. Settlements in the locality of these discharge points experience a high prevalence of water-related diseases. Water borne bacterial diseases are suspected of being responsible for up to 9 percent of human mortalities and vector-borne diseases, such as malaria and schistosomiasis, up to 41 percent. Eighty per cent of disease in the area are linked to drinking water supply and sanitation conditions.

There are significant problems in sanitation provision, practices and awareness amongst the IND's communities. However, the severity of problems has also been observed to be related to IND flooding regime and extent. Human health problems are notably worse during low flood years when the dilution factor is reduced and when the circulation of water in the IND is lower. Research work is ongoing to establish the exact nature of this relationship so that it can be taken into account in local water management planning and management.

Source: B. Kone, Wetlands International, Mali Office, *pers comm.*

Women of a village at Lac Debo, part of Mali's Inner Niger Delta, washing their clothes in the lake. By Sander Carpay

ii. A more detailed understanding of the frameworks within which the sectors work and the risks and opportunities they present.

These two points form the focus of the next two chapters.

The Mekong Delta contains many villages depending on it for food, construction material, water and sanitation. By Pieter van Eijk

Urban wetlands, as this case of Panamá City, suffer under the waste of its city. By Julio Montes de Oca

2.7 Summary

The above overview of the environmental, livelihood and health aspects of wetlands shows that there is a considerable overlap in the interests of professionals working in wetland conservation and those promoting WASH interventions. Both influence the inter-relationship between wetland dependent communities and the ecosystem in which they live.

It is clear that:
- Wetland dependent communities are a part of the wetland ecosystem
- Livelihood, health and wetland conservation issues are interdependent
- There is a need for sectoral collaboration to address these interdependencies

This recognition creates opportunities for intersectoral collaboration between the wetland conservation sector and the WASH sector. This collaboration should be based upon:

Inter-sectoral collaboration should be based upon:
- Recognition of the services that wetlands perform, particularly in terms of water quantity and quality and the existing upstream- downstream interactions; and,
- An understanding of how these services are, and can be, used by local communities

Young boy is not using the latrine near a rice field. By Simavi

3. Finding the common ground between wetland conservation and WASH approaches

3.1 Introduction

Environmental and development based visions of water management are not always in harmony. Like local communities who have been balancing such issues for decades, the professional water sector continually struggles to align competing goals and manage trade-offs between different water uses and users in its efforts to implement integrated water resource management. The different goals of providers of WASH and of organisations focused on wetland conservation and management illustrate these tensions. Historically, wetland conservationists have tended to undervalue the positive role that people have in wetland management and to overlook the importance of sustainable development in addressing conservation problems. Conversely, WASH professionals, in addressing water supply, sanitation and hygiene needs, have tended to neglect the roles of wetlands in supporting community livelihoods and the potential impacts that WASH solutions may have on these.

Consequently there has been little joint conceptualisation of the issues or approaches to resolve them. The two sectors work separately often resulting in unsustainable, unbalanced solutions for community and ecosystem health. Mapping a path towards solving this problem requires developing an understanding of the different perspectives, goals and conceptual approaches within the two sectors. This will help identify where the best options for joint working can be found, built on common understandings, motives and approaches.

3.2 Understanding the motivation, aims and approaches of WASH professionals

Over the last 50 years the WASH sector has developed as a specific sector with its own aims, goals and methodologies. WASH generally employs principles of participation, community management, ownership and empowerment. Success is commonly measured in terms of numbers of people connected to water and sanitation facilities and services and the effect on the human living environment. Responsibility for promoting WASH lies principally with governments and local authorities. In the developing world these organisations often face a lack of technical knowledge and skills, awareness of the issues and transparent governance. Consequently, civil society often plays a significant role in supporting these institutions or filling gaps in capacity. International civil society organisations often play a crucial role in developing local capacities to improve conditions on the ground. Although there is no internationally binding convention or governmental agreement on WASH related issues there are a number of institutions and frameworks at global level that set targets (e.g. the World Health Organisation (WHO) and the Millennium Development Goals (MDGs)), monitor progress (e.g. the WHO and UNICEF Joint Monitoring Programme (JMP)) and provide guidance and advice (e.g. WHO, Water Supply and Sanitation Collaborative Council (WSSCC)) on principles and approaches.

The effects of these interventions on the natural environment and the influence of any changes in the status of the natural environment on the availability and quality of WASH services are not

Box 3.1 The Millennium Development Goals

The eight Millennium Development Goals (MDGs) - which range from halving extreme poverty to halting the spread of HIV/AIDS and providing universal primary education - form a blueprint agreed to in the year 2000 by all the world's countries and leading development institutions. They set the agenda for current development efforts to meet the needs of the world's poorest people. The MDGs provide the basis for developing concrete action plans to reverse the grinding poverty, hunger and disease affecting billions of people. MDG 7 focuses on environmental sustainability and includes the following targets:

1. Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources
2. Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss
3. Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation
4. By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers

Source: www.un.org/millenniumgoals

normally taken into account. This failure to appreciate the links between the two is enshrined in international agreements and policy. For instance, the development goals set under MDG 7, on environmental sustainability have separate targets for WASH and for natural resources. As a consequence, donors and actors overlook the potential effects that WASH interventions can have on sustainable development and ecosystem stability. Often these effects extend beyond the immediate area in which WASH interventions occur.

3.2.1 Providing safe water supply

The provision of a safe, reliable water supply for domestic use is a key concern for WASH organisations. Despite considerable improvements in this area in the past 20 years, there are still close to 1 billion people without access to such a supply. The safety of water depends very much on its use: for the most part "domestic water use" requires an acceptable quality standard for domestic drinking, washing, bathing and food preparation. Most countries have their own guidelines regarding water quality and targets for safe water supply provision. These are mostly adapted from guidelines provided by the WHO. The MDGs (Box 3.1) provide a target for provision levels. Target 3 of MDG Goal 7 on environmental sustainability defines the meaning of access to safe drinking water supply in the following way: *'water quantity: the availability of at least 20 litres per person per day from an improved source within 1 kilometre of the user's dwelling'*.

Together these targets provide a broad level framework against which water supply provision is judged. They also set the goals for much of the work that WASH oriented organisations do. While these targets are included within MDG 7 for environmental sustainability, it is notable that no link is made between this and the other targets under this goal, including those related to reducing biodiversity loss. As a result, in many instances, these individual targets are pursued separately, at the possible cost of damaging progress towards other MDG targets.

Table 3.1 Drinking water categorisation

Source classification	Drinking water source
Unimproved systems	Unprotected dug well, unprotected spring, cart with small tank/drum, tanker truck, and surface water (river, dam, lake, pond, stream, canal, irrigation channels), bottled water.
Improved systems	Public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs and rainwater collection.
Piped systems into dwelling, plot or yard	Piped household water connection located inside the user's dwelling, plot or yard.

Source: UNICEF and World Health Organization, 2008

Figure 3.1 shows a *'drinking water categorisation'* which expresses the different categories of water supply systems and their related sources. WHO figures show that the vast majority of people now secure their water from improved sources. It is not possible to make an assessment of how wetland dependent communities fit within this categorisation. However, given that these communities are often living in marginalised urban or rural areas, it is highly likely that a significant proportion of the people lacking access to improved supplies are wetland dependent communities.

3.2.2 Safe sanitation and wastewater management

Another key concern for organisations involved in the WASH sector is the safe and hygienic separation of waste from the immediate human environment. This is a key element of improving people's health. Frequently this waste is conveyed by water. Typically such wastewater contains a mixture of dissolved or suspended substances discharged from domestic residences, commercial properties, industry or agriculture. It can contain a wide range of potential contaminants at various concentrations (see Box 3.2).

As with safe water supply, the provision of sanitation is strongly driven by standards set by the WHO and the MDGs. Target 3 of MDG Goal 7 includes the aim to halve the proportion of the world's population without sustainable access to basic sanitation by 2015 (Box 3.1). WHO and UNICEF monitor the number of people with access to improved sanitation, which is defined as one that hygienically separates human excreta from human contact. Again, these targets are important in the way they define the efforts of WASH organisations. However, they do not specify basic standards or approaches to sanitation provision. MDG 7 focuses on the safe separation of human excreta within the household through access to and use of toilets. It does not consider the wastewater flows that are created by some facilities. Furthermore, MDG 7 does not target potential problems associated with wastewater generated from other domestic activities, such as bathing, cooking and laundry. Depending on the volume, composition and disposal, these wastewater streams can also pose a threat to the health of both humans and ecosystems.

Different types of sanitation approach are characterised in Figure 3.2. This figure gives indications as to where some of the problems lie in relation to the links between sanitation and the environment. In the developing world, most people have no sanitation or only some form of conventional sanitation. These contribute to poor health in local communities and can lead

A boy fetching water in a protected spring in Uganda. By Stef Smits

Box 3.2 Different types of wastewater

Yellow water	Urine
Brown water	Faeces and toilet water (urine plus flush or washing water) or excreta plus toilet water
Grey water	Shower, kitchen, and other bath water (including detergents), but not excreta
Black water	All household water: kitchen, bath and toilet water combined
Industrial water	Oils, lubricants, heavy metals, acids, detergents, nitrates, phospates, xenobiotics
Agricultural water	Drainage water and runoff which can include fertiliser or pesticide residues, sediments and salts

to discharge of waste into wetlands. Many remote wetland areas have no sanitation facilities and people often simultaneously use the wetland as a source for their water supply and a sink for their wastewater, often in very close proximity. In the developed world, the large majority of people are served by environmental sanitation. This focuses on the entire chain of managing wastewater, looking for the optimal approaches and technologies related to collection, transport, treatment and disposal of wastewater flows. Environmental sanitation systems can vary from conventional centralised water treatment systems, to decentralised partial treatment systems and to those that discharge raw wastewater into water bodies, such as the sea, rivers or lakes. Safe disposal of wastewater is a complex issue and the costs of wastewater treatment and disposal depend on the different technologies used along the sanitation chain (Tilley *et al*, 2008). Full details of the different technology options within the sanitation chain can be found in Annex 1 and Annex 2 provides details of some of the risks to land and water that might be associated with them. In general, conventional environmental sanitation is unlikely to be the most appropriate solution for wetland dependent communities because the required infrastructure is both too complex and expensive. In urban wetland areas, it might be an option

Ponds functioning as wastewater treatment in Ginebra, Valle del Cauca, Colombia. By Stef Smits

Figure 3.2 A sanitation categorising: *'The Sanitation Ladder'*

Type of Sanitation	Characteristics	Type of Sanitation systems
Ecological Sanitation	**Reduction, reuse and recycling:** • Reduction of water use • Reuse of faeces and urine (separated excreta) • Reuse of treated grey water **Pollution prevention:** • Full prevention of pollution of soil, air and water **Health measures:** • Creation of barriers between pathogens and humans	All forms of sanitation systems that aim at reuse of nutrients available in excreta, including urine separation and composting toilets, urinals, composting of excreta, urine application in agriculture, reuse of treated grey water for irrigational purposes, etc.
Environmental Sanitation	**Reduction, reuse and recycling:** • Reuse of treated wastewater and sludge (mixed excreta) **Pollution prevention:** • Full prevention of pollution of soil, air and water **Health measures:** • Creation of barriers between pathogens and humans	**Waterborne systems:** Sewerage systems connected to a Wastewater Treatment Plant (WWTP)) Septic tanks (emptied and safely discharged) Watertight pits **Dry systems:** Shallow pits
Conventional Safe or Improved Sanitation	**Reduction, reuse and recycling:** • Not safe **Pollution prevention:** • None (untreated wastewater ends up in waterways, unlined pits latrines) Health measures: • None or limited	**Waterborne systems:** Flush or pour-flush toilet/ latrine to: - Piped sewer system - Septic tank system (unemptied) - Soak pit **Dry systems:** Pit latrines with slab Ventilated pit latrines Composting toilet
Conventional Unsafe or Unimproved Sanitation	**Reduction, reuse and recycling:** • Reuse of treated wastewater and sludge (mixed excreta) **Pollution prevention:** • Full prevention of pollution of soil, air and water **Health measures:** • Creation of barriers between pathogens and humans	Flying toilets, pit latrines without a slab or platform, hanging latrines, bucket toilets
No Sanitation	**Reduction, reuse and recycling:** • None Pollution prevention: • None Health measures: • None	Open defecation in fields, forests, bushes, bodies of water or other open spaces, or disposal of human faeces with solid waste

if connections could be made to existing systems. Ecological sanitation principles appear to hold more potential, not only being cheaper but also providing health and environment benefits and offering the opportunity for recycling raw materials into livelihood support.

3.3 Wetlands conservation: the wise-use principle and the ecosystem approach

Organisations working in wetland conservation do so because of the globally important role of wetlands in terms of biodiversity and the vital roles that wetlands play in terms of service provision to people. The alarming rate of degradation and loss of wetlands, which exceeds that of any other ecosystem type, provides a real sense of urgency. Although there is currently no way of systematically assessing global wetland degradation, extrapolation of trends in parts of the world where data is available suggest that more than 50% of the resource has been degraded or lost over the past century (MA, 2005).

Existing approaches to conservation have evolved out of more traditional biodiversity-focused approaches that dominated until about 15-20 years ago. These approaches were highly sectoral and overlooked the importance of the environment to people. Conservation work now recognises that strong links bind ecosystems and people. As well as providing shelter and resources for animal and plant species ecosystems also support peoples' livelihoods. Conservation measures must, of necessity, be integrated with the interests of local people. It is now recognised that taking a highly sectoral approach does not lead to conservation success. Wetlands are affected by a range of different pressures from settlements, industry and agriculture, which are managed by organisations and individuals that are largely unaware of their impact. Conservation needs therefore to engage with these different actors, and seek to mainstream its principles into their policies and practices.

There is a wide and diverse range of government agencies, civil society organisations, private sector concerns and individuals involved in wetland conservation. This community of policy and practice comes together under the Ramsar Convention on Wetlands, the only international convention focused on a particular ecosystem type. The Convention is *"an intergovernmental treaty that embodies the commitments of its member countries to maintain the ecological character of their Wetlands of International Importance and to plan for the "wise use", or sustainable use, of all of the wetlands in their territories"* (see Box 3.4). International expertise, contracting parties and partner organisations working through the Convention have been instrumental in developing the principles and approaches to wetland conservation.

One key central concept of wetland conservation that has been developed under the umbrella of the Ramsar Convention is *'wise wetland use'*. This to builds on the the concepts of the ecosystem approach and sustainable use as originally applied by the Convention on Biological Diversity (CBD), and the definition of sustainable development adopted by the 1987 Brundtland Commission:

"Wise use of wetlands is the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development." (http://www.ramsar.org)

The Convention includes two important terms that should be further defined: ecological character and ecosystem approach. The first is defined by the Convention as: *"the*

Box 3.4 The Ramsar convention

The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

Negotiated through the 1960s by countries and non-governmental organisations that were concerned at the increasing loss and degradation of wetland habitat for migratory waterbirds, the treaty was adopted in the Iranian city of Ramsar in 1971 and came into force in 1975. It is the only global environmental treaty that deals with a particular ecosystem, and the Convention has member countries in all the geographic regions of the planet.

The Convention's mission is *"the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world"*.

At the time of writing the Convention had 159 governmental Contracting parties, listed 1894 wetlands of international importance (identified using a diverse range of criteria based on biodiversity to wise use) covering a total of 184,944,789 hectares. It provides guidance on wise wetland use through a toolkit consisting of a series of handbooks addressing issues such as the wise use of wetlands, river basin management, water allocation and management, managing groundwater and participatory skills. Furthermore there is a series of technical reports that provide more extensive technical support to parties and partners.

Source: http://www.ramsar.org

combination of the ecosystem components, processes and benefits/services that characterise the wetland at a given point in time". An ecosystem approach is defined by the Convention on Biological Diversity as: *"a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way".* (CBD, COP 5 V/6, 2000; see http://www.cbd.int)

"Wise use" therefore has at its heart the conservation and sustainable use of wetlands and their resources, for the benefit of humankind. It recognises that people play a central role in wetland management and that conservation work must recognise their needs. Increasingly conservation aims to manage wetlands on the basis of the multiple services they provide and the multiple uses that people make of these services. This is an important point because it means that the conservation community is in principle open to dialogue and engagement with other development interests.

In adopting this wise use approach, many wetland conservation organisations have introduced strategies to safeguard and enhance the livelihoods and needs of people who live in and around wetlands, in an attempt to provide social benefits that are linked to conservation. However, conservationists have often found it difficult to show whether, or how, this has actually bettered the lives of local communities. Conservation organisations are used to gathering quantitative data, but have found it difficult to measure success in broader development process that they are less familiar with and less easy to measure in a precise scientific manner (Wetlands International, 2009).

3.4 Common grounds between wetlands conservation and WASH sectors

At first sight practitioners in these two sectors have different aims and approaches. WASH practitioners aim to improve health (and contribute to poverty alleviation) by increasing access to good quality fresh water, sanitation infrastructure and services, and by improving hygiene practices. The wetlands conservation sector aims at conserving wetland ecosystems and their biodiversity in ways which also improve local livelihoods. Seen through the eyes of wetland communities there are clear and strong linkages between these two sets of aims. Human welfare in these communities depends on the maintenance of their livelihoods and on good health, both of which are linked to wetland ecosystem service provision and water supply and sanitation. Thus these two types of intervention are linked to one another and can potentially be linked in a positive way that creates synergies. It makes sense to deal with these two sets of concerns in a holistic, integrated manner. This raises the questions of why this does this not take place more often and what prevents closer collaboration between wetland and WASH experts in the field? This section highlights some of these issues and possible ways of addressing them.

3.4.1 Improving understanding of the linkages between wetlands and WASH

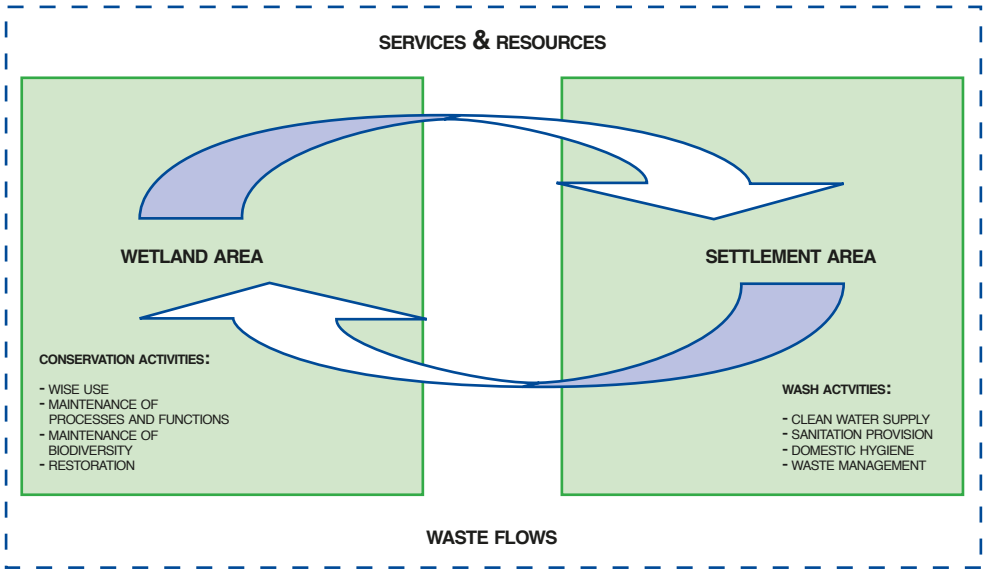
Some barriers that exist between the two sectors can be bridged by developing a better awareness and understanding of the potential risks and opportunities in delivering WASH in wetland areas. For WASH practitioners this involves developing a better understanding of the functioning of wetlands, how this relates to their work and how the effects that their work can have on it. This topic is addressed in the next chapter which provides an overview of the most relevant wetland services in relation to WASH. As already indicated, wetlands are a diverse range of ecosystems, which provide very varied services. Different wetland types function and perform in different ways. More in-depth understanding of specific wetland types is needed to properly identify different risks and opportunities in different types of wetland.

3.4.2 An integrated approach to managing the same resource

Practitioners in these two sectors not only deal with the same community target audience but are also involved with managing the same natural resource: water. From a wetland conservation perspective, water management is needed to maintain the hydrological regime and the services that a wetland provides. A natural, well-functioning wetland needs little in terms of management, and can withstand natural fluctuations in the quantity and timing of the water it receives. Problems arise when a wetland's hydrological flow changes to the extent that the natural functioning of the system is affected. This can happen when too much water is abstracted from the wetland or when the water flow into the wetland is changed through diversion or storage. Climate change also disrupts wetland functioning because it affects the amount and timing of water inflow.

From a WASH perspective, water management is driven predominantly by community need and usually seeks to secure an adequate water supply of acceptable quality. Access to water is considered sustainable when local demand and uptake does not exceed supply. From a wetland conservation perspective damage might be done well before this point is reached, leading to effects on the livelihoods and health that are less visible to a WASH practitioner. The key to resolving this issue is to factor water for ecosystem needs into water supply schemes, which requires adopting a less sectoral approach. Figure 3.3 illustrates the environmental linkages that take place in reality and contrasts these with the traditional sectoral boundaries for interventions.

Figure 3.3 Linkage of wetland and settlement areas



The project boundaries of both wetland management and WASH interventions - whether in terms of activities or in terms of geographic boundaries - are often set too narrowly. This is despite the obvious reality that upstream activities in a water system will influence downstream ecosystems, resources and livelihoods. Looking beyond normal intervention boundaries, at a realistic scale, will enable more attention to be paid to the links between upstream and downstream stakeholders, and help improve livelihoods, health and biodiversity. The key to this is to focus on the principles of local scale integrated water resource management.

3.4.3 Integrating the value of wetlands into WASH planning

Environmental sanitation approaches look at the whole waste treatment system and attempt to identify the optimal tools and approaches in terms of their effectiveness and cost-benefit ratio. The role and impact of wetlands needs to be integrated into these considerations. There are a range of tools and approaches available to do this, many professionals in the WASH sector are not aware of these, or how to implement them and, as a result they are rarely used in project planning.

3.4.4 Broader problem analysis and models of governance models

WASH interventions are based on local demands that take into account a community's needs and local conditions. By contrast, wetland conservation interventions are commonly based on an assessment of the quality of the environment and its impact on people and biodiversity. Potential conflicts between community livelihood and health issues can be resolved by taking a holistic approach that brings together the relevant aspects of these two approaches. However, local communities rarely have the chance to provide a holistic picture of their living conditions as this requires integrated baseline studies that show the linkages between people, environment and development. At present this is not standard practice. Both sectors tend to set clear boundaries regarding their entry point and the scope of their physical interventions. Reshaping water resource management stakeholder engagement processes and the resulting patterns of governance is one way this could be overcome.

3.4.5 Language and terminology

Cooperation between practitioners in the two sectors is also hindered by a different use and understanding of terms, definitions and concepts. There are many words that are common to both types of organisation but which have quite different meanings in terms of scale and scope. Some might refute this as mere semantics but the evolution of terminology in different sectors has resulted in quite different meanings, giving rise to possible misunderstandings between the two sectors. When different practitioners do not understand the respective meanings of commonly used terms, there is the danger of concluding that key issues are being covered, or that there is an agreement, when this might not be the case. A few examples of common misunderstandings are highlighted below, recognising that there are many more instances where confusion can arise:

- **Wetland** - although it is a general word for a group of water-related ecosystems, WASH practitioners may often consider wetlands to be specific biodiversity rich areas such as peat swamps or marshes. This might lead to a typical reaction that WASH interventions are not being carried out in wetland areas so there is no need for cooperation. Furthermore, wetlands may be perceived as a barrier to development, a resource to be exploited (reclaimed land, unused water) or a source of problems (such as diseases and pests). Explanation of the more embracing concept of wetlands and the resources and services they provide can lead WASH organisations to understand that the areas they are working in include (or actually are) wetlands and that people are dependent on the ecosystem services that they provide.

- **Environment** - WASH organisations tend to define environment more narrowly than conservation organisations, and use the term to refer predominantly to the immediate context in which their project or programme is located. In wetland conservation, environment includes this, together with the ecological environment or context where people live. This tends to be much wider, with boundaries set by the ecosystem and not by the community.

- **Catchment** - in WASH this will tend to refer to the area around a community from which water will be withdrawn. For wetland conservationists this will again normally be much wider, taking in the natural boundary of the watershed that (potentially) delivers water to a particular community.

- **Sanitation** - for non-WASH specialists this often means toilets, but within the sector it has a much broader definition that includes all techniques and technologies that hygienically separate waste from humans.

3.5 Summary

This chapter has discussed the motivations, aims and approaches of both the WASH and wetland management sectors. These concepts do not fully reflect the reality in which people and ecosystems exist and can serve to artificially separate issues that are naturally linked. Even though designed with the best intentions and for practical purposes, these boundaries are often a barrier to sustainable management of a healthy environment on which people's livelihoods depend. Both sectors need to address the challenge of better understanding the linkages between wetlands, human well being and their WASH needs, as well as the interactions between wetland use and water supply and water treatment.

Man walking in the wetland near Hyderabad, Andra Pradesh India, filled with wastewater. By Simavi

4. Wetland services and WASH: understanding the risks and benefits

4.1 Introduction

A key challenge to better integrate wetlands into WASH planning and implementation is to develop a common understanding of the importance of wetlands, as well the risks and opportunities for WASH interventions involved. It is well established that wetlands provide services that can be beneficial to people (see Box 2.3) and that these can be degraded or lost when a wetland is not properly managed. Yet these points are not well integrated into thinking around WASH interventions. This chapter uses the MA classification of wetland ecosystem services to analyse the many benefits that they provide to communities, the risks that WASH implementation poses to wetlands and the potential benefits that WASH provisioning can derive from them.

4.2 The provision of fresh water

Many wetland areas are perennial or intermittent surface water systems which offer a source of water that can potentially be put to many different uses. Water is delivered to the wetland through one or a combination of different hydrological processes, such as surface flow in rivers and streams, groundwater discharge from underground aquifers and through flow in soils. The hydrogeomorphology of the wetland then dictates the availability of water for use. In many situations water taken directly from a wetland requires only minimal treatment for domestic use and is a valuable resource for communities. In fact, wetland water is often the most accessible source of water for communities, as it requires little or no specialist equipment and is often located literally on the doorstep.

A second role that wetlands play is in recharging groundwater sources that can be used for domestic water supply. This role is highly variable, being dependent on wetland type and context; many wetlands sit on top of impermeable geology, making recharge impossible. Yet in many situations wetlands play a very significant role in maintaining aquifers which communities can tap into via boreholes and open wells. Well-known examples are the floodplain rivers in the West African Sahel and in India. In both cases these rivers are responsible for considerable groundwater recharge during their seasonal flood. For instance, in Mali, baseflow contribution to the Upper Niger River's flow is markedly less after consecutive years of low flooding.

Wetlands located close to communities can offer potable water with minimal treatment and this reduces the cost of water supply. In most natural systems the supply is replenished according to an annual water cycle which sets the boundaries for sustainable use. Surface freshwater is more accessible, whilst groundwater recharged from wetlands will require additional costs to abstract but may be of better quality.

Risks from WASH activities
There are certain risks associated with using wetlands for water supply. ***Over-abstraction*** is a major issue, as water supply goals are largely set by community demand and do not adequately take into account the boundaries of sustainable use, creating the possibility

of over-abstraction and wetland degradation. In reality domestic water use accounts for a relatively low proportion of society's water footprint in comparison to agriculture or industry. However the potential for over-abstraction should not be ignored, it can be a substantial risk in certain situations such as drought, particularly when combined with water demands by agriculture or where wetland resources are limited in the first place. Over-abstraction occurs when water taken from surface or subsurface sources significantly reduces the amount of water within or flowing into a wetland. This can have an impact at two levels. First, direct over-abstraction of water from a wetland may degrade the functioning of the ecosystem in the immediate surroundings, undermining the quality of the water supply and posing a risk to livelihoods and health. Second, when there are multiple abstraction points in the same basin, upstream communities abstracting water may affect the quality of a downstream wetland, creating problems for the communities that are dependent upon it. These upstream and downstream effects are rarely factored in when planning water supply schemes at the community level. They may be considered in larger schemes; although downstream impacts are often underestimated.

The WASH sector can also affect water supply since the ***choice of sanitation system*** has an important influence on water quality. Many wetlands contain large bodies of water that can dilute and even improve water quality (as discussed later in this chapter). However, the choice of sanitation system must be carefully planned to prevent freshwater sources from being contaminated by waste disposal. In flowing wetland systems direct waste disposal is an option as long as it takes place downstream of the water abstraction point; however the hydrological

Fetching water from an unprotected source in Kenya. By Trevor Wickham

regime of a wetland must be understood in order to guard against periodic stagnation and contamination of a downstream water source.

Equally the use of wetlands for water supply can pose risks to the WASH sector. For example, it is increasingly rare to find wetland surface water that sufficiently unpolluted that it can be safely used with little or no treatment. Pollution from land use, industry and domestic sources increasingly means that surface waters are not fit for domestic use. The WHO drinking water ladder shown earlier in Figure 3.1 identifies surface water as an unimproved source and positions it on the lowest *"rung"*. This means that the quality of surface water intended for domestic use needs to be tested and, where necessary, appropriately treated to allow its use.

Groundwater recharged from wetlands is less susceptible to these problems, as it is generally of better quality and free of pathogens, although in rare cases it may contain naturally occurring toxins such as arsenic in Bangladesh and fluoride in Sri Lanka.

Too much water can also pose a risk to safe water provision. In wetland areas where floods occur, boreholes or protected water sources can be contaminated by water inflow, so that they no longer form a safe water source for domestic use. As a result, water sources for domestic use need to be carefully designed taking into account the specific hydrological regime of the wetland.

4.3 Water regulation - hydrological flows

Wetlands are part of the natural hydrological infrastructure. They act as regulators of water flows both within and between surface water systems and groundwater. Through their buffering and storage capacities, wetlands stabilise the water level by recharging local or regional groundwater systems and maintaining baseflows in rivers and streams (see figure 4.1). The morphology of a wetland and its surrounding geology dictate the capacity of a wetland to store and release water to surface or groundwater sources. The degree to which this takes place depends on the nature of the water being supplied to the wetland.

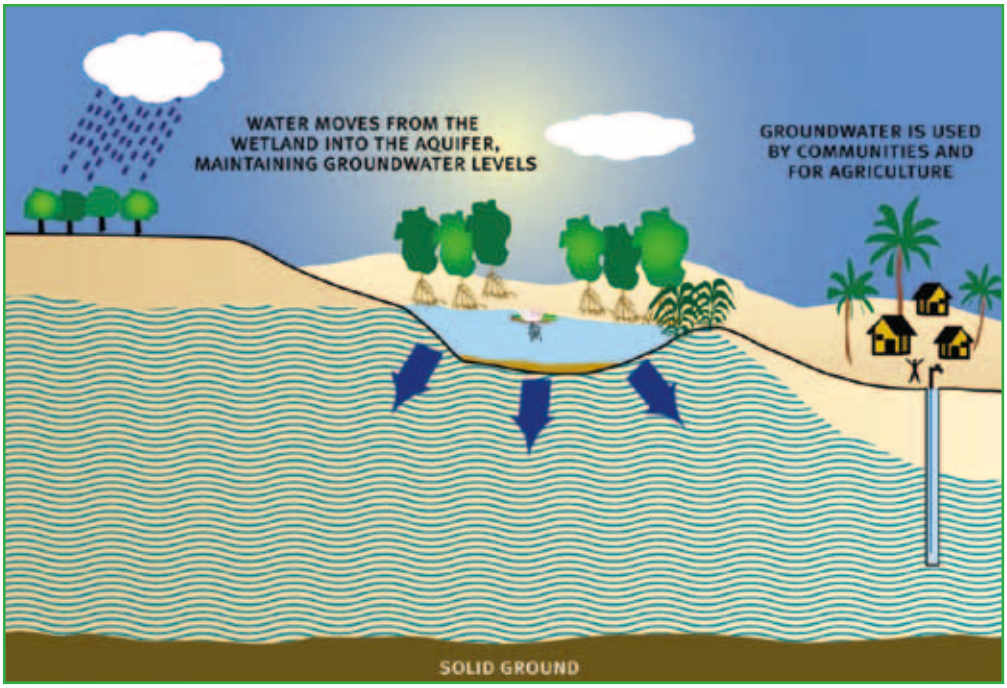
Typically, water input - for example from groundwater discharge, or surface runoff water, including flood water from rivers - is stored in wetlands. If a wetland overlies permeable soils and rocks, then this water may be able to filter down, replenishing groundwater aquifers where it can be stored or released at a slower rate into river systems. Streams and rivers provide natural outlets from wetlands.

Benefits to WASH activities
These services help maintain freshwater resources, as described above, that local or regional populations use for many purposes, including their WASH requirements.

Risks from WASH activities
Over-abstraction of water from a wetland is the main risk from WASH interventions. This can affect the capacity of a wetland to regulate its water resources, damaging the baseflow needed to maintain a river's flow and the recharge of aquifers.

Risks to WASH activities
Although maintaining groundwater aquifers is important for making water available for

Figure 4.1. The water regulating effect of wetlands. Source: Adapted from Davis and Claridge, 1993



domestic water supply, a water table that is too high can also cause problems. Wetland ecosystems are often typified by high water tables, and this is an important factor to take into account when planning WASH interventions. High groundwater tables (at or near the surface) are at more risk of being contaminated by human activities and can pose an increased risk to human health by spreading pollutants or even diseases. Certain sanitation systems are not possible in such situations, for example pit latrines with soakage systems. Such factors need to be taken into consideration when designing sanitation facilities.

Water levels can often be highly seasonal, and/or dependent on climatic conditions which fluctuate from year to year. Where a wetland is used as a freshwater source this natural variability needs to be taken into account and balanced with the water supply needs of a particular target group to avoid the risk of shortages. This might require some form of community water storage to guard against deficits.

4.4 Natural hazard regulation

It is well established that wetlands have the ability to mitigate the effects of certain types of natural hazards, particularly those caused by water. The capacity of wetlands to regulate hydrological flows helps to maintain river and groundwater levels through drier months, providing water resources for people and wildlife throughout the year, often over a large area. During floods, wetlands (particularly lakes, marshes and swamps) can act as reservoirs, protecting downstream settlements against flood damage. As such the loss or degradation of wetlands within a river basin can reduce the stability of river and groundwater levels,

Swamps and marshes store huge amounts of water, providing water all year long, as here in Central Kalimantan, Indonesia. By Anne Marie Menting

Strong droughts related to climate change together with unsustainable practices can even dry up complete lakes, such as here at Lake Naivasha in Tanzania. By Pieter van Eijk

Case 4.1 Wetlands as hydrological buffers in Danau Senatarum, Indonesia

The Danau Sentarum National Park in West Kalimantan, Indonesia, consists of more than thirty floodplain lakes surrounded by swamp and peat swamp forest. The lakes are all interconnected and linked with the Kapuas River - Indonesia's longest river. During the wet season, a quarter of the Kapuas' floodwaters flow into the lake system, reducing flood risk downstream. In the dry season the connection is reversed and waters flow from the lakes into the Kapuas. During this time, half of the Kapuas' water is derived from the lakes, ensuring that river levels remain stable, making river transport possible and maintaining household water supply and irrigation.

Source: W. Giesen, *pers.comm.*

threatening communities' water supplies and increasing their vulnerability to flooding. In coastal areas, wetlands, such as mangroves, provide shelter belts against storms, tidal surges and even tsunamis, protecting property and life.

Benefits to WASH activities
We have noted the particular benefits of water regulation and the provision of freshwater during periods of drought. By maintaining river flows and water availability during dry periods, wetlands are part of a natural infrastructure that helps safeguard the water supply for communities. Increasingly this is recognised as an important element of potential strategies to combat climate change.

Flood protection and defence against coastal inundation from storms and surges are also of great benefit to WASH. The retention and storage of floodwaters by wetlands, and particularly of upstream systems, can help safeguard investments in WASH and the health of downstream communities. Floods can cause physical damage, but they may also flush waste storage facilities and create serious pollution events that cause disease and fatalities. Maintaining wetlands upstream of at risk communities reduces this risk.

Risks from WASH activities
The risks of WASH interventions having a negative impact on the role of wetlands in regulating water flows are covered in previous sections on freshwater provision and water regulation.

Risks to WASH activities
Wetlands that play a role in regulating floods typically increase in area and depth under flood conditions and diminish as the water is released. WASH interventions that establish facilities such as waste processing or storage in areas threatened by seasonal flooding face a risk of being subject to pollution and disease. Consulting with local communities and taking note of their own risk management approaches is vital for assessing the potential risks from floods.

Risks to the WASH sector from drought events occur if the system is not thoroughly analysed taking seasonal or annual variations in water availability into consideration. There are also risks if the demand increases beyond the capacity of a wetland to replenish itself.

4.5 Water purification and waste treatment

Some wetland types have hydrological and biogeochemical processes that allow them to play an important role in improving water quality and treating waste. They can reduce nutrient loads (e.g. nitrate and phosphorous), remove heavy metals, neutralise bacteriological contamination and significantly reduce turbidity. Many different soil, hydrological, biological and geomorphological processes are involved in achieving these effects (Kadlec 2008). These effects are amplified when water carrying pollutants or waste remains in a wetland long enough to interact with the ecosystem flora, fauna and substrate. This allows natural processes to act in breaking down waste and pollutants into constituent components that can be taken up by biomass or stored in sediment. The effectiveness of these processes depends on many factors. These can be broadly divided into those that affect the transformation and storage processes themselves and those that determine the length of time that contaminated water stays in the wetland to be affected by these processes. The natural processes that combine to achieve this are described in more detail in Box 4.1, Figure 4.2 and Table 4.1.

Benefits to WASH activities
The role of wetlands in water purification and waste treatment means that they have the potential to be a cost effective tool within WASH strategies. Upstream wetlands can act as a guarantor of the quality of water supply to communities, while downstream wetlands can be integrated into waste disposal strategies. Well-known examples of harnessing these capacities

Healthy mangroves provide protection to coastal communities as they reduce the impacts of storms and tidal waves, salt intrusion and even sea level rise, such as here in Mucura, San Bernardo Archipelago, Colombia. By Sander Carpay

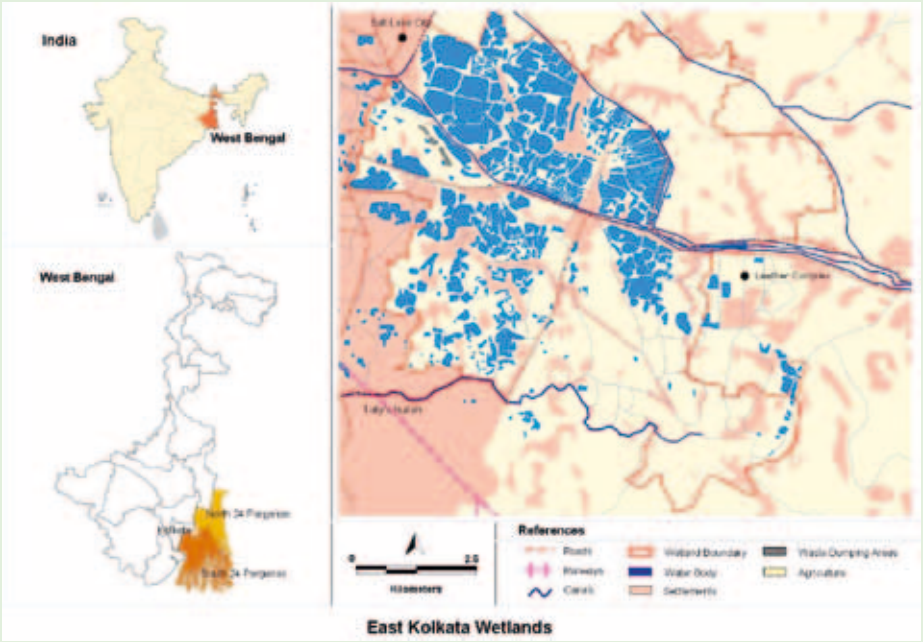
Case 4.2 East Kolkatta Wetlands

Wetlands as Wastelands

The East Kolkatta Wetlands (EKW) are located within the Gangetic delta on the eastern fringes of Kolkatta City. It is an assemblage of fish ponds spread over 12,500 acres. They formed the eastern margin of Kolkatta City which grew on the levees of River Hooghly in the sixteenth century. The city grew without a proper drainage system and most of the solid waste and sewerage were dumped initially into the river. Frequent outbreak of malaria, plague and other diseases made the planners abandon this waste dumping strategy and invested in the construction of channels to carry all sewage and sewerage into the non-descript malarious jungle - which was originally a series of salt lakes. Thus the city grew without investing into a waste treatment facility, basically depending on the nutrient retention function of the wetlands.

From Wastelands to Food Security

The wetlands gradually lost their connectivity to sea due to deltaic processes and extensive channelisation. This simultaneously triggered a gradual transformation to sewage fed fisheries, horticulture and agriculture, and thereby adding/transforming nutrient retention to augmentation of food security. A conducive environment for colonisation of freshwater fish was created and some informal stocking of fish was undertaken. Subsequent construction of waste water channels in the city increased access of farmers in the area to wastewater, which in turn encouraged others to adopt wastewater aquaculture. The wetland system presently has 264 functioning aquaculture ponds (called bheries), which produce annually more than 15,000 MT of fish. Since 1876 the western periphery of the wetlands have been converted to horticulture, and this productive vegetable growing area produces on average 150 MT of vegetables daily. These wetlands thereby have become central to food security of the city. The combination of agriculture and aquaculture provides livelihood support to a large, economically underprivileged peri-urban population of around 20,000 families.



East Kolkata Wetlands

East Kolkatta wetlands. By Ritesh Kumar

Recognition as a Wetland of International Importance

Despite being central to food security, the wetlands continued to face pressures from the expansion of Kolkatta city. Plans to convert areas for housing and a trade centre stimulated a movement to have the wetland protected. The site was declared as a Wetland of International Importance under the Ramsar Convention in 2002. The East Kolkatta Wetlands (Conservation and Management) Act was notified in 2006 to lay the foundation of the East Kolkatta Wetland Management Authority and systematic implementation of wise use principles for management of Ramsar Sites.

Towards integrated management planning

The wetland management authority has initiated measures for wetland management, key being development of an integrated management plan. Inventorisation and assessments undertaken have stressed the need to adopt an integrated river basin management approach with a shift towards multi-functionality of wetlands. Challenges in the form of increasing sedimentation rates, changing quality of sewage from organic to non-organic attributed to industrialisation, sewage allocation between various production systems, changing quality of sewage, addressing poverty, decline in biodiversity and enhancing effectiveness of institutions and governance systems have been identified, for which specific strategies and action plans have been proposed. The authority is also detailing an ecotourism plan to help realise conservation as well as livelihood objectives through sustainable wetland management.

Source: Wetlands International-South Asia, 2009

Box 4.1 The capacity of wetlands to treat waste water

When a critically high load of pollutants enters a wetland it changes the balance between the various naturally occurring processes. If its treatment capacity is rapidly exceeded, the ecology of the wetland system can exhibit a sudden, drastic change often involving a shift in species dominance and species composition. If there is a steady overloading of the system, this can result in a gradual shift in species composition that will slowly compromise the ability of the wetland to provide water treatment and degrade the important provisioning services of the wetland, such as fish production.

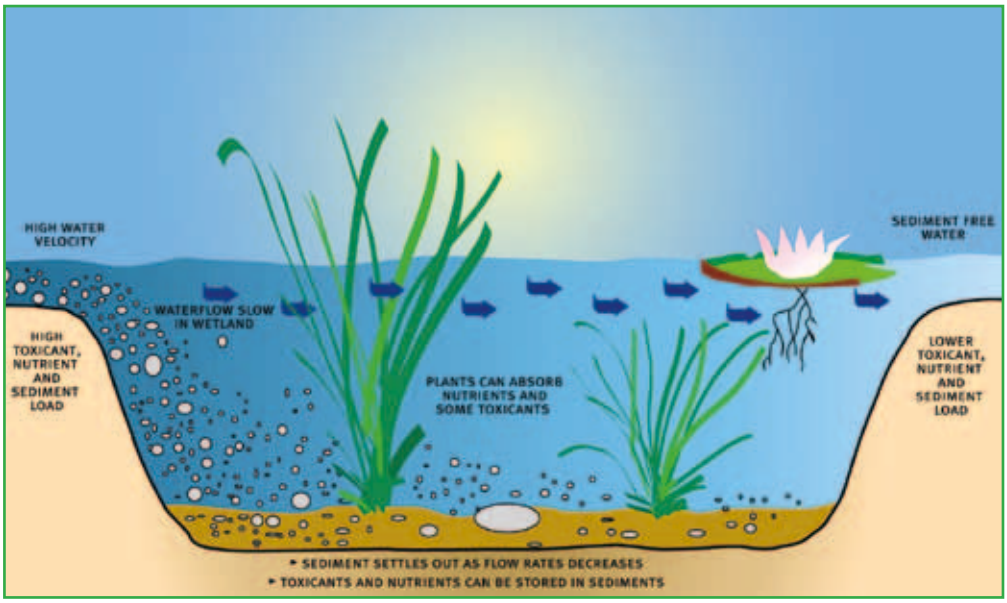
The effect of organic materials depends on the ability of water bodies to process these through various means including microbiological action, sedimentation and ultraviolet (UV) radiation. Detergents generally slow down these processes. If the pollution load is too high, oxygen levels in the water bodies and their soils drop and aquatic flora and fauna will die. Nutrients such as phosphorous and nitrate stimulate aquatic life but, beyond a certain level, they increase algae growth and cause eutrophication of water bodies.

The capacity of a wetland to treat wastewater is determined by the following factors:

- Plant and soil types within the wetland (different types have varying abilities to take up, bind or absorb pollutants);
- Hydrological regime (certain regimes are more suited to treating specific pollutant types; in particular low flows which allow solids including helminth ova to fall out of suspension);
- Climatic regime (temperature and UV intensity can control chemical and biological processes);
- Area and depth of the wetland (the larger the area, the greater the pollutant concentrations that can be treated; the shallower the depth the greater chance of UV radiation and oxygenation, but conversely the capacity for sedimentation is lower);
- The type and concentration of pollutants within the wastewater (high concentrations may exceed the ability of the wetland to treat the wastewater before it passes through the wetland; some pollutants cannot be removed);
- The volume and concentration of wastewater entering the wetland (large flows may exceed the ability of the wetland to treat the wastewater before it passes through the wetland and may also flush out contaminated sediment); and
- Wetland management (wetlands that are poorly managed for activities such as agriculture, fisheries or conservation may have a lower capacity to treat wastewater).

Source: Verhoeven *et al.*, 2007

include the East Kolkatta wetlands in India and the Nakivubo swamp in Uganda. In both cases, downstream wetland systems receive wastewater from urban areas, improving its quality and enhancing agricultural initiatives in the wetland by the urban poor. WASH programmes can make use of these qualities by using wetland systems as part of their waste disposal strategy. In the United States and Europe, natural, adapted and artificially created wetlands have been used for many years to act as part of the wastewater treatment chains, for the most part *"polishing"* wastewater after it has been pre-treated to remove the most significant pollutants. In Egypt, the Manzala Engineered Wetlands are an experimental constructed wetland system that is being used to assess the capacity and potential for treating Cairo's waste before it enters valuable Nile delta wetland systems.



Careful consideration needs to be given before using wetlands in waste treatment systems. Each wetland has a different potential to treat specific wastewater pollution types; and it is always necessary to assess the size, landform, water regime, soil and plant types of a wetland before determining whether it will be suitable for treating wastewater. After assessing these

Table 4.1. Water treatment processes in wetlands

Process type	Sedimentation	Vegetation processes	Bacterial processes	Soil processes
Removal of	Sediment, trapped bacterial flocs, helminth ova	Nitrogen (N); Phosphorus (P); heavy metals; toxins	Nutrients (N and P); organic matter	Phosphorus (P); toxins
Process description	Vegetation lowers water velocity, causing sediment deposition. By the time water is released from the wetland, it is relatively clear.	During growth, wetland vegetation is effective in absorbing nutrients, metals and some toxins. Nitrogen removal is further accelerated by microbial action concentrated around plant roots.	Denitrification is a bacterial process that removes different forms of carbon and N. P is also removed by bacteria. The efficiency of nutrient removal depends on the wetland type.	Wetland soils usually have a high organic content and bind nutrients - especially P - and other contaminants. However, phosphorus accumulates over time; once soils are saturated with P it is no longer removed from the water.

characteristics, a careful balance needs to be made between the composition and volume of wastewater discharged into the wetlands and the wetland's capacity to absorb them.

Risks from WASH activities

The capacity to purify and treat wastewater largely depends on the health of the wetland ecosystem. Wetlands are more than water reservoirs. Healthy wetlands are naturally self-regulating through a series of hydrological, biological, physical and chemical interactions (Mitsch and Gosselink, 2007). When a wetland is overloaded with wastewater these interactions begin to break down (see Box 4.1). This often leads the wetland to degrade, and instead of improving water quality it may become a source of pollution or a breeding ground for water-borne diseases. The wetland may also become incapable of providing food, fresh water, fibre and fuel. For instance, a wetland with too many nutrients will experience a change in the vegetation and fish species, along with the wetland's character. Such changes affect the kind and extent of the roles that a wetland plays for people living in its environs. Conversely, in some instances, such East Kolkata wetlands (see case 4.2) changes to the wetland caused by waste disposal have created opportunities for food production and livelihood support which are appreciated by local communities.

The waste composition also needs to be factored into the picture. The higher the concentration of pollutants in a wastewater discharge, the higher the possibility that it will exceed the carrying capacity of a wetland. The composition and volume of wastewater flows depend on the sanitation technology choices made: at source (i.e. toilet type); during the transport of wastewater; and for final treatment and disposal. It is important to note that some common contaminants in domestic waste water, such as detergents, impair the effectiveness of a wetland.

A wetland filled with wastewater in Brisbane, Australia. By Pieter van Eijk

Risks to WASH activities

A wetland system whose carrying capacity is exceeded becomes a risk to WASH (see Box 4.1) as the wetland can be transformed from a treatment system into a source of pollution and disease. Preventing this from occurring requires a clear management strategy that takes into account the type and volume of contaminants being processed and the capacity of the wetland system to handle them. A simple management strategy might include harvesting reeds to remove accumulated nitrogen, phosphorus and metals. More advanced approaches that can be applied to partially or fully designed systems might include sediment removal.

These sorts of risks need to be extended further into the cost-benefit analysis that informs the decision about integrating a wetland within a WASH waste disposal system. A key argument for the use of wetlands is that they can be cost effective components of waste treatment systems, avoiding the large costs of building and maintaining a traditional waste treatment

Case 4.3 Productive use of wastewater treatment - duckweed in Bangladesh

Small scale, duckweed-based ponds to treat domestic wastewater have been operated for decades in Bangladesh. Uptake of nutrients from the wastewater supports the growth of the plants, and the protein-rich duckweed biomass is harvested daily and fed directly into adjacent fishponds. This practice yields an annual fish production of 12 to 16 tons per hectare. A financial evaluation of this system suggests that these systems are able to generate a net profit from treating domestic wastewater. This is possible because the low-cost treatment is combined with revenue-generating aquaculture.

Harvesting seaweed in Hue Bay, Vietnam. By Marcel Silvius

facility. This may be true in many cases, but the maintenance costs and issues of scale versus waste volume should not be overlooked. The Manzala Engineered Wetlands are being assessed in terms of these issues. Although they are being shown to perform excellently in terms of water purification, the sheer volume of wastewater that comes out of Cairo and needs to be treated, the area of engineered wetlands that would be needed to do this and the costs involved in managing these wetlands, cast some doubts on the feasibility of the system if scaled up. On this basis it seems most likely that wetland systems are probably most effective when used to support WASH in small to medium size target communities or when waste streams are not very heavily loaded with pollutants.

If a wetland is to be used as part of the treatment process of domestic wastewater it is essential to understand the composition of the wastewater, in terms of volume and pollutants and how these will be regulated. There are some substances, such as fluoride and pesticides, along with some steroids and pharmaceutical residues that are not removed by wetland processes and these can accumulate within wetlands and their food chains. Other substances that are removed from the water can re-enter the system and cause problems at a later stage. Helminth eggs are one example: they can settle in the sediment but may continue to be viable if they are disturbed, DDT and heavy metals are other examples; they need to be bound into the substrate to prevent them from being biologically available. It should be noted that treatment of these substances can also be a problem in mechanised, conventional treatment processes so a full assessment of wastewater pollutants and pathogens is required before deciding on the most appropriate form of treatment.

4.6 Provisioning of food, fibre and fuel

Probably the most recognised benefit of wetlands for people is their role in providing resources such as food, fibre and fuel. In many developing countries, these capacities form the mainstay of wetland community livelihoods and health, providing the principal attraction for communities to live in and around a wetland system. In many communities these resources are partially or fully managed to ensure food security and to support livelihoods. For instance, one million people in the Inner Niger Delta in Mali are partially or completely reliant on the delta's production for their livelihood; fish production can reach 130,000 tons per annum, there are in excess of two million head of grazing livestock and flood pulse rice production can reach up to 170,000 tons/p.a. In Chilika Lagoon in North East India, 200,000 people are dependent on wetland fishery and agriculture production; the sale of fishery related products generated an estimated $18.23m in 2004/5. In Nakivubo swamp on the edge of Kampala, Uganda, some 5.3 km2 of wetland was found to provide local informal users with an estimated value equivalent to $200,000 p.a. (Emerton *et al,* 1998). The significance of these benefits to many rural and urban poor people cannot be under-estimated.

Benefits to WASH activities
The benefits to WASH from food, fibre and fuel provision are not directly obvious. However, the role they play in supporting community livelihoods and the subsequent effect in maintaining health is important.

Benefits from WASH activities
In this respect it is more important to consider the benefits of WASH activities to wetlands. Wastewater flows into wetlands can help to enhance the provision of different resources by

increasing nutrient inputs that stimulate growth and enhance harvests; waste is potentially a resource and can be converted into valuable products. The use of wastewater in urban agriculture and urban fisheries is very common. The Nakivubo swamp offers an example of vegetable growing supported by nutrient inputs, and is an important source of food and income for local communities.

Risks from WASH activities
The risks from WASH activities exist principally where a system is being used as a point for waste disposal as part of a wider sanitation treatment chain. As highlighted in Box 4.1, over-loading of pollutants can cause the character of an ecosystem to change and have the effect of reducing food provision. This will more often be a risk in wetlands that are relatively hydrologically closed, with limited flushing. Here nutrient accumulation will be more significant and levels of toxicity can more easily increase. Eutrophication caused by excess nitrogen and phosphorus is a particular case in point; this reduces oxygen levels in a wetland and can ultimately lead to loss of fish and key plant species.

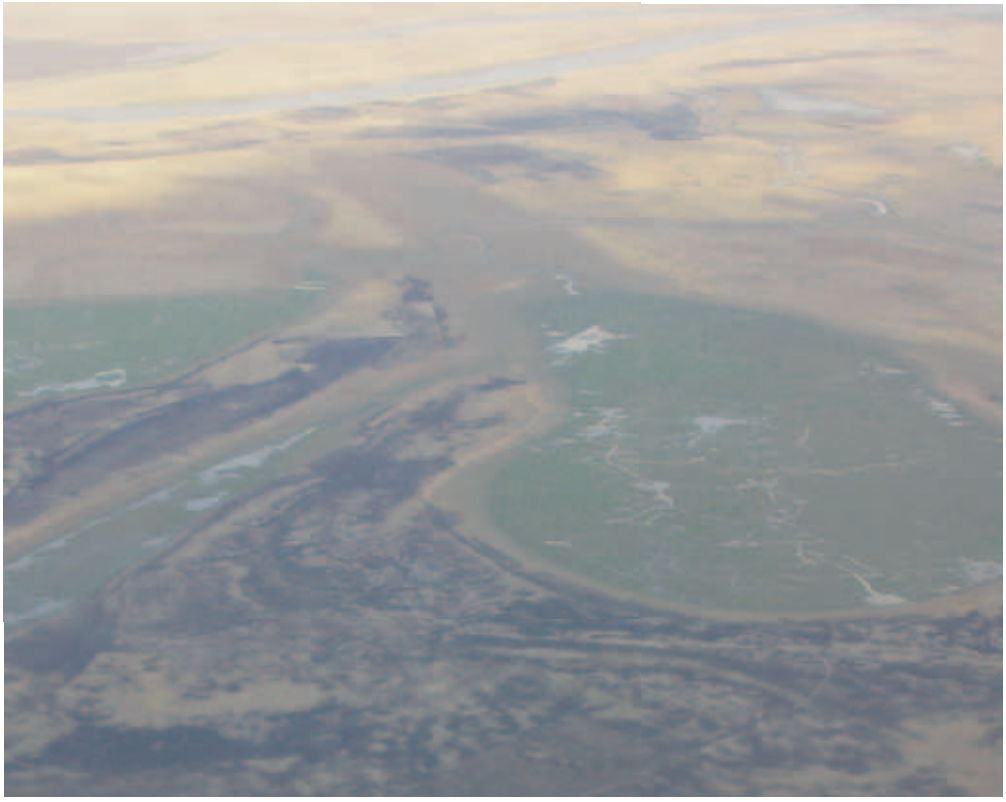
Risks to WASH activities
Food production in a wetland can often benefit from waste disposal, but where this is the case hygiene should be a paramount concern for WASH practitioners. Efforts need to be focused on ensuring that communities exploiting the wetland and nutrient inputs are aware of the health issues of working in contaminated water and of the need to adequately clean produce prior to sale and consumption.

4.7 Mainstreaming wise use of wetlands within WASH: opportunities to add value

4.7.1 Balancing risks and benefits
Wetland services can clearly contribute to the development of communities that live near, and depend upon wetlands. However, while wetlands play a key role in water supply and sanitation there are risks and benefits involved in mainstreaming the wise use of wetland services within WASH interventions and these need to be balanced. This can be achieved by devising strategies that positively build on the linkages and effects between wetlands, water supply and sanitation and avoid placing stress on these links. Table 4.2 provides an overview of the opportunities and risks of mainstreaming the wise use of wetlands within WASH activities and indicates how a balance \ can be found that adds value for wetland-dependent communities.

4.7.2 Managing the risks and benefits: questions of scale
We have shown how the links between wetlands and WASH occur at different scales. WASH interventions typically take a community-focused approach to improve health and livelihoods. Conservation typically takes an ecosystem and / or landscape approach to maintain delivery of services and support of biodiversity. However, the relationship of WASH with wetlands is complex: the services which benefit WASH are linked at different levels. WASH offers direct water supply and direct waste disposal to communities, however, the links between the wetlands and wetland dependent communities extend further than this and, ultimately, the sustainability of water supply cannot be separated from the health of its catchment area.

River basin wide planning is required in an integral way in order not to shift the problems from one part to the other; this is the Inner Niger Delta in Mali. By Leo Swarts



WASH and wetland focused organisations need to be concerned with this from two perspectives:

i. the sustainability of supply to a particular community is usually dependent on the upstream environment, that is out of their direct control; and
ii. the sustainability of the downstream supply for other communities can be affected by the management of wetlands within the primary target community of a WASH initiative.

It is important to place people and their WASH needs in this context. Essentially all water falling as rain or snow, and all water released as wastewater by humans to an area of land or a water-body will drain, via flows over the ground or via underground aquifers, to a river and then to the sea. Mapping and quantifying these flows helps to illustrate the downstream implications of pollution. These flows can be viewed locally, in terms of where and how people deposit their wastewater, collect their drinking water and use wetland services and products. It can also be viewed on a meso-scale by looking at areas that are connected hydrologically and the downstream implications of WASH activities.

Table 4.2: Mainstreaming wise use of wetlands within WASH

Opportunity	Risk	Balance	Added value
Fresh water source for domestic and productive use	Over-abstraction of water leading to water shortage	- Balanced abstraction and recharge - Habitat management	Water flow secured for both ecosystem functioning and people's needs
Water regulation	- Very low water tables increase WASH construction costs - High groundwater tables are more susceptible to contamination; increasing the risk of spreading pollutants and diseases. - High water tables reduce sanitation options (as waste cannot be stored underground or soaked into the substrate)	- Maintaining water tables - Local IWRM for multiple uses	- Recharge local or regional groundwater systems. - Maintain base flows in rivers and streams - Water available for exploitation by local or regional populations for multiple uses, including WASH
Flood and drought control	Loss or degradation of wetlands reducing river stability and groundwater levels.	- Selection of safe protected sites to tap water from source - Land use planning	- Disease prevention - Minimise flood damage - Provide water resources throughout the year and over a large area
Water purification and waste treatment	- Uncontrolled discharge of waste and wastewater - Exceeded carrying capacity leading to polluted water and disease risks - Degradation of wetland ecosystem - Invasive species	- Balance between carrying capacity, wastewater volumes and composition - Developing capacities for responsible management of wastes and wastewater	Wetland as a cost effective part of the treatment process to ensure safe drinking water
Provision of food, fibre and fuel	Excess nutrients may over-stimulate plant growth and result in changes in species composition (dramatic or gradual)	Understand the quality of wastewater streams and regulate them accordingly	Productive use of managed wastewater flows into wetlands

Ultimately it should be considered at a larger scale, looking at whole river basins. The hydrological and physical characteristics of a river basin influence the way people live and how they interact with each other. As well as being a physical unit, a river basin is also a social unit (Boelens and Hoogendam 2002). People's actions influence the availability and quality of wetlands and water resources, for themselves as well as for neighbouring and downstream

communities. The upstream and downstream linkages between sanitation, water supply and wetlands are best understood in the context of river basins. Untreated wastewater ends up somewhere in the river basin: in the soil, the shallow groundwater or surface water bodies. This has an impact on other water use and users within the river basin. Wastewater from an inadequate sanitation system can enter groundwater that is used for a water supply. The level of pollution, where it ends up downstream, and how it gets there, depend on the type of sanitation systems used and how they are linked within the overall water system.

It is therefore important to embed WASH activities in the river basin context and the wider water use and management. This allows for recognition of the role that wetlands play in providing good quality water supplies and the potential negative impacts that water supply and sanitation can have on natural water resources. This sort of approach can allow potential pollutant sources to be identified and prevented (for example by creating a treatment barrier to prevent pathogens from contaminating drinking water supplies). Such an integrated basin level approach to water resource management will bring multiple sustainable solutions that directly benefit the well-being of people living within the catchment area.

4.8 Summary

This chapter described the multiple benefits that wetlands provide to communities through the ecosystem services that they provide. It is important to maintain these services as they directly influence the well-being of people living in and around wetland areas.

Choices about sanitation systems, water abstraction and wetland management all have an influence on each other. These in turn influences both ecological environmental and human health, which determines the potential for sustainable development within a water catchment / basin.

The following chapter describes principles for managing the links that exist between wetlands and WASH activities and how to optimise these links so as to benefit the health and livelihoods of communities that depend in part or in whole on wetlands.

5. Management of vital linkages

5.1 Introduction

Previous chapters have made the case for improving cooperation between practitioners of WASH and wetland conservation. The barriers to achieving this have been outlined, the issues driving WASH and wetland conservation activities explored and the benefits and risks of WASH interventions capitalising on wetland service provision have been illustrated. Now we consider what can be done to address these issues and create more sustainable and holistic solutions in wetland areas. The key principles that need to be addressed by practitioners are described and practical approaches to improve cooperation between the two sectors are outlined. This chapter explores the main directions in which fruitful cooperation between the WASH and wetland conservation sectors could follow in order to sustainably capitalise on the linkages between the two.

5.2 Integrated Water Resource Management

Practitioners of WASH and wetland conservation both work with water and communities that use this resource, either directly (water supply and disposal of waste) or indirectly (by benefiting from ecosystem service provision). As such they need to work in a more integrated way. Policy and practice need to be better linked, reflecting the realities on the ground. Organisational and institutional capacities need to be developed to achieve this. The concept, principles and processes of Integrated Water Resource Management (IWRM) provide a guide as to how this can be achieved, as this embraces all aspects of water management. It promotes the coordinated development and management of water, land and related resources, in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. IWRM is based on the Dublin principles, agreed in 1992 at a preparatory conference to the Rio Earth Summit (see Box 5.1). These provide a useful basis for considering the main elements that should underpin the linkage between WASH activities and wetland conservation.

IWRM is about applying the principles of efficiency in use (as water is a finite resource), equitable sharing of water resources for all stakeholders, environmental sustainability and valuing water as an economic good. IWRM recognises the need to manage water resources at different scales, from local to basin, to ensure that local needs can be sustainably met.

Although the principles and concepts of IWRM are widely recognised, and many are adopted in government and non-government high level policy and strategies, globally the implementation of IWRM is not yet satisfactory. This is not surprising as it is not a quick fix solution. The Global Water Partnership definition states that it is a *"process"* that has to be pursued progressively through individual initiatives that work towards removing sectoral constraints (IRC, 2006). However, given the integral role of the environment in supporting people's livelihoods, it is surprising that it is still regularly overlooked in IWRM implementation. Furthermore, organisations responsible for promoting WASH activities still have some way to go in fully integrating their policy and practice with wider IWRM processes. The process and principles of IWRM need to be fully adopted at all levels for integration to occur. Those which are most relevant to improving the linkage between WASH and wetland conservation issues are discussed in more detail below.

Box 5.1 The Dublin principles

1. Fresh water 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 groundwater 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 users in the planning and implementation of water projects.

3. Women play a central part in the provision, management and safeguarding of water.
This 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 recognised as an economic good.
Within this principle, it is vital to recognise first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Past failure to recognise 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.

Source: United Nations Conference on Environment and Development (UNCED), Rio de Janeiro, 1992

5.3 Overcoming challenges

5.3.1 No community is an island

Following IWRM principles means working at multiple scales. At the local scale, a community's multiple uses of water are most tangible offering the best opportunities for locally identified and developed solutions. Local IWRM enables the interface between WASH and ecosystem service needs to be considered in relation to community and ecosystem requirements. It can help to:

i. Ensure access of the poor to an equitable share of water resources at catchment level
ii. Promote water and sanitation for multiple uses at household level, to support people's livelihoods.
iii. Ensure integration of ecosystem water requirements in planning and management

However, IWRM is also about other scales of water management and the different actors involved. Therefore vertical linkages between local, provincial and national levels of water planning and management are also critically important. Whilst most pressing water resources issues occur at the local level, their resolution and/or impact may well have implications for action taken at a hydrological catchment or basin scale. The challenge therefore is to bridge the gap between these different scales. Basin-level integrated water resource management planning must take into account the realities of small-scale users' needs integrating them into the wider water resource context. However, there are some challenges to realising this integrated approach.

WASH organisations often regard IWRM as something far removed from the day to day reality of their work. The most frequently heard arguments for this include: *"the domestic sector only uses a relatively small amount of water"* or *"IWRM discussions deal with river basin level issues, while we work at the local level"*. While it is often true that the domestic sector takes a relatively small share of total available water resources, the requirements of domestic users for a high quality and a reliable water supply mean that, at critical times of the year, domestic use can become significant. Equally, urban populations can represent an important local demand that may conflict with the requirements of farmers and the environment in the rural hinterland. Increases in sanitation services delivery often lead to increased pollution if wastewater is not properly managed.

For **wetland conservation organisations** IWRM processes offers the best opportunity to really link ecosystem water requirements and service provision to local scale water management and planning. However, the ecological environment is frequently under-represented in these processes because the links between ecosystems and people's health and livelihoods are not fully recognised by those concerned with local water planning. The tendency is to focus more on direct water-use by people. Equally some conservation

Table 5.1. Stakeholder groups and their interests

Stakeholder	Interests
-Individuals/households	-Access to safe drinking water and sanitation
-Wetland dependent communities	-Access to sustainable livelihoods from wetland goods and services
-Government agencies (local, regional and national)	-Economic development through agriculture, aquaculture, industry and forestry -Urban development -Healthcare provision -Environmental protection
-Public utilities	-Providing drinking water supplies and sanitation services
-International and local non-governmental organisations	-Provision of drinking water supplies and sanitation -Wetland wise use
-Private companies	-Economic activities

organisations still focus much of their efforts on identifying and protecting biodiversity rich wetlands, failing to sufficiently recognise that the maintenance of these ecosystems can only be sustainably achieved through engagement as a stakeholder in IWRM at different scales.

Breaking down these sectoralised perspectives takes time. They are both philosophically and institutionally embedded in organisations and their view on how they should be working. There is a need for awareness raising, capacity building and mainstreaming of IWRM approaches in both sectors. More specifically there is a need to highlight the different scales of linkages of their activities in the terms of IWRM and the consequences of their activities. From this point, organisations need to develop practical guidance on how to ensure sustainable approaches, that take this into account, can be mainstreamed into their activities.

5.3.2 Engage the whole community

A key element of IWRM is the participatory approach; all stakeholders from local users through to decision-makers, planners and managers at different scales must be involved. In reality this picture is rarely as inclusive as it needs to be and some sectors or users tend to be excluded from participation. This is a critical barrier to improving the livelihoods and health of wetland communities. Project or programme planning and implementation in the WASH and wetland conservation sectors is normally undertaken separately. It is rare that all stakeholder groups are identified and consulted and the implications of a project fully understood. Without identifying who will be affected, and how, it is not possible to attempt to address their needs or take them into account. Hence, all stakeholders need to be identified, consulted and their needs addressed. It is also important to understand at an early stage the economic implications of a project and how it will affect people's health, livelihoods and wider ecosystem services.

There are a large number of stakeholders involved in sanitation provision and drinking water supply and more involved in wetland management (Table 5.1). In most cases there are many interests at work so it is often hard to reach a consensus regarding sanitation provision, drinking water supply and wise use of a wetland. Some interests have strong lobbies behind them, but most are not organised. In some cases interests and stakeholders are moderated, even articulated and coordinated, but in many cases this does not happen. Without an understanding of the needs of all stakeholders, social justice, in relation to access to sanitation and a safe, clean drinking water supply, the maintenance of wetland environmental health and the associated benefits to livelihoods, cannot be reached. Ensuring successful integration is another powerful reason for undertaking an assessment of all stakeholders and their varying interests.

A common characteristic of communities using wetlands is that they have limited formalised access rights to the resources they use, even though these resources are critically important to their livelihood. These communities may or may not be the focus of WASH activities. Care should be taken to fully understand and engage with all groups that access wetland resources and the implications of WASH and conservation activities on these patterns of resource use. Without this assessment, projects and programmes may be developed that benefit some stakeholders at the expense of others.

5.3.3 Involving women: key to success

Women - as the primary users of water in cooking, washing and tending livestock - need to be centrally involved in any community water and sanitation programmes. Even though women's involvement in the planning, design, management and implementation of such projects and programmes has proved to be fruitful and cost-effective, the substantial benefits of involving women are often not fully recognised. As a result women are all too often not as centrally engaged in water, sanitation and wetland management efforts as they should be.

Evidence shows that water and sanitation services are generally more effective if women have taken an active role in the various stages involved in setting them up, from design and planning, through to the ongoing operations and maintenance procedures. As well as dealing with these technical and practical issues, women also have an important role in educating their families and community about hygienic practices. Again, evidence suggests that their involvement makes these ventures more likely to succeed.

Improved service provision and better knowledge about hygiene have beneficial effects for a whole community, most obviously through improved health and quality of life. There are more subtle effects of these measures on the lives of women, such as greater confidence, increased capacity to earn money, and a general sense of well being that allows them to dedicate more time to making the home a better place to live. Ultimately, what is good for women is good

Box 5.2 For her it's the big issue - facts and figures

The eight Millennium Development Goals (MDGs) - which range from halving extreme poverty to
In many societies, water is at the core of women's traditional responsibilities: collecting and storing water, caring for children, cooking, cleaning, and maintaining sanitation. These tasks often represent a whole day of work; in some regions, women spend up to five hours a day collecting fuel wood and water and up to four hours preparing food. In Africa, 90% of the work of gathering water and wood, for the household and for food preparation, is done by women. Their interest in WASH issues is major, since it is they who look after the household, and whose children often fall sick due to contaminated water or lack of hygiene: each year, nearly two million children die from diarrheal diseases.

Whether a woman lives in Africa, South America or Asia, one of her primary tasks is to gather water for her family. Women in poor communities across Asia, Africa, and South America typically walk an average of 3 miles a day to fetch water for their households, often from contaminated sources such as rivers, unprotected springs, and shallow wells. The time this takes - 40 billion hours annually of women's time worldwide - could be spent instead on income-generating activities, education, and caring for the family. Moreover, the quality of water that women in developing nations must bring home puts people at risk of deadly diseases such as cholera, typhoid, amoebic dysentery, and diarrheal diseases that kill more children under five than AIDS, malaria, and tuberculosis combined. Only with safe and accessible water will women and their families have a chance to live and to lead productive lives.

Sources:
-http://us.oneworld.net/article/362103-undo-water-burden-placed-women;
-http://www.wateryear2003.org/en/ev.phpURL_ID=2543&URL_DO=DO_TOPIC&URL_SECTION=201.html

for the family and the whole community, who share the benefits from all these improvements. Such measures can have knock on effects on the health and prosperity of nations. These are all important reasons for engaging women in the planning, implementation and operation of water supply, sanitation and hygiene projects (Fisher, 2006).

This pivotal role of women extends beyond WASH issues. As shown in this publication, the health and sanitation issues facing wetland communities are closely related to the management of water resources, both locally and upstream. Local water resource management - or the lack of it - will have effects downstream. Often women will be among the groups most affected by any such changes (see Box 5.2), because of the different ways that women make use of wetland resources and the limited access and control that they have over these resources. Women often grow different crops - more vegetables and staples for the family table - care for different types of livestock, have different rights and access to economic resources, e.g. irrigation schemes, and have different patterns of economic activity, e.g. processing and selling fish at the local market.

It is obvious that there will be differences in the needs and interests of men and women and the role they can play in health and sanitation issues and water resource management. Yet, the specific needs of women and the role they can play are frequently overlooked. Unequal power relations often place women in a disadvantaged position. While the women labour to provide water for household needs and their subsistence and economic activities depend on the management of water resources, it is usually the men who make decisions about water resource management and development at both local and national levels. Community based approaches are not always inclusive of women's interests and do not always take gender perspectives into account. The inadequate involvement of women has hindered programmes and projects aimed at improving the sustainability of water resource management.

This shows the need to explicitly include gender specific analyses over access to and use of water resources. This needs to be context-specific and address questions such as the productive and domestic uses of water as well as women's and men's access to, and control over, water, land, credit and extension services. Women will probably have different perceptions than men about health, sanitation and water management issues.

Projects, programmes and policies that address gender inequalities will contribute to better water resource management and offer more human development opportunities for both men and women. When listened to, women often come up with extremely practical suggestions and solutions. There are many examples of programmes and projects that have benefited from a proper gender analysis and specific measures that involve women in analysis, planning, implementation and monitoring. These measures have played important roles in improving health, reducing poverty eradication and improving sustainable resource use. Thus, a deliberate strategy of gender mainstreaming is needed both within WASH interventions and those aimed at wetland conservation (GWA and UNDP 2006).

A girl sitting in front of her family's home in a wetland in Vietnam. By Pieter van Eijk

5.3.4 Coordinate and integrate sectors

Even if all stakeholders are initially engaged through participatory consultations, actual implementation of programmes or projects often occurs through uncoordinated initiatives developed at different administrative levels and by separate sectors (see Box 5.3). Wetlands are multiple-use resources, not just in terms of community use but also as resources that different government sectors regulate or access. In many cases the private sector might also have a significant stake. For instance many wetlands are important food production areas that have regional or even national significance. As a result agencies responsible for fisheries, agriculture or forestry may all have stakes in the management of natural resources in a wetland area. When the different agencies responsible for development, such as water, irrigation, health and urban planning are included, the diversity of different sectoral approaches to managing communities in wetland areas becomes very great. These different sectors will often all have their own vision and approach to resolving issues in a particular location. Therefore vertical and horizontal engagement is required, within and across sectors, to better integrate management approaches. Co-ordinated initiatives involving these government agencies, civil society and private sector organisations needs to occur to ensure project success and the avoidance of detrimental impacts on environmental and human health.

5.3.5 Recognition of full economic benefits

Wetland management and WASH provision not only require coordination but must be based on awareness and careful consideration of the costs and benefits involved. The summary of wetland service provision and the associated risks and benefits to WASH outlined in chapter 4 show that there can be significant costs and benefits associated with the way in which WASH interventions are conducted in wetland areas.

Box 5.3 Sectoral decision making, Vietnam

The Mekong Delta region of Vietnam provides a good example of sectoral separation in government decision making. The national government has set targets for sanitation, water supply, fisheries, agriculture, forestry, health provision and biodiversity conservation. It is the responsibility of regional and local government agencies to implement the national goals for increased rice, pineapple, shrimp and forestry production and to meet targets for health care provision. Without adequate consultation with local farmers and other government departments the agricultural department has undertaken the conversion of natural wetland areas to rice and pineapple production. These wetlands are underlain with acid sulphate soils. Conversion to agriculture, and the associated drainage, resulted in the release of sulphuric acid into surface and groundwater. This compromised the health department's water supply initiatives as connections to aquifers or surface waters no longer provide safe water. Similarly efforts to reduce dengue and malaria in the area have been jeopardised by the fisheries department converting large areas of the southern delta into shrimp ponds. These provide an ideal habitat for mosquito larvae and this has had huge health implications for the local population. Health department initiatives have seen the connection of villages to improved sanitation systems such as pour flush toilets with piped outlets into rivers and canals. Traditional sanitation systems, with squat toilets over ponds, provided organic food inputs for fish ponds. *'Improved'* domestic sanitation facilities level have often resulted in untreated wastewater contaminating drinking water supplies and threatening biodiversity conservation efforts by other government departments.

Source: Maltby and Simpson, 2002

A community meeting in Sévéry, a village in the Inner Niger Delta, Mali. By Marie-José Vervest

A village sanitation centre built by Simavi in Bangladesh. By Simavi

The costs of providing access to safe water and sanitation vary, depending on the level of treatment and the technologies involved. A centralised high-tech treatment plant generally has high construction, running and maintenance costs while de-centralised lower-tech treatment options can offer suitable treatment at substantially lower costs. There are economic costs in providing adequate sanitation and drinking water supply but in the absence of such facilities there are other costs to people who have to pay for health services, who pay more to access clean water supplies, or who may lose income from being unable to work.

Wetlands can play an important role in different aspects of WASH. For example, using a natural or constructed wetland for sewage treatment can bring substantial economic benefits. Such a use of wetlands can reduce treatment costs but it is essential that the provision of one service does not negate the delivery of other services (Box 5.4). For example, if wetlands receive nutrients in quantities which exceed their absorption capacity this will reduce their ability to support fish or plant populations, which may be the basis of local livelihoods.

Therefore the planning of WASH activities in wetland areas must identify the potential risks and benefits; including indirect ones and take into account the associated costs and benefits. This means taking ecosystem service costs and benefits into account alongside the more direct costs of the WASH activity.

Box 5.4 Examples of economic benefits of wetlands managed for wastewater treatment and drinking water supply

Provisioning Services

- Fisheries in Chilika (India) form the primary livelihood base of over 200,000 fishers living around the lagoon (Kumar, 2004)
- Mangroves in Ream National Park in Cambodia provide subsistence support to nearby households, averaging US$220 every year for each household and a total of US$ 1.2 million for the community (Emerton, 2003)
- Groundwater, often recharged through wetlands, plays an important role in water supply -providing water to an estimated 1.5-3 billion people worldwide. The floodplain of the Nguru wetlands in Nigeria provides a groundwater recharge that has been estimated as having a daily value of US$ 413,000 (Acharya *et al.*, 2000)

Regulating Services

- Mangroves in Koh Province in Cambodia provide storm protection which is estimated to be worth US$32 for every hectare (Bann, 1997);
- The water purification role of Nakivubo wetland adjacent to Kampala, Uganda on the coast of Lake Victoria was estimated to have a value of between US$980-1810.000 p.a. (Emerton *et al.*, 1998)
- That Luang marshes, adjacent to Vientiane City, Laos regulates floods and recycles the nutrients from its industrial and domestic wastewater. These functions have an estimated value of US$2.8 million per year and US$71,000 per year respectively (Gerrard, 2004)

Cultural

- Ecotourism in Kenya's wetlands is estimated to be worth US$450 million per year (Moran, 1994)

Approaches to evaluating the costs and benefits of WASH interventions are relatively standardised. However, the costs and benefits of wetland services are not so commonly included in the equations. There are many examples from developed countries where wetlands have been used as part of tertiary wastewater treatment. In such cases the projects go ahead on the basis that the calculations show a quantifiable benefit in using wetlands in this way. However, in developing countries, where the range of costs and benefits are broader and the interactions more complex, this is less common practice. Such approaches have been adopted for the Nakivubo Swamp, Uganda (Emerton *et al.*, 1998) and the East Kolkata Wetlands in India (see case 4.2) which provide two of the best known examples of such approaches. Much more work is needed to develop standardised approaches that can be used by WASH practitioners. Stuip *et al*. (2002) and Constanza *et al.* (1989) provide a useful overview and introduction about how to assess the values related to wetland services.

5.3.6 The importance of good governance

Governance relates to how individuals and public institutions interact together to create change. It involves a range of mechanisms, processes and institutions through which individuals and groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differences. In a wider sense, governance is also reliant on an effective legal system, the role of the media and the presence of political parties, lobby groups and civil society. Good governance is a critical component of IWRM. It is the mechanism through which

A specially constructed wetland for the treatment of wastewater. By Stef Smits

Floating islands in Loktak Lake, India. By Ritesh Kumar

sectoral and community (including women's) issues are represented and resolved during the planning and implementation stages of development interventions. Improving the linkages between wetland conservation and WASH activities requires developing governance systems that are appropriately designed, resourced and implemented and ensuring that WASH and conservation stakeholders are represented, together with target communities.

Local scale governance is particularly important as water resource management failures are often the result of weak governance at a local scale. This is despite a growing tendency for the responsibilities for water resource management to be devolved to local stakeholders. Local governance is a central principle of IWRM. It provides recognition that local stakeholders frequently have the best understanding of the issues affecting them and how to resolve them. However, policy makers and governmental institutions do not always provide the resources to support local governance. Moreover, poorly designed or structured governance systems often allow local authorities to exploit natural resources for profit at the expense of some local communities. Good governance structures need to engage the appropriate range of stakeholders and equip them with the resources and influence to make a difference. This is a vital component in achieving effective and equitable local scale water management. In practice professionals involved in both WASH and conservation activities often face significant problems when trying to engage in governance structures overseeing local scale resource management.

Box 5.5. Governance in sanitation and drinking water provision; theory and reality

To be effective the governance of sanitation and drinking water provision should be:

- open and transparent;
- inclusive and communicative;
- coherent and integrative;
- equitable and ethical;
- accountable;
- efficient; and
- responsive and sustainable.

Source: Rogers and Hall, 2003

Unfortunately the governance of sanitation and water provision has often been:

- bureaucratic and labyrinthine rather than open and transparent;
- exclusive and expert-driven rather than inclusive and communicative;
- sectoral and segmented, rather than coherent and integrative; and
- biased in favour of those able to access the large water and sanitation networks, rather than equitable and ethical.

Source: Mcgranahan and Satterthwaite, 2006

Water and sanitation affect all community members, from young to old. By Simavi

Governance and WASH activities
Inadequate sanitation and drinking water provision are often the result of a failure of governance (Mcgranahan and Satterthwaite, 2006). This may stem from a lack of institutional resources, social structures or a system of rights, entitlements or financial resources. In the case of sanitation this is often because of lack of political will or interest; human waste has limited political appeal. Sanitation is often regarded as a problem to be dealt with behind closed doors, in the privacy of the household. The negative effects of poor sanitation are frequently ignored by local politicians. As a result in many regions of the world, poorer groups, have either no access to sanitation and water supplies, or receive a very poor service.

Governance can be improved by building the capacity of individuals and civil society, supporting local governments and communities and making service providers more accountable. All these factors can have a beneficial effect on the provision of sanitation and drinking water supply.

Governance and the wise use of wetlands
There is a wealth of guidance on the need for and establishment of wetland management systems and how to link this with relevant governance structures (e.g. *"Managing Wetlands"* Ramsar Handbook 16, 2007; see **www.ramsar.org**). Despite this, wetland conservation projects are rarely engaged with wider natural resource governance structures. Frequently there is no management plan and wetlands are used in an unregulated, unsustainable way

Box 5.6. Integrated approach to management of That Luang Marsh, Lao PDR

That Luang Marsh is a large wetland downstream from Vientiane, the capital of Laos, which receives all the wastewater and floodwater from the city. The management challenges are typical of wetlands located downstream from urban areas. The WWF, WWT and local government departments, are jointly running a programme 'Wastewater treatment through effective wetland restoration of That Luang Marsh (WATER)' that seeks to integrate wastewater treatment with the wise use of the wetland.

Recognising stakeholder needs

That Luang Marsh has been drastically altered through urban expansion and conversion to agriculture but it still supports the livelihoods of more than 40,000 people. As well as formal landowners, who grow rice or manage fish ponds, there are many people who have limited access rights within the marsh but who practice capture fishing or harvest wetland plants for food. These wetland products are vitally important resources for some poorer sections of society. The wetland also provides services including urban flood control and wastewater treatment for industry and all the residents of Vientiane. A range of government departments (e.g. agriculture, environmental protection and urban development) and national and international NGOs have an interest in the future of the marsh and the way it is managed: and all have plans for its future.

The WATER project has involved stakeholders from across Vientiane through a series of workshops and meetings. Visioning exercises have led to the development of zoned plans for the marsh that ensure the needs of all stakeholders are maintained and developed. These plans have been developed into an adaptive management strategy for the area which will be translated into action for government departments and local government institutions, down to the village office level.

Recognising the economic benefits

That Luang Marsh not only provides a range of wetland products but also provides flood control for Vientiane City and recycles the nutrients from its industrial and domestic wastewater. These functions have an estimated value of US$2.8 million per year and US$71,000 per year respectively (Gerrard, 2004). The economic importance of the marsh to the people of Vientiane has not been widely recognised and this contributes to its continued degradation and destruction.

The WATER project has undertaken a series of training sessions with government staff in many agencies to raise awareness of the economic importance of the marsh to Vientiane and the costs involved in wastewater treatment or flood control if it was lost. The local media has been enrolled to raise awareness among the general public.

Poor governance

Agricultural expansion and drainage works have had a large impact on That Luang Marsh over the last 20 years. Urban development has led to the destruction of large areas of the wetland for industrial and residential construction and for infrastructure. These developments have often occurred without adequate planning or regulation. Some government staff remain unaware of environmental protection policies and legislation related to That Luang Marsh. Government initiatives for urban development have ignored planning restrictions and individuals who breach the law are not prosecuted, so development continues unabated. There is no single body with sole responsibility for managing the marsh or for integrating sanitation provision, wastewater treatment and agriculture. As a result the initiatives of separate government departments do not consider the impacts that their plans may have on other sectors, stakeholders or the integrity of That Luang Marsh.

To address this, the WATER project has set up a steering committee for the management of the marsh. The committee is chaired by the vice-mayor of Vientiane and includes the heads of the different government departments that have a stake in the wetland. This allows direct communication between the different departments, enabling the identification of conflicts and solutions. Wetland monitoring, the development of a management plan and stakeholder engagement is undertaken by a technical team that includes representatives from all of the relevant government departments.

Increasing integrated management skills and technical capacity
Prior to the WATER project there was a lack of understanding of the sources of pollution, the impacts it had, the goods and services that That Luang Marsh provided and how to manage urban or agricultural development. In addition the technical capacity of government departments to develop or deliver an integrated approach to sanitation provision and wise wetland use was very limited.

The WATER project has undertaken a comprehensive programme of training to raise the technical capacity of government staff. The staff have now designed and supervised the construction of small scale treatment systems to treat point source wastewater inputs from industry and domestic properties. These pilot studies will be used as a training resource for other government staff. Staff have also been trained in coordinated management planning and implementation. An adaptive management plan will be developed by these staff and implemented within the relevant government departments.

Source: M. Simpson, *pers comm*. Wastewater treatment through effective wetland restoration of That Luang Marsh (WATER) Project, 2009.

by many actors (see Box 5.6). When governance structures are in place they are often uncoordinated. For instance in Pakistan the catchment of the Rawal Lake is managed by the Capital Development Authority, the lake itself is managed by the Irrigation Department and the responsibility for downstream use is with the Rawalpindi Water Supply and Sanitation Authority. As such there is a lack of effective coordination and resource management simply falls *'between the cracks'*.

The following measures all contribute to wetlands issues being better integrated within water resource management governance:

- Development of an adaptive wetland management planning process that includes all the stakeholders that make use of the wetland resource. This should develop a common vision and action plan that is appropriate to scale and governance structures. Particular attention needs to be paid to the functions of water treatment, buffering and resource provision at both local and wider river basin governance levels;
- Local integrated wetland management needs to be integrated within a national policy framework. This might consist of existing laws and policies, constitutional directives or recognised international conventions. Some countries have prepared specific wetland regulations or policies and these can be used as a model for other countries;
- Develop appropriate and dedicated governance and management arrangements. Usually wetland management will need to be linked to established governance

Box 5.7. Chilika Development Authority: An example of a wetland focused governance and management structure

Lake Chilika is the largest coastal lagoon on the east coast of India. Covering between 906 km^2 and 1,165 km^2, it is an assemblage of shallow to very shallow marine, brackish and freshwater ecosystems and a hotspot of biodiversity. Over one million migratory birds commonly winter here. The diverse and dynamic assemblage of fish, invertebrate and crustacean species found within Chilika provide the basis of a rich fishery which supports over 200,000 local fisher folk and generates over 6% of the state's foreign revenue. The lake is also inextricably linked to the local culture and belief systems. Based on its rich biodiversity and socioeconomic importance, Chilika was designated as a Wetland of International Importance (Ramsar Site under the Convention on Wetlands) by the Government of India in 1981.

Chilika underwent considerable degradation during 1950 - 2000 owing to increasing sediment loads from degrading catchments and reduced connectivity with the sea leading to decreasing salinity. A key institutional response was constitution of the Chilika Development Authority (CDA) in 1991. Key objectives of the authority include : a) protection of the lagoon ecosystem with all its genetic diversity; b) formulation of management plan for integrated resource management; c) execution of multi-dimensional and multidisciplinary developmental activities implemented by either itself or through other agencies; and d) collaboration with various national and international institutions for management of the lagoon. The authority is chaired by the Chief Minister, which signifies the high priority accorded by the government to lake conservation. Members of the governing body include secretaries of the concerned state government departments and stakeholder representatives.

In 2000, CDA enabled a major hydrological intervention in the lake through opening of a new mouth to the Bay of Bengal which helped improve salinity levels, enhanced fish landing, decreased invasive species and improved lake water quality overall. The initiative rejuvenated the lake ecosystem and improved livelihoods of communities dependent on its resources for sustenance. The restoration was recognised with a Ramsar Award to the CDA in 2002. The authority also initiated several measures for ecosystem restoration including catchment area rehabilitation, hydrobiological monitoring sustainable development of fisheries, wildlife conservation, ecotourism development, community participation and development and capacity building at various levels. One of the key features of these interventions is ensuring stakeholder participation, particularly local communities in design and implementation of various interventions. While maintaining a very lean and efficient institutional arrangement, it has successfully created a network of 44 international and national institutions which provide technical support to its various initiatives. This has played an instrumental role in bringing the latest know-how and technical expertise to support lake management.

CDA is presently developing an integrated management plan for the lake ecosystem based on integrated river basin and coastal areas management principles, being supported by Wetlands International. It has also triggered formation of a state wetland authority, which would bring all upstream wetlands under one management ambit, and provide a basis for integration of wetlands into river basin and coastal zone management. The authority is also being vested with regulatory powers to enable it regulate detrimental activities within the lake, in particular certain fishing practices which have negative implications for lake ecosystem processes and functions.

Source: Kumar and Pattnaik (in press).

structures. In some cases a special management arrangement, properly resourced and empowered, may be required. This is more likely to be needed when the area is large, there is a wide range of interests and/or the issues are institutionally and technically complex. Box 5.7 outlines an example in Chilika Lake, India.

Coordinated governance for sanitation, water supply and wise wetland use
The challenges involved in improving governance within IWRM are significant and complex, both for WASH and wetland conservation practitioners. However, they lie at the core of improving the way that the issues experienced at the community level are recognised and integrated into planning and management. To resolve sectoral issues and the joint issues at the core of WASH and wetland conservation activities, governance structures and processes must be established in order to engage the relevant stakeholder groups in planning and management. Box 5.8 shows the priorities for WASH organisations. Both sectors also need to be represented in larger scale governance bodies, such as those responsible for river basins, urban areas and regional development. Here a different set of tools needs to be developed that enables these needs and challenges to be represented alongside other, possibly better articulated, interests.

5.3.7 Increasing integrated management skills and technical capacity

Many of the cross-cutting linkages discussed above can best be addressed by building cross sectoral and interdisciplinary capacities. No single sector sees itself as having *'sole ownership'* of these issues and, as such, individual organisations typically do not have all the in-house capacity to address them.

Inadequate drinking water provision is often the result of a failure of governance. By Simavi

Box 5.8. Local scale IWRM governance

Improving local scale water resource management can often be a governance issue. Whilst the devolvement of responsibilities to local stakeholders is increasingly common, policy makers and governmental institutions do not always provide the resources to support local governance, thereby undermining it. Good governance structures that engage all the involved stakeholders and equip them with the resources to participate in decision making or programme / project design are the key to achieving effective and equitable local scale water management strategies. Tools and methodologies need to be developed that can integrate WASH interventions into IWRM at the local level. These include:

- Stakeholder dialogues
- Approaches and tools for integrated planning
- Multiple Use Services (MUS) approaches
- Sanitation and livelihoods

Some resources for developing these approaches can be found via the International Water and Sanitation Centre (IRC).

Practitioners at both basin and local levels often do not see the benefits of integrating sanitation provision, drinking water supply or wise wetland use projects or, if they do, they encounter difficulties in understanding where and how to begin. Often the skills to develop integrated approaches are not available as this involves practitioners working outside their area of expertise and engaging with unfamiliar structures and policies.

Organisations also often lack certain technical capacities. Few organisations have the full suite of capacities that would enable them to engage with stakeholders, determine the wastewater treatment capacity of a wetland; understand sanitation and water supply technologies and their implications for the environment; and be able to economically evaluate wetland goods and services. They need to be able to draw on the expertise and knowledge of other organisations to fill these gaps.

It is not easy to fill this gap. It is unrealistic to expect WASH organisations to become wetland conservationists or vice versa. Existing capacities in the different sectors need to be linked to each other. Some general issues, such as developing broader awareness of wetland services within WASH organisations and understanding of more sustainable WASH approaches among wetland conservationists would probably bring about an increased understanding of the agenda and priorities of these two complementary sectors. This could be achieved through formalised training schemes or the development of educational and resource materials. Inter-sectoral cooperation, partnerships and platforms can play a key role in facilitating discussion, mutual understanding and an exchange of skills.

5.4 Summary

This chapter has considered different aspects of how to better manage the linkages between wetland services and WASH oriented activities. It argues that the principles of IWRM are the most effective way of achieving this. IWRM can help foster sectoral integration, community engagement, gender mainstreaming and improved governance - all key issues for improving the management of these linkages. However, there is a real practical challenge in *'giving hands and feet'* to these rather generic and abstract issues. These challenges will involve developing new and appropriate tools, developing institutional and management capacity and fostering inter-sectoral cooperation. Ways of meeting these challenges are set out in the next section which maps a way forward for practitioners and organisations in these two sectors.

Strong gender-based division of labour can exist in relation to water supply, sanitation and hygiene, like here in the Inner Niger Delta in Mali. By Maria Stolk

Wetlands International is developing a flood prediction tool (OPIDIN) for the whole Inner Niger Delta. This is a woman from Sévéry village fetching water from the floodplain for domestic use. By Sander Carpay

6. The way forward

6.1 Introduction

This publication seeks to bridge the gaps in knowledge and awareness that exists between WASH and wetland conservation organisations. Its main goal is to set an agenda for future work and cooperation that can help achieve this. This chapter synthesises the information in the preceding chapters and suggest a way forward. It provides:

1. A summary of the key concepts and approaches highlighted in this publication that need to be borne in mind when planning or implementing WASH interventions in wetland areas. These issues need to be considered by policy makers, planners, managers and practitioners. It is intended that this information will benefit WASH focused and wetland conservation organisations to communicate better with each other and inspire them to form partnerships with each other.

2. Suggestions for joint collaborative work between organisations involved in WASH interventions and wetland conservation. While this document sets out the theoretical reasons for developing joint approaches, such joint approaches are rarely realised on the ground. As a first step this section presents the main issues that these organisations need to address and integrate into their institutional and programmatic planning.

Boys in Laos enjoying the water coming from wetlands. By Matthew Simpson

6.2 Guiding principles

Assess what the linkages are

I. Evaluate whether wetlands should be part of water treatment solutions
Wetlands can contribute to improved water quality and the treatment of wastewater. Although not always widely understood or recognised, wetlands can effectively convert nutrients and can neutralise or reduce pathogen contamination. Wetlands can also reduce heavy metal concentrations and reduce water turbidity. However, wetlands have a water treatment carrying capacity, beyond which they can be degraded by excessive wastewater pollution. If wetlands are to be used to provide cost effective treatment and disposal of wastewater it is essential to manage waste inflows properly.

II. Evaluate whether wetlands are important as water regulators or buffers
The hydrological buffering effect of wetlands needs to be fully recognised and safeguarded. Wetlands can play a vital role in storing floodwater, recharging groundwater aquifers and maintaining river baseflows all of which support water supplies. Their role in maintaining high water tables can also be important in supporting agriculture. The buffering role of wetlands plays an important role in safeguarding against extreme climatic events, such as storms and droughts, which often are the result of climate change. This function should be more explicitly considered within climate adaptation strategies.

III. Consider how community livelihoods are affected
The management of wetland and sanitation systems can provide a range of livelihood opportunities for poor people. Wastewater and solid waste can be used as fertiliser, fish food and fuel, providing small-scale business opportunities. Wetlands also provide a range of resources. Collection of fish, snails, clams, shrimps, medicinal plants, edible wetland vegetation and plants and mud for handicrafts or construction can help supplement household incomes or provide basic sustenance. If managed in a sustainable way wetland resources and wastewater reuse products can generate a range of livelihood options and help cover the costs of sanitation and water supply maintenance. However, there can also be negative effects when a wetland's capacity to deliver services of value to WASH are exceeded; in such cases ecosystem degradation can harm other services such as food supply and negatively affect livelihoods.

IV. Make informed choices along the sanitation chain
The choice of sanitation technology and waste disposal is important, not only for the convenience of individual users, but also in terms of the potential for downstream pollution. Inappropriate choices, at any stage of the sanitation chain (toilet - wastewater storage - transport - treatment - disposal), can result in environmental and human health problems. Choices have to be realistic, taking into account the cost of investment and maintenance. Income levels, the availability of basic infrastructure, population density, the volume of water available for waste transport and the distance from existing facilities will all influence the appropriateness of standard, centralised solutions (usually sewer systems with wastewater treatment plants). In many cases decentralised or household level solutions may be more appropriate, and the use of wetlands as part of the treatment and disposal of wastewater can fit well with these choices.

Improve the management of linkages

V. Apply the principles of integrated water resource management
It is important that the management of sanitation provision, drinking water supply and wetlands conservation coherently fit within an IWRM based approach. An integrated approach to water resource management, whether locally or regionally is more likely to result in solutions that are environmentally, economically and socially suitable.

VI. Raise awareness amongst stakeholders
The full extent of the linkages between sanitation, drinking water supply and wetlands is not widely appreciated and is not part of the standard repertoire of civil society, government or private sector actors responsible for wetlands conservation or WASH focused activities. It is also rarely acknowledged by funding organisations. Raising awareness of the different functions of wetlands and WASH interventions, including the role of waste flows, the scope for modifying and rehabilitating degraded wetlands and the dynamics between sanitation systems and treatment functions in wetlands is an essential part of any strategy to improve management of the linkages.

VII. Assess the costs and benefits
Providing adequate sanitation and drinking water supplies is costly. However, if these services are not provided the costs in terms of health care, loss of household earnings and environmental damage can be large. Managing wetlands to reduce nutrients from wastewater and contribute to the provision of clean water can contribute to a more cost effective solution compared with building conventional mechanised treatment plants. Yet wetlands provide other significant economic benefits, through recreation, maintenance biodiversity and livelihood options. It is important that wetlands are managed in a sustainable manner to avoid the degradation and loss of these ecosystem services.

VIII. Link initiatives to wider urban and regional planning
Sanitation, drinking water supply and wetland management need to be an integral part of urban and regional (land-use) planning. This ensures that they are not marginalised and forgotten, but are mainstreamed into urban and regional development. The important resources and services that wetlands provide can only be maintained if developments such as housing, industry or agriculture are regulated so that they do not harm these functions. Linking with city or regional planning processes will also help the effective enforcement of measures to halt any further degradation of wetlands, through measures such as land-use zoning or controlling over-drainage.

IX. Target improved governance
A lack of, or ineffective, governance is often the underlying reason for an absence of or poor quality sanitation provision, drinking water supply or effective wetland management. This in turn is often due to the marginalisation of key stakeholders, including women. In particular the lack of access to sanitation, clean water and natural wetland resources can have severe consequences for poorer groups. Stronger governance that guarantees the effective participation of all stakeholders is required to overcome these problems. Governance needs to be strengthened at all levels but especially at the local and community levels where transparency can be maintained and performance delivery can be most effectively monitored. Support for institutions, social structures and the development of a system of rights and entitlements should primarily be targeted at this level. The representation of women's

perspectives through this must be ensured.

X. Link and build capacity
Integrated sanitation provision, drinking water supply and wetland management solutions are rare. Better training of practitioners, community representatives and local government staff in technology, design and management is required so that the implications of sanitation chain options, water supply provision and wetland management are better understood and delivered more effectively. Increased technological and organisational capacity will help to provide sustainable sanitation, water supply and wetland solutions that benefit environmental and human health and support livelihoods. Partnerships between actors and organisations in different relevant sectors are essential to support these actions and to link existing organisational capacities within specific initiatives and programmes.

6.3 Towards mainstreaming wetlands issues within WASH activities

It is evident that there is still a long way to go before wetlands issues are routinely addressed in WASH interventions. However the two sectors share the same goals of improving the health and well being of wetland dependent communities. Frameworks such as IWRM provide a basis for integrating efforts to achieve this. Sectoral practices, culture and approaches and a lack of awareness of the linkages mean that much work aimed at these communities is planned and implemented independently, to the detriment of the communities. Furthermore there is a lack of awareness amongst other stakeholder groups (e.g. development agencies, river basin authorities, donors) about the strength of the linkages between improved human health and the health of wetland ecosystems. Organisations working in these two sectors need to work on mainstreaming the linkages within their management practices and raising awareness of them. We present five key directions for work where we believe that organisations concerned with WASH and wetland conservation could fruitfully collaborate together:

1. Develop cross-sectoral partnerships to establish joint ownership of the linkages identified in this document and explore how to develop a stronger understanding of them so that they can be better addressed in the field;

2. Undertake cross-sectoral action research in wetland areas (incorporating catchments/ basin links); that can provide the required knowledge to develop more integrated approaches and tools;

3. Develop awareness of these linkages within organisations that focus on WASH and wetland conservation and other organisations that are influential in development and natural resource planning and management;

4. Develop the means to increase the capacity of WASH and conservation practitioners to better manage these linkages, including the development of tools, joint expertise networks, training resources and trainers, guidance and handbooks;

5. Lobby development and natural resource management policy makers and donors to recognise the importance of these linkages and to prioritise them within funding streams.

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Annex 1. Technology options within the sanitation chain

Functional Group	Technology type	Description
Toilet types	Dry toilet	Raised pedestal or squat pan over a drop hole with no addition of water.
	Urine diverting dry toilet	Toilet that operates without water and has a divider that separates the urine from the faeces.
	Urinal	Toilet that only collects urine.
	Pour flush toilet	Toilet in which flushing takes place by water being poured in by the user.
	Cistern flush toilet	Usually a porcelain toilet where the water for flushing is provided by a water tank above the bowl.
	Urine diverting flush toilet	Similar to the cistern flush toilet except that the toilet bowl has two sections to separate the urine from the faeces. The faeces will be flushed away while the urine compartment may or may not be water flushed.
Wastewater collection and storage/ treatment options	Urine storage tank/ container	Tank for urine storage to be moved or emptied when full.
	Single pit	Excreta, along with anal cleansing materials are deposited into a pit. Lining the pit prevents it from collapsing and provides superstructure.
	Single ventilated improved pit (VIP)	An improvement on the Single pit because continuous airflow through a ventilation pipe reduces odours and acts as a trap for flies as they escape towards the light.
	Double VIP	Similar design to the Single VIP that allows the technology to be used continuously and allows for safer and easier emptying. Each pit is used for a certain period of time (until full) then the other pit is used and the first pit can be emptied after some time.
	Fossa alterna	Alternating waterless, double pit designed to make compost.
	Twin pits for pour flush	Two alternating pits connected to a pour flush toilet. The blackwater (and greywater) is collected in the pits and allowed to slowly infiltrate into the surrounding soil.
	Dehydration vaults	Used to collect, store and dry faeces. Faeces will only dehydrate when the vaults are watertight to prevent external moisture from entering and when urine is diverted away from the vaults.
	Composting chamber	Chamber to convert excreta and organics into compost.
	Septic tank	Watertight chamber for storage and treatment of black-water and grey-water. Settling and anaerobic processes reduce solids and organics, but the treatment is only moderate.
	Anaerobic baffled reactor	Improved septic tank using baffles under which wastewater is forced to flow. The increased contact time with the active biomass results in improved treatment.

Functional Group	Technology type	Description
	Anaerobic filter	Fixed-bed biological reactor. As wastewater flows through the filter, particles are trapped and organic matter is degraded.
	Anaerobic biogas reactor	Anaerobic treatment that produces digested slurry and biogas.
Wastewater transport options	Anaerobic baffled reactor	Improved septic tank using baffles under which wastewater is forced to flow. The increased contact time with the active biomass results in improved treatment.
	Anaerobic filter	Fixed-bed biological reactor. As wastewater flows through the filter, particles are trapped and organic matter is degraded.
	Waste stabilisation ponds	Large, man-made water bodies that are filled with wastewater that is treated through naturally occurring processes.
	Aerated pond	Large, outdoor, mixed aerobic reactor. Mechanical aerators provide oxygen and keep the aerobic organisms suspended and mixed with the water to achieve a high rate of organic degradation and nutrient removal.
	Constructed wetlands (free-water surface, horizontal subsurface flow, vertical flow)	Series of wetland beds that replicate the naturally occurring processes of a natural wetland. As water slowly flows through the wetland, particles settle, pathogens are destroyed, and organisms and plants utilise nutrients.
	Trickling filter	Fixed bed, biological filter that operates mostly under aerobic conditions. Pre-settled wastewater is trickled or sprayed over the filter.
	Up-flow anaerobic sludge blanket reactor	Single tank in which wastewater enters the reactor from the bottom and flows upward. A suspended sludge blanket filters and treats the wastewater as the wastewater flows through it.
	Activated sludge	Multi-chamber reactor unit that makes use of aerobic micro-organisms to degrade organics in wastewater.
(Semi-)centralised treatment options	Sedimentation/thickening ponds	Simple settling ponds that allow sludge to thicken and dewater.
	Unplanted drying beds	Simple, permeable bed that, when loaded with sludge, collect percolated leachate and allow the sludge to dry and evaporate.
	Planted drying beds	Similar to an unplanted drying bed but with increased transpiration via the plants.
	Co-composting	Controlled aerobic degradation of organics using more than one faecal sludge or organic solid waste.
	Anaerobic biogas reactor	Anaerobic treatment that produces digested slurry and biogas.
Final use or disposal options	Fill and cover	Simply covering a pit latrine with soil.
	Application of urine	Separately collected urine can be used as a liquid fertilizer
	Application of dehydrated faeces	Dried faeces produce a crumbly, white-beige material that can be used to improve soil structure.
	Application of compost	Compost can be applied to agricultural crops as fertilizer.
	Irrigation	Water that has undergone secondary treatment can be used for irrigation.

Functional Group	Technology type	Description
	Soak pit	A pit used for soak-away or leaching to allow water to soak into the ground
	Leach field	Usually a network of perforated pipes to allow water to soak into the ground. Often used with a settling tank system.
	Aquaculture ponds	Controlled cultivation of aquatic plants and animals in ponds containing wastewater.
	Floating plant pond	Modified maturation pond where the plants uptake nutrients.
	Water disposal/ groundwater recharge	Treated effluent and/or stormwater can be discharged directly into receiving water bodies (such as rivers, lakes, etc.) or into the ground to recharge aquifers.
	Land application of sludge	Digested or stabilised faecal sludge can be applied to the land as fertilizer.
	Surface disposal	Stockpiling of sludge, faeces, bio-solids that cannot be taken elsewhere.

Annex 2. Sanitation systems: effects on land and water bodies and related risks

Flying toilets/ open field defecation	Excreta gets spread onto the soils: *Effect 1: Soils get contaminated with organic matter, bacteria, viruses and helminth.* *Risk 1: Children and grown-ups who get into contact with the soil might get infected and become sick.* Seepage of excreta into the soils during rainy season. *Effect 1: Soils get contaminated with organic matter, bacteria, viruses and helminth.* *Risk 1: Children and grown-ups who get into contact with the soil might get infected and become sick.* *Effect 2: Possibility of contamination of groundwater (if ground water table is high) and in case of severe pollution becomes unusable as potable water* *Risk: People who use ground water as drinking water source can become infected and become sick.* Run-off water becomes contaminated with polluted soils and contaminates the surface water during heavy floods. *Effect: Limited risk of surface water pollution.*
Flying toilets/ open field defecation	Seepage of liquid pit contents to the soils direct below the pit *Effect 1: soils get contaminated with organic matter, bacteria, viruses and helminth.* *Risk 1: No risk.* *Effect 2: possibility of contamination of groundwater (if ground water table is high) and in case of severe pollution becomes unusable as potable water* *Risk 2: people who use ground water as drinking water source can become infected and become sick.* In case of flooding, run-off water becomes contaminated with overflowing pit contents: *Effect 1: Run-off water contaminates the surface water.* *Risk 1: people who use surface water as drinking water source can become infected and become sick.* The above goes for both pit latrines and pour flush toilets. However for the latter, due to the higher water content the chances of surface and groundwater contamination increases considerably.

Septic tank	When the septic tank is not watertight: seepage of liquid contents to the soils direct below the septic tank. *Effect 1: Soils get contaminated with organic matter, bacteria, viruses and helminth.* *Risk 1: No risk.* *Effect 2: Possibility of contamination of groundwater (if ground water table is high) and in case of severe pollution becomes unusable as potable water* *Risk 2: people who use ground water as drinking water source can become infected and become sick.* When the septic tank is watertight: no direct effects or risks. In both cases the overflow of the septic tank (effluent) should cause no negative effects when the septic tank functions as septic tank and is maintained properly (regular emptying). Also not in case of discharge into surface water bodies. However if the septic is not functioning properly (very often the case) and the effluent is not treated, the same effects occur as mentioned under flying toilets / open defecation category. Below an additional effect is stated. Insufficiently treated effluent of the septic tanks is discharged into the surface water *Effect: Surface water bodies get contaminated with viruses, bacteria etc.* *Risk: people who use surface water as drinking water source can become infected and become sick.* *Effect: If large amounts of untreated effluent end up in the surface water bodies, there is a chance of eutrophication.*
Eco-logical sanitation	In general, it does not matter what type of ecological sanitation is used, since what is important here is what happens with the waste afterwards. If fresh waste from any ecological sanitation system is dumped in a wetland it has the same impact as open defecation. However, it can be stated that urine diversion toilets tend to have less effect on the environment, than for instance pit latrines. In the former the faeces is stored dry, while in the latter water and urine is added to faeces and hence it is possible it leaks into the groundwater.

Localised sewer, no treatment	Where the sewer-pipes are not watertight: seepage of liquid contents from the pipes into the soils direct below the pipes. Note that nowhere in the world sewers are completely watertight *Effect 1: Soils get contaminated with organic matter, bacteria, viruses and helminth.* *Risk 1: No risk.* *Effect 2: Possibility of contamination of groundwater (if ground water table is high) and in case of severe pollution becomes unusable as potable water* *Risk 2: people who use ground water as drinking water source can become infected and become sick.* The effluent from the localised sewer is discharged into the nearest surface water-body *Effect 1: The effluent of the sewer contaminates the surface water with viruses and bacteria* *Risk 1: People who use the water as drinking water become infected and get sick.* *Effect 2: The BOD levels increase in the water-body due to the organic matter in the black-water* *Risk 2: In case of severe pollution oxygen levels in the water drop and aquatic life dies off.* *Effect 3: If large amounts of untreated effluent end up in the surface water bodies, there is a chance of eutrophication.*
Centralised sewer system, no	As with localised sewer but then usually on a much larger scale.
Centralised sewer system, treatment	Where the sewer-pipes are not watertight: seepage of liquid contents from the pipes into the soils direct below the pipes. *Effect 1: Soils get contaminated with organic matter, bacteria, viruses and helminth.* *Risk 1: No risk.* *Effect 2: Possibility of contamination of groundwater (if ground water table is high) and in case of severe pollution becomes unusable as potable water* *Risk 2: People who use ground water as drinking water source can become infected and become sick.* The effluent from the treatment plant is discharged to the nearest surface water body *Effect 1: The effects depends on effective treatment levels, assuming that also tertiary treatment takes place (removal of nutrients):* *Risk 1: No risk, organic matter, nutrients and viruses and bacteria are removed. What should be monitored though is the storage of the sludge.*
Sewer and stormwater	As with centralised sewer system with no treatment. Peak flows are to be expected (during heavy rainfall) and overflow of sewer-pipes. Locally contamination of area with black-water can be expected.

Annex 3. Glossary

Aerobic treatment
A wastewater treatment process in which bacteria and other organisms are used to feed on waste products and break them down, taking oxygen from their surroundings.

Anaerobic treatment
A wastewater treatment process that relies on anaerobic digestion processes in which bacteria are used that feed on the substrate on which they grow in the absence of oxygen.

Aquifer
A saturated underground formation, group of formations, or part of a formation consisting of water-bearing permeable rock or unconsolidated materials (clay, sand, silt or gravel). From this layer groundwater can be extracted through a well. Since the water has to travel through several layers before it reaches the aquifer, it is often cleaner than the water in reservoirs at the surface.

Catchment
A catchment is any landscape defined structure that captures water. In nature this is an area of land that collects water which has drained to the lowest point in an area, for instance a lake or the sea.

Domestic wastewater
Wastewater principally derived from households, business buildings, institutions, etc., which may or may not contain surface runoff, groundwater or storm water.

Eutrophication
The process of an aquatic body becoming enriched with nutrients that stimulate aquatic plant growth, such as algae, resulting in depletion of dissolved oxygen. Ultimately this can lead to effective death of an ecosystem.

Governance
The balance of power and the balance of actions at different levels of authority. Governance is about who sits at the table, who sets the priorities, and who plays what role in making and implementing the rules of the game. Governance translates into authority; decides on laws, regulations, and institutions; creates financial mechanisms; and defines user rights.

Groundwater
Subsurface water in a saturation zone or aquifer that can be extracted through a well.

Latrine
An installation used for defecation and urination.

Nitrification
Biological oxidation of ammonia sequentially transformed to nitrite and nitrate. The process is carried out by special bacteria.

Pit latrine
Latrine with a pit for the accumulation and decomposition of excreta and from which liquid infiltrates into the surrounding soil.

Pour flush latrine
A latrine that depends on small quantities of water, poured from a container by hand, to flush faeces away from the point of defecation. The term is normally used for a latrine incorporating a water seal.

Recharge
Process by which groundwater is replenished. During the process water from the land surface moves downward to an aquifer.

Septic tank
A tank or container, normally with one inlet and one outlet, which retains wastewater and reduces its strength by settlement and anaerobic digestion of excreta.

Sewer
A channel or conduit that carries wastewater and storm-water runoff from the source to a treatment plant or receiving stream. “Sanitary” sewers carry household, industrial and commercial waste. Storm sewers carry runoff from rain. Combined sewers handle both.

Solid waste
Litter and other waste in the streets. It can be flushed away with stormwater into the sewer or drainage system and cause blockage in the system.

Ventilated improved pit (VIP) latrine
A pit latrine with a screened vent pipe and a dark interior to the superstructure.

Wastewater
Water carrying wastes from homes, businesses and industries that is a mixture of water and dissolved or suspended solids.

Wastewater disposal
Collection and removal of wastewater deriving from industrial and urban settlements by means of a system of pipes and treatment plants.

Wastewater quality
The state or condition of spent or used water that contains dissolved or suspended matter from a home, community farm or industry.

Contributing organisations

International Water and Sanitation Centre (IRC)
The IRC facilitates the sharing, promotion and use of knowledge so that governments, professionals and organisations can better support poor men, women and children in developing countries to obtain water and sanitation services they will use and maintain.

More information? Visit www.irc.nl

International Water Management Institute (IMWI)
IWMI is one of 15 international research centres supported by the network of 60 governments, private foundations and international and regional organisations collectively known as the Consultative Group on International Agricultural Research (CGIAR). It is a non-profit organisation with a staff of 350 and offices in over 10 countries across Asia and Africa and Headquarters in Colombo, Sri Lanka. It aims to improve the management of land and water resources for food, livelihoods and nature. Research is the core activity of IWMI.

More information? Email iwmi@cgiar.org or visit www.iwmi.cgiar.org

MetaMeta
MetaMeta is a group of companies, that are established to deliver socially relevant but commercially viable services. MetaMeta Research undertakes applied research and capacity building on water and natural resources management. MetaMeta Communications bridges the gap between knowledge suppliers and practitioners. MetaMeta Management develop projects and supports the management of complex programs.

More information? Email info@metameta.nl or visit www.metameta.nl

Netherlands Water Partnership (NWP)
NWP is an independent body set up by the Dutch private and public sectors in the Netherlands to act as a national coordination and information centre for water-related issues abroad. The principal aims of the NWP are to harmonise the activities and initiatives of the Dutch water sector abroad and to promote Dutch expertise in water worldwide. The NWP is the channel through which government bodies, NGOs, knowledge institutes and private organisations in the water sector share information on their activities and services.

More information? E-mail info@nwp.nl or visit www.nwp.nl

SIMAVI
Simavi is an international health organisation that believes everyone has a right to good health. This is why we work on people's health in the poorest regions of developing countries. We focus specifically on the health of mothers, as they are key to their family's health. Together with them we take care of safe drinking water and sufficient hygiene, healthy pregnancies and children's health. We also provide those mothers with the knowledge they need in order to prevent diseases. Together with local organisations we offer direct and practical support. We stand up for the interest of people. This works. For more than eighty years.

More information? E-mail simavi@simavi.org or visit www.simavi.org

WASTE
WASTE works towards sustainable improvement of the urban poor's living conditions and the urban environment in general. The multi-year, multi-country programmes and projects have a focus on bottom-up development in relation to recycling, solid waste management, ecological sanitation and knowledge sharing. WASTE, located in the Netherlands, teams up with organisations in Africa, Asia, Latin America and Eastern Europe that share its goals and approaches.

More information? E-mail office@waste.nl or visit www.waste.nl

Wetlands International
Wetlands International is the only global NGO dedicated to the conservation and wise use of wetlands. It works globally, regionally and nationally in a large number of projects to achieve the conservation and wise use of wetlands and to benefit diversity and human well-being. Wetlands International is a science-based organisation; it aims to provide 'tools' and information to assist governments in the protection and restoration of wetlands. In addition, the organisation makes an effort to influence relevant policies, conventions and treaties.

More information? Email post@wetlands.org or visit www.wetlands.org

Wildfowl & Wetlands Trust Consulting (WWT Consulting)
WWT Consulting is the UK's leading specialist wetland consultancy in creation, restoration, management, and visitor centre design. It was established in 1989 at Slimbridge, UK, the headquarters of the Wildfowl & Wetlands Trust (WWT), in response to the demand for advice on how to conserve, improve and manage wetland habitats for wildlife and people. All profits generated are gifted to WWT to help fund their conservation work.

WWT is a leading UK conservation organisation saving wetlands for wildlife and people across the world. WWT also aims to raise awareness of the issues that affect the survival of wetlands and wildfowl. The organisation makes an effort to enhance people's lives through learning about and being close to nature and inspiring them to help WWT's conservation work worldwide.

More information? E-mail consulting@wwt.org.uk or visit www.wwt.org.uk

Untreated outflow of waste water in a Lao village. By Matthew Simpson

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Mission:

To sustain and restore wetlands, their resources and biodiversity for future generations.

The health and livelihoods of people in rural and peri-urban areas in developing countries is often strongly related to ecosystems services and water supply, sanitation and hygiene (WASH). Although provision of both is integral to water management, the linkages between the two are rarely recognised in approaches to ecosystem management or WASH provision.

This book presents a baseline of information that helps understanding of how WASH and wetland service provision are connected, why these linkages are vital and how they can be better managed. Furthermore, the publication presents a set of principles to be taken on by sector professionals as a way forward to improve integration in the future.

The publication is the result of an ongoing collaboration between individuals and organisations from the wetland conservation sector and the water supply, sanitation and hygiene sector.

For further information please visit our website or contact our office.

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For more information on wetlands & WASH:
www.wetlands.org/wetwatsan

WWT CONSULTING
www.wwt.org.uk/our-work/wwt-consulting

simavi
www.simavi.nl

META
www.metameta.nl

NWP Netherlands Water Partnership
www.nwp.nl

PARTNERS VOOR WATER
Bundeling van krachten
www.partnersvoorwater.nl

WASTE
advisers on urban environment and development
www.waste.nl

IRC
www.irc.nl

IWMI International Water Management Institute
www.iwmi.org

WETLANDS INTERNATIONAL