PLANNING GUIDE FOR DECENTRALISED WASTEWATER MANAGEMENT

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TABLE OF CONTENTS

1 INTRODUCTION – THE PLANNING PROCESS

Figure 1.1 shows the overall planning process. It emphasises the fact that good planning is information-based and summaries the information requirements at various stages in the planning process.

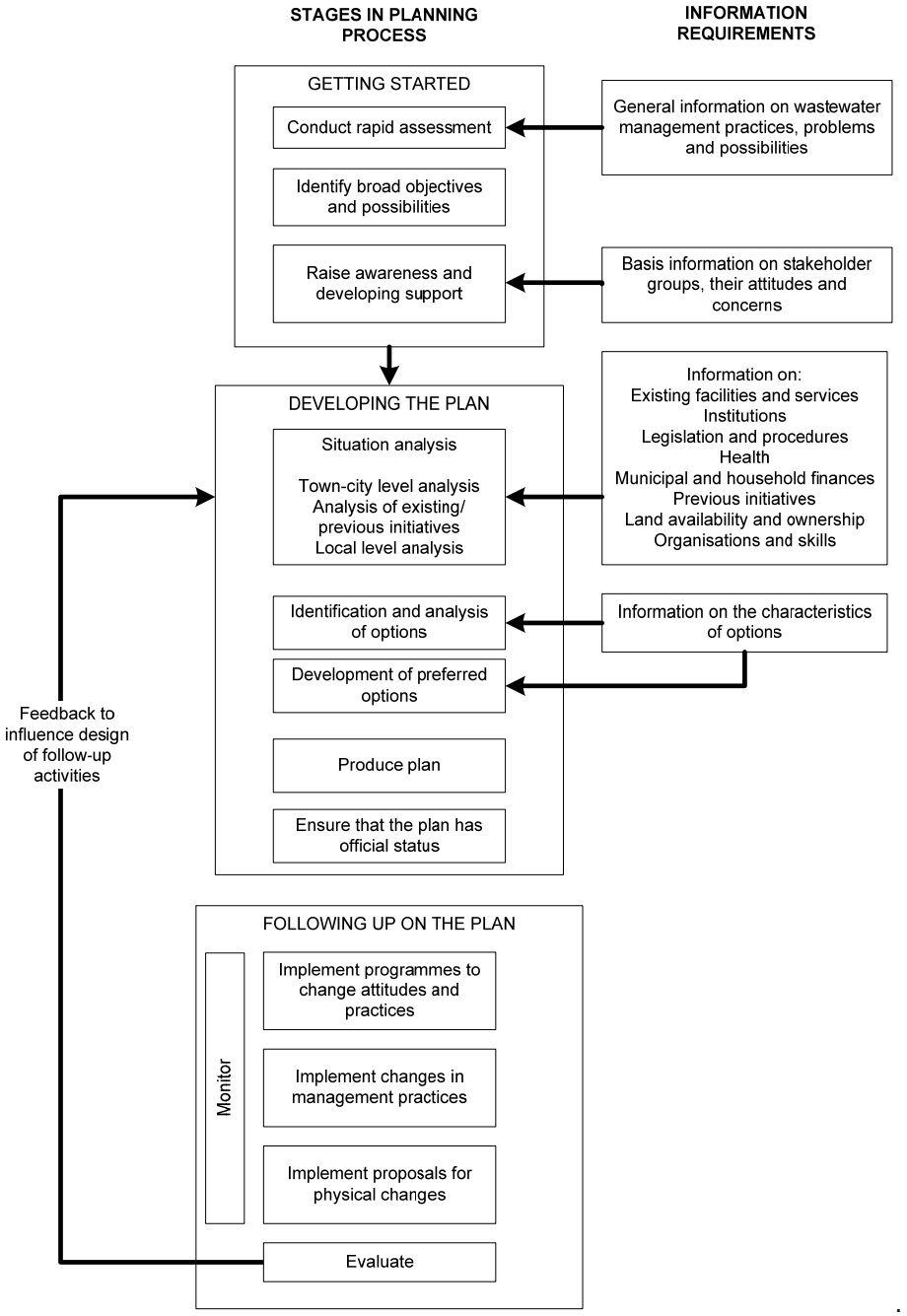

Figure 1.1 - The planning process

Figure 1.1 shows an essentially linear planning process but it does emphasise the need to feed the results of evaluation into later versions of the plan. In practice, the implementation of different components of the plan is likely to take place at different rates and opportunities for feedback will occur fairly regularly. In order to make use of this feedback, treat the plan as provisional, to be reviewed and adapted as necessary in the light of experience.

If the plan is likely to include a number of new/unfamiliar components and/or little information is available, it may be appropriate to introduce an intermediate stage between analysis and plan production. This 'developing solutions' stage (Tayler, Parkinson and Colin 2003 p31 and pp35 – 41), provides time to:

- *Increase the time and resources devoted to identifying components of the overall plan*, thus overcoming one of the major drawbacks of the traditional project cycle – the identification of activities on the basis of insufficient information.
- *Develop the commitment and capacity of the various stakeholders to implement the final plan*.

'Developing solutions may involve efforts to improve the information base, identify and carry out immediately implementable improvements and review specific operations and services. These activities may lead to the commissioning of small pilot initiatives Larger pilot initiatives should be included in the early stages of the plan proper.

The remaining sections of this Guide that follow work through the various stages in the planning process in more detail. Section 2 deals with 'getting started', section 3 with developing the plan and Section 4 with following up on the plan.

2 FIRST STEPS

2.1 Rapid appraisal

2.1.1 Why carry out a rapid appraisal

Rapid appraisal can help you to develop sufficient understanding of the existing situation to identify needs, priorities and objectives and so define the scope of the action to be undertaken.

The main focus should be on developing a qualitative understanding of problems and possibilities. However, any available maps will help you to understand where these problems and possibilities are occurring and how they might be related. Similarly, initial analysis of existing quantitative information (numbers and statistics) may help you to identify problem areas and establish the limits of what is likely to be possible.

The following questions provide a structure for rapid appraisal.

Relating to existing facilities	▪ Is wastewater being produced? ▪ How is it currently being carried? ▪ What happens to it?
Relating to roles and responsibilities	▪ Who is currently responsible for managing it, both in theory and in practice? ▪ Who either uses it or suffers because of the way in which it is currently managed
Relating to problems and possibilities	▪ What are the problems and issues that need to be addressed? ▪ Are there any initiatives that provide us with examples of possible ways forward?

- If your concern is with a particular area, you may answer the basic questions in relation to that area rather than the town as a whole.
- If you are concerned with a whole town or a number of towns, you will have to base your initial assessment on investigations in representative areas.

2.1.2 Developing a framework for rapid appraisal

Different types of development and/or different service levels are likely to produce different types and quantities of wastewater. For instance, high-income areas with water connections will normally produce more wastewater than low-income areas with public standposts. They may also have different arrangements for dealing with wastewater. Higher income areas are more likely to have sewers while some low-income areas may have no drainage at all. People with different services levels may have different priorities. For all these reasons, it will often be necessary to investigate the situation with regard to each type of development.

This suggests that the first step in rapid appraisal should normally be identify different types of development. (See Box 2.1) Use maps, aerial photographs and/or satellite images to help in this task if they are available. Otherwise, use your judgement to identify the main types of development and where they occur.

Box 2.1 Types of urban development

- Formally laid out areas with fairly large plots, each with its own house. These will usually be higher income areas and are the most likely to produce wastewater and have formal wastewater collection arrangements.
- Formally laid out areas with smaller plots and space around houses. These are quite likely to be government schemes and may well have water connections and formal wastewater collection arrangements.
- Regularly laid out areas with narrow rights of way, buildings covering plots up to the front and side boundaries and perhaps with discontinuities in rights of way at where one 'scheme' meets another. These may well be informal subdivisions and are likely to produce wastewater.
- Areas with irregular access paths and with houses built right up to plot boundaries. These might be old villages that have been absorbed into the urban fabric or informal areas. Villages that have been absorbed into the urban fabric are more likely to have house water connections.
- Isolated buildings surrounded by open land. These might be government apartments and may well have water connections.

  These categories are intended for guidance and may have to be modified to reflect the situation in the area that concerns you.

Use general information on the types of development to decide on which areas you intend to visit in order to assess existing conditions.

If you do not know a city, town or area well, it may well be useful to check your initial conclusions about types of development by talking to local stakeholders. These might include government officials, NGO activists and politicians among others.

Later, this initial assessment of the different types of development in the town can be used as the basis for more detailed local analysis. (See Section 3).

2.1.3 Rapid field appraisal

The next step will be to visit representative areas in order to find out whether wastewater is being produced, whether black and grey water is being combined at source and what then happens to the resulting wastewater. This initial rapid appraisal will involve:

- ***Observation*** – looking at what exists on the ground; and
- ***Conversation*** – talking to people about their sanitation facilities and how they currently manage their wastewater.

Talking to people will help you to resolve questions and uncertaintites about what you have observed.

When the area to be assessed is large, drive round the areas identified from maps and your preliminary discussions in order to confirm your broad assumptions about them.

This can then be followed by more detailed assessment inside the chosen areas themselves. Walk through each area, looking for evidence of the way in which wastewater is being produced, transported and used, and talking to local people about what you can and cannot see. This activity is sometimes referred to as a transect walk.

Focus on areas in which water is being discharged beyond plot boundaries, in either open drains or sewers (revealed by the presence of manhole covers).

Inspect sewers to determine whether or not they carrying wastewater. These are the areas that are likely to require improved wastewater management. Try to answer the following questions:

- *What sanitation facilities exist on site and how do these affect the composition of the wastewater?* The key issues here are whether black and grey water are being combined and, if they are, whether there is scope for separating them at the household level. These issues can be explored by talking to householders and inspecting typical on-plot sanitation facilities. Use Figure 2.1 as a guide to assessing the likely composition of wastewater.

- *What happens to wastewater?* Possible answers to this question include:

  Discharge to a natural water course

  Discharge to a local pond, where it might or might not be used to support aquaculture.

  Use to irrigate local fields/gardens

  Use for a local aquaculture venture

  Discharge to a main sewer or drain, which carries it outside the area.

In all these cases, it is possible that the wastewater is treated before discharge. However, treatment will rarely consist of anything more than a household or communal septic tank. Use the diagram below to help you in determining the composition of wastewater.

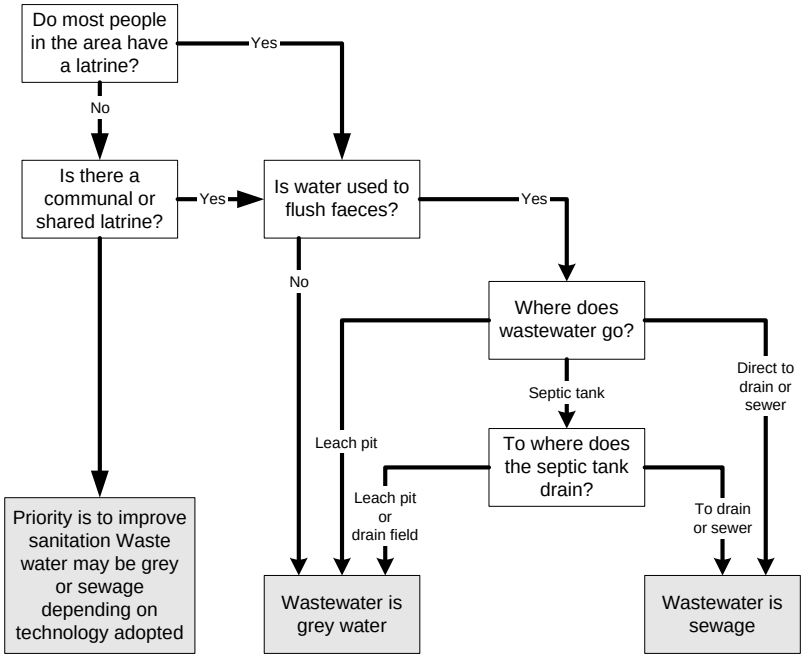

Figure 2.1 - Procedure for assessing composition of wastewater

The information obtained from this assessment will help you to understand current patterns of wastewater disposal and identify possible objectives in different areas.

2.1.4 Understanding existing roles and responsibilities

At the rapid appraisal stage, it will also be useful to seek an initial understanding of roles and responsibilities. One way to do this will be to develop a simple stakeholder matrix in the form shown below:

Stakeholder	Official responsibilities	Actual roles	Costs and benefits arising from existing situation.
Government environmental agency	Set standards and check compliance		
Specialist water and sanitation departments/agencies			
Local government			
NGOs			
CBOs			
Householders			
Farmers			
Farm workers			
Consumers of produce grown using wastewater			
Private sector service providers			
Downstream water users			

Filling in the columns on official and actual roles and responsibilities, costs and benefits will give you a good initial understanding of the ways in which the various stakeholders might be involved in or affected by any proposals to change and improve wastewater management. This matrix does not have to be completed at the rapid appraisal stage but starting it then will help to ensure that institutional issues are considered from the outset. Aim to develop it further as you move into more detailed situation analysis.

2.2 Identifying broad objectives

With a basic understanding of the existing situation and the problems associated with it, you should be able to identify broad objectives. As a general rule, your first concern will be with public health but it will always be better if the approach adopted helps to achieve environmental objectives. Increasing income can be a useful objective, particularly if it provides an incentive for an individual, group or organisation to take responsibility for operating a scheme.

Further guidance on possible objectives is given below. Since decisions will be influenced by local factors, this is offered as suggestions rather than firm rules to be followed in all cases.

- Where there are few existing sanitation facilities, the aim should be to develop an integrated approach to wastewater management. The possibility of keeping black and grey water separate, perhaps using some form of ecological sanitation, should be explored. If faeces or faecal sludge are

retained on-site, there will be a need to develop sanitary arrangements for sludge removal, transport and re-use. ***The decentralised option should always be considered***.

- Where untreated wastewater is already being used locally, either for agriculture or aquaculture, the objective will often be to improve existing systems, by introducing treatment and/or improved irrigation management systems or agreeing restrictions on the way in which wastewater is used. ***A decentralised approach will normally be the preferred option***.
- Where wastewater is being discharged to a local pond, the possibility of adapting the current system to provide some form of primary treatment, provide for some form of aquaculture and/or use the effluent in some way should be considered. ***A decentralised system will sometimes but not always be the preferred option.***
- It will be harder to introduce a decentralised approach where wastewater is being transported away from where it is produced, in either drains or sewers, However, where there is a local demand for treated wastewater for either irrigated agriculture or aquaculture, it may be appropriate to divert either part or all of the flow from selected areas to decentralised systems.

Note that it will often be appropriate to follow adopt different options in different areas. Central areas with existing collector sewers and drains are likely to be appropriate for more centralised approaches while a decentralised approach may be appropriate in peripheral areas.

No matter how logical and technically sound the thinking that goes into the development of objectives, there will be little chance of achieving them unless there is general agreement on their importance. So, we now turn to the action that might be taken to increase awareness of the need for improved wastewater management and develop support for efforts to bring about improved management systems.

2.3 Raising awareness and developing support

Experience with many failed projects reveals that it is not enough for one organisation or group of individuals to decide an objective and start to work towards that objective. Rather, before embarking on a course of action it is important to ensure that:

- people have a desire for change; and
- key people and organisations are sufficiently committed to the change to make it happen.

The first will normally require that people are made more aware of both the need for change and the options for achieving that change. The second requires that at least some key stakeholders go a step further and commit themselves to taking an active role in bringing about that change.

Use the list of stakeholders developed during rapid appraisal as a starting point for exploring both these needs.

2.3.1 Raising awareness of the need for change

When tackling the need to raise awareness of the need for improved wastewater management, focus first on people and organisations who may influence the change process. These include elected representatives, senior government officials and the people with access to them, for instance the leaders of influential

NGOs. Where possible, try to involve these influential stakeholders in the planning process, if not actively then as supporters of the process.

Once sufficient support has been developed, you will need to go on to discuss the need for change with those who are likely to be directly affected by any proposed changes. The focus of your discussions will depend on the findings of your rapid appraisal and the likely concerns of the people with whom you are talking. Some ideas on what this might mean in practice are given below.

Farmers If farmers are using untreated wastewater to irrigate vegetables, the focus should be on the health risks that they may face when working in their fields and the action that they might take to reduce these risks. (These might include local wastewater treatment, provision of protective clothing and changing the way in which water is applied to crops).

Government officials may assume that anything that takes place outside existing rules and procedures does not exist. So, the focus may need to be on raising awareness that wastewater is being used for irrigation, albeit informally and in breach of formal government rules and regulations. Following on from this, the emphasis might be on the ways in which systems could be designed to take account of existing practices while reducing the health risks that are created by those practices.

Civil society The initial focus might be on the potential dangers to health of eating crops irrigated with wastewater The more difficult follow-on task will be to provide them with information on the practical options open to them to ensure that they do not buy such vegetables.

Techniques for awareness raising

One way to raise awareness is to talk to people. However, experience suggests that lectures and written materials may not be enough to convince people of the need to change long established and deeply held assumptions. It will always be better to explore issues with people than to explain those issues to them. What might this mean in practice? Some of the options are introduced and briefly described below.

Visits to successful projects and initiatives can be used to convince people that change is possible. The initiatives visited should represent conditions as close as possible to those in the area where improvements in wastewater management are proposed. Ensure that visitors have opportunities to talk to people like themselves, so that they can say 'these are people like us and if they can do it we can do it'.

Demonstrating the effects of poor wastewater management One rather extreme but effective example was implemented among garbage collectors in Bhaktapur, Nepal in the 1980s, with the aim of showing people that poor sanitation and hygiene could lead to severe worm infestation. People were shown a film on round worms (ascaris, as part of an entertainment programme. They were then asked to bring their stools for testing. Of 522 residents, 467 brought their samples and testing of the samples showed that only 22 were worm free. Deworming medicine was then provided and a competition was held among children to determine who could produce the most worms. This procedure achieved two objectives. First, it ensured that children became worm-free, at least temporarily. Second, and more important, it provided a physical demonstration of the fact that poor sanitation and hygiene can lead to worm infection and thus demonstrated the need for changed

practices. A similar approach could be used with people working in vegetable plots irrigated with untreated sewage.

Role plays – in which people are encouraged to act out a scenario relating to some aspect of wastewater disposal and reuse. Use this technique to make people aware of the problems and difficulties faced by other stakeholder groups. So, for instance, a role play in which a government official has to play the part of a poor farmer struggling with debt and bureaucracy may make the official more sympathetic to the difficulties faced by small farmers and hence less likely to unequivocally dismiss the latter's concerns.

Awareness raising does not have to be a strictly time-bound activity. We will see in the next unit how participatory approaches to investigating and mapping existing facilities and activities can be used to raise awareness. Later, it may well be that pilot and demonstration initiatives can be used to raise people's awareness of what is possible.

2.3.2 Developing support for the change process

The planning process is unlikely to lead to action unless it has support from local stakeholders. Indeed, the aim should be to ensure that the process is led by local champions rather than by outsiders. These local champions must, in turn, have support from the general population, or at the very least some its active members.

Whoever leads the process should make every effort to canvass support from a wide range of stakeholders. This will help to ensure that:

- the process enjoys widespread support
- the team has a comprehensive understanding of the issues to be addressed; and
- it has access to a range of resources to deal with problems as they arise.

For instance, if the initiative to improve wastewater management comes from the civil society sector, perhaps through an NGO, every effort should be made to engage government stakeholders as active participants in the process. On the other hand, if the interest in improved wastewater management comes from government, real efforts should be made to ensure that representatives of civil society are involved in the process. In both cases, it will be advisable to explore the possibility of involving private sector stakeholders, including farmers and small contractors in the process.

It may well be advantageous to set up a small ad-hoc group to lead the process, not least in the early stages by attempting to raise awareness of issues in the organisations that they represent. The aim should also be to encourage individuals and organisations to take responsibilities for specific tasks in later stages in the planning process, in particular in situation and options analysis.

3 DEVELOPING THE PLAN

3.1 Overview

The plan may cover a whole town or city or a specific area or areas within that town or city. It should be concerned not only with long-term objectives but also with the steps that will be required to move towards those objectives. Focus especially on the first steps in the planning process, particularly if these involve new approaches and technologies. If the available knowledge/information is insufficient, consider the possibility of including an initial 'developing solutions' stage in the planning process. This will allow new approaches to be tested and the additional information required to support later interventions to be gathered.

The planning process will normally involve the following steps:

- *Analyse existing situation*
- *Investigate options for improving wastewater management in priority areas*
- *Develop proposals based on selected options* and
- *Incorporate proposals into overall plan*
- *Ensure that the plan has official status*

Each of these steps will be considered in turn later in this section.

3.2 Situation analysis

The purpose of situation analysis is to build on the broad understanding of existing conditions developed during rapid appraisal in order to develop clear objectives and priorities. It will normally involve analysis can be further divided into the following:

- *Contextual analysis* –used to identify the opportunities and constraints presented by existing legislation, government priorities and procedures, and existing programmes.
- *Town level analysis* - to develop an overall wastewater management concept for the town, bearing in mind physical conditions and the opportunities and constraints revealed by contextual analysis.
- *Analysis of previous/ongoing initiatives* – which will help to determine what works, what is not likely to work and why.
- *Local analysis in priority areas* to establish local problems and possibilities and the actions that might be taken in response to them. Local analysis can be used either to inform the development of a town-wide plan or to provide the information required for more local wastewater planning exercises.

We will return to these points shortly. First, we consider the questions, who should be involved in situation analysis, who should be consulted during situation analysis and what information collection methods are likely to be appropriate for what purposes.

3.2.1 Who should be involved in situation analysis?

Situation will normally be carried out by a small team, which should, if possible, include representatives of the different stakeholder groups. General information on the knowledge and experience of different groups is given below.

Group	Local/specialist knowledge knowledge	Knowledge of overall situation
Community members and the organisations that represent them	Good understanding of their own area	Usually limited knowledge of higher-order facilities and services
Government officials	Staff who work locally should have good knowledge of local conditions. Senior officials may have limited knowledge of local conditions.	Senior officials should know about higher order facilities and official organisational structures and systems
NGO representatives	May have relationship with specific communities and hence good knowledge of the situation of those communities	Often limited but some NGOs may have studies the overall situation in order to put local issues into context
Entrepreneurs	Good knowledge of the practical aspects of the business in which they are engaged	Likely to have more limited awareness of wider strategic issues

Ensuring that the investigation team includes representatives of the various groups will help to ensure that there is wide consultation, which in turn will help to establish stakeholder priorities and make use of stakeholder knowledge. In particular, it will ensure that:

- A person with direct knowledge of a particular subject or area brings their specialist knowledge to the team; while
- Other team members bring a different perspective, for instance noticing points that might have escaped the first person's attention because he or she is so familiar with them.

3.2.2 Who should be consulted during situation analysis?

In general, town level analysis will require consultation with people who have a professional or political interest in the provision of improved sanitation services. These are likely to include

- *Representatives of civil society,* including business leaders, representatives of organisational networks such as the CDS networks in India, any citizen's forums etc.
- *Elected representatives* some of whom may become strong champions of change and improvement.
- *Government officials*, who should be able to provide information on existing legislation and government structures and systems, including perhaps sources of finance.
- *Representatives of* NGOs, both those with a specific interest in sanitation and drainage and those with a more general remit and an extensive network of activities and contacts in the town/city.

There are some examples of the involvement of community members in town level analysis. (See http://www.achr.net/cds_pp.htm for information on one city-wide planning process that gave a key role to community members.

At the local level, talk to community members and the organisations that represent them. Local politicians and representatives of government departments, for

instance, ward councillors, local representatives of citizen's forums and government officials based in zonal offices, may also have valuable knowledge of the local situation .

Focused participatory appraisal

One way of involving community members in local analysis is to carry out a participatory appraisal of existing wastewater management facilities and services. This exercise needs to be more focused than a conventional open-ended participatory appraisal. It should start like a conventional participatory exercise, with community members taking the lead in identifying problems and resources within the community. As the process moves from appraisal of problems to assessment of options and decisions on what is to be done, it will normally be both necessary and desirable to have an increased input from technical specialists. The specialists should provide information on technologies and/or approaches, the conditions under which they will work, their costs and their potential benefits. They may also ask community members to clarify points regarding community maps, timelines etc, so as to facilitate the use of these resources in the ongoing planning process. This information can then be used, together with the local information obtained by community members, as the basis for analysis of the various options.

3.2.3 Choosing appropriate information collection methods

Use informal discussions and visits to provide an initial understanding of in-house facilities. Questionnaire surveys can then be used to develop a more detailed and understanding of in-house facilities, people's plans and priorities, attitudes to wastewater management and demand for change.

Information on existing drains, communal latrines, treatment facilities and wastewater use and disposal patterns can be obtained from visual surveys, in effect more detailed versions of the observations made during rapid appraisal.

Focus group discussions may be used to probe specific issues, to explore the history of attempts to manage wastewater and to explore people's perceptions and concerns with regard to wastewater. What problems do they see with existing disposal arrangements? What, if anything, would they like to see done to improve the situation?

Information on roles, responsibilities, organisational structures and systems, ownership of existing facilities, legislation and procedures, possibilities and constraints may be obtained through discussions and interviews with stakeholder groups and individuals.

3.2.4 Contextual analysis

Contextual analysis will help you to understand what is and is not possible in relation to legislation and institutional powers, responsibilities and capacity. Questions to be asked include the following:

- What legislation and procedures have a bearing on wastewater management and what do they have to say about what is allowed in terms of technologies and approaches? Look particularly for information on roles and responsibilities since this may affect the possibilities for decentralised management.
- Are there discharge standards for wastewater and/or national standards for wastewater that is to be reused for either irrigation or aquaculture? If so, what

are the implications for choices between technologies and wastewater management options?

- Where do financial and decision-making powers lie? The answer to this question may influence the options for financing and managing decentralised systems.
- What organisational structures and systems exist within civil society, both formally and informally?
- Do any of these structures and systems give a voice to the poor?
- Do any of these structures provide a voice for women?[1]

Most of the information collected during contextual analysis will be about what is meant to happen. Use town and local level analysis to check whether this corresponds with what is actually happening on the ground.

3.2.5 Town level analysis

Physical analysis

The aim of physical analysis at the town level is to understand the overall drainage situation in the town and how this influences the options for wastewater disposal/reuse in different locations. Start by obtaining the best map that you can of the town, preferably to scale. Look for a map at a scale in the range 1:5000 to 1:25000, depending on the size of the town. If there is no suitable map or existing maps are old, an early step in the planning process should be to develop an improved map base.

Next, define drainage areas and plot them on a copy of the map, following the steps set out in the box below. This will help you to define the overall geography of the town's drainage and determine which areas might be suitable for decentralised disposal/reuse systems.

Steps in developing a town drainage plan

1. Identify and plot main drains and sewers and the courses of the natural watercourses and drainage channels to which they discharge. Also, identify any proposals for new drainage facilities and determine their status (Are they covered in existing plans, do they have a budget?
2. Determine the limits of the areas that drain to each main drain or sewer. Use a contoured map if it is available but check your findings by observation in the field.
3. Identify any areas in which little wastewater is produced at present and record their boundaries on the map. These areas may be suitable for household-level responses to sanitation and wastewater disposal needs but bear in mind the possibility that increased water use will increase future wastewater production. .
4. For each drainage area, determine whether existing wastewater is predominantly grey water or sewage.
5. Identify any areas in which wastewater is being used for either irrigation or aquaculture, together with the drains and/or sewers that serve those areas.
6. Identify the location of any flooding problems and, if possible, their causes. (Determine how local these causes are and whether flooding is caused by domestic and/or industrial wastewater or by storm run-off).

[1] An example of a town-wide structure that gives a voice to the women living in low-income areas is the Community Development Society or CDS structure in India.

Use the drainage map that you have produced to distinguish between areas that:

- Are already served by centralised drainage systems or for which centralised drainage systems are planned.
- Are served by local drainage systems.
- Have little provision for drainage beyond plot boundaries.

Where there is little provision for drainage beyond plot boundaries, distinguish between areas that have deficient drainage and those that have no drains because no wastewater is being produced.

On the basis of the map, identify areas that are likely to be suitable for centralised and decentralised drainage systems. Decentralised systems are more likely to be viable in :

- areas in which wastewater is already being reused locally.
- areas within currently centralised systems that face problems (because of a non-functioning pumping station or persistently blocked sewers for instance), which might be solved or reduced by dealing with waste more locally.
- fringe areas with limited water supply, which currently generate little wastewater but may be expected to generate more in the future.

Institutional analysis

Contextual analysis should have already provided information on institutional structures, roles and responsibilities. The aim of institutional analysis at the town level will be to understand how systems work in practice and in particular who does what.

The way in which systems operate is likely to be strongly influenced by the attitudes of the people who work within them. So, institutional analysis should also include interviews with key stakeholders, designed to ascertain their attitudes and assumptions and the likely effect of these attitudes and assumptions on the prospects for change and improvement. It may be, for instance, that government officials do not consider that decentralised wastewater management is a viable option. Where interviews reveal resistance to change, the ongoing planning and implementation process must address the issue. The ways in which this can be done are considered later.

It will be equally important to determine whether or not existing legislation is being implemented. If not, it will be necessary to explore the reasons in order to determine whether there is either potential for change or a need to develop better approaches to enforcing legislation.

Health

Investigations at the town/city wide level may provide general information on excreta-related illnesses. Official records may provide an indication of the prevalence of diarrhoeal disease. However, such records are often partial since they cover only those who attend formal health facilities (clinics, health centres and hospitals). Where records of infection levels with nematode worms ascaris and hookworm) are available, they may provide a better indication of possible problems with either hygiene or the use of untreated water for irrigation. The presence of

schistosomiasis and other diseases contracted through contact with water indicates a need to consider adequate protection measures for workers in aquaculture.

In practice, existing official records are unlikely to provide conclusive evidence of a statistically significant link between poor wastewater management and infection, for instance that those who work in sewage-irrigated fields suffer from higher rates of ascaris infection than the population as a whole. It may still be possible to use the results of studies from similar areas to indicate the strong likelihood of a link. See http://www.iwmi.cgiar.org/health/wastew/R-107.pdf for a description of the way in which comparative studies were used to illustrate the need to introduce measures to protect the health of people working in sewage-irrigated fields.

Financial analysis

Financial analysis can help to determine who might finance the implementation and ongoing O&M of wastewater management systems and what funds they are likely to have. At the town/city-wide level, focus on the financial status of the municipal authorities and other organisations with a possible interest in wastewater management. Specific questions might include:

- What funds are available to finance the construction of new wastewater management schemes (from the town's own finances and from grants and loans from higher levels of government, perhaps with external funding)
- What financial provision is made for the operation and maintenance of existing drainage and wastewater management facilities? Is it sufficient or is routine maintenance clearly being neglected? Detailed information on O&M costs will often not be available and this, in itself, is an indication that insufficient attention is being paid to O&M).

This analysis will help you to determine what is realistically possible. There is no point, for instance, in assuming that a municipal authority will provide adequate finance to support the operation and maintenance of expanded wastewater management facilities if it is failing to finance that of existing facilities.

3.2.6 Analysis of previous initiatives

Town/city level analysis may well reveal previous and ongoing initiatives in the field of wastewater management. Analysis of these can provide useful information on available resources and constraints. Do not confine investigations to apparently successful initiatives. Knowing what does not work can help you to avoid repeating the mistakes of others. Questions on wastewater treatment initiatives are suggested below:

- What form of treatment was provided?
- Who was responsible for the initiative?
- Who owned the land on which the facilities were located and what procedures were required to make the land available?
- How was the project financed? Was any subsidy involved , if so, who provided it?
- Who is theoretically responsible for managing operation and maintenance of the facilities and who actually manages them?
- Is the system working?
- If so, which O&M tasks are carried out and which are ignored?
- How is the ongoing operation and maintenance of the system financed?

- What financial, technical and managerial problems are currently being experienced?
- What happens to the effluent – in particular is there any potential to use it for irrigation or aquaculture?
- Is any information available on the health and environmental impacts of the initiative?
- Has there been any interest in or has any action been taken to replicate the system elsewhere.

Look for evidence that schemes and programmes have been subsidised. It will be difficult, if not impossible, to replicate schemes that rely on heavy subsidies of operation and maintenance costs. Similarly, systems that use large amounts of land, provided free of charge by government or other stakeholders, may be difficult to replicate. Look at how management systems worked/are working. This will help you to decide which management arrangements are possible for future initiatives.

Previous initiatives will not necessarily be confined to those involving treatment. There may also have been efforts to restrict the crops grown on untreated wastewater, encourage farm workers to wear shoes and other protective clothing and increase consumer awareness of the health risks associated with eating wastewater-irrigated vegetables. The key questions in relation to such initiatives include:

- Who promoted, planned and implemented the initiative?
- What was their key message?
- What methods did they use to communicate this message?\
- What resources did they require (and would these resources be available for follow-up initiatives?
- Were there any immediate impacts?
- Were these impacts sustained over time?

If impacts were not sustained over time, the initiative cannot be considered to have been a success.

3.2.7 Local area analysis

Use local area analysis to develop a detailed understanding of the situation in a particular area in order to inform choices between possible wastewater management options for that area. Start from the household level and work outwards, looking at how wastewater is produced, what happens to it and the options for managing it.

Household level

At the household level, investigate typical on-plot/in-house wastewater disposal arrangements and then use Figure 2.1 to assess the likely composition of wastewater. At this stage, it will also be necessary to make an estimate of the average amount of wastewater produced. It is difficult to measure wastewater flows directly and the more normal approach is to assume that wastewater flows equate to a percentage, typically around 80%, of water consumption, but lower if water is used extensively for gardening.

Where household level investigations reveal that faecal sludge is being retained either on or close to plots in leach pits and septic tanks, it will be necessary to consider the options for faecal sludge management.

Even where grey and black water flows are currently combined, it may be worthwhile to consider the option of separating them. The feasibility of this option will depend to a large extent on existing plumbing arrangements and how easy or otherwise it is to separate flows.

The attitudes of household members will also have an impact. Investigations need to explore people's attitudes to wastewater and the available management options. They my reveal, for instance, that household members are not prepared to consider options that involve separating flows and/or retaining faecal sludges on site in a tank or pit. Where this is the case, the decision then has to be made as to whether to enter into dialogue in the hope of persuading people that they should consider new wastewater disposal arrangements.

Wastewater disposal and reuse arrangements

As with analysis at the town/city level, a good first step in developing an understanding of existing wastewater disposal/reuse arrangements will normally be to map existing facilities and resources. The area to be mapped might be a particular residential area or the area covered by an existing wastewater collection and disposal system. It may be necessary to include adjacent areas in the analysis if either;

- wastewater flows from an upstream area flow through an area or settlement; or
- adjacent areas are served by facilities that might have spare capacity to serve the area with which you are concerned.

The map may be developed from a community map or based on an existing map base. It should include information on:

- Existing drains and sewers.
- Any existing treatment/disposal facilities. These might include formal facilities (for instance communal septic tanks) and informal facilities (for instance local ponds and swampy areas). Household septic tanks may be noted and recorded, either directly on the map or in a separate data base. (If using a separate data base, make sure that it can be cross-referenced to the map).
- Any industrial discharges, which might affect the quality of the wastewater.
- Points at which wastewater is discharged to an agricultural area, trunk sewer, main drain or watercourse
- Any areas that are irrigated by wastewater. Distinguish between agricultural areas and 'municipal' spaces. In the case of agricultural areas, note the main crops grown. In the case of municipal spaces, note whether the public has access to irrigated areas.

Consider the possibility of carrying out the mapping as a participatory exercise, involving people from the community. This will help to both make use of their local knowledge and involve them in the development of proposals, thus helping to ensure that they are engaged in the planning process and thus have some 'ownership' of it.

Mapping of physical facilities must be supported by interviews and group discussions, designed to obtain answers to the following questions:

- Who benefits from existing reuse arrangements – in particular, what benefits do they bring (or might they bring in the future) to poor and otherwise disadvantaged people?
- Are existing practices creating health and environmental problems?
- To what extent are those who work with wastewater aware of these problems?
- Is there scope for wastewater reuse, and if so where and who by?

Land availability, ownership and use

The map can also be used to plot open areas of land that might be either used for treatment and/or aquaculture or irrigated with wastewater. Look particularly for any flooded areas that might be reclaimed as part of a combined drainage improvement/wastewater management scheme.

Start by looking at garden areas, on or adjacent to residential plots. While these are likely to be too small to show on the map, it may be that they provide opportunities to use treated wastewater locally. Next, look at local land uses. Is land being used for cultivation and is it or might it be irrigated with wastewater? Never assume that open land will be freely available. Even the land occupied by swamps and ponds is likely to have an owner. Conversely, do not ignore apparently marginal uses, such as the growing of crops along the edges of roads, even when these are strictly illegal.

Information on existing organisations and skills

Information on existing organisations and skills will help you to determine whether or not the institutional capacity required for the wastewater management options exists.

The stakeholder matrix developed during rapid appraisal can be used to identify the organisations that operate or could operate at the local level. The task now will be to obtain further information on these organisations in order to determine:

- Whether they have or might have an interest in playing a role in efforts to bring about improved wastewater management;
- Whether they have the resources (knowledge, finances and skills) required to fulfil this role.

Information on the management arrangements for existing facilities (drains, sewers, pumping stations, septic tanks etc) may provide insights into possible management options for proposed facilities and services. This can be collected through interviews with key informants, who might include government officials, community leaders and representatives of NGOs and the private sector and, particularly in the case of in-house facilities, community members. Use the questions already listed in section 3.2.4 as the basis for exploring management arrangements.

Cross-check your findings by talking to representatives of different stakeholder groups. For instance, a government official may say that drains are regularly cleaned because that is what is theoretically meant to happen but local people may say that the drains in their area are rarely if ever cleaned.

Financial information

Information on willingness and ability to pay must be available in order to assess the viability of the various decentralised management options. Use the following check-list to guide your investigation:

- Are any grants and/or loans available to fund construction of new facilities and/or rehabilitation of existing facilities?
- Is there any possibility that new works could be funded from the municipal capital budget?
- What capital costs are local people, including those who produce and those who use wastewater, willing to fund?
- Are people willing to pay for the ongoing operation and maintenance of an improved wastewater management regime?

For an introduction to approaches to assessing willingness to pay see McGranahan, Jacobi, Songsore, Surjadi and Kjellen 2001 pp115 – 129 and Tayler, Parkinson and Colin 2003, pp137 – 139. Your aim at this stage should be to develop a realistic assessment of the overall situation rather than to use sophisticated techniques to carry out precise calculations. You will often find, for instance, that household members are willing to pay something to have wastewater removed from the vicinity of their houses but have much less interest in and willingness to pay for what happens to it after that.

3.2.8 Presenting information

If possible, link spatial information presented on a map with socio-economic information on households, recorded on a data-base. If an accurate map base is available and you have access to people who understand GIS, it may be possible to develop this simple linked information system into a fully fledged GIS system. However, a simpler system will usually be more appropriate in the first instance.

Information on roles and responsibilities, both official and actual, might be recorded in a simple matrix with roles and responsibilities recorded along one axis of the matrix and organisations along the other.

3.3 Identification and analysis of options

3.3.1 How choices are influenced by objectives

Choices between the options for wastewater management will be strongly dependent on what is to subsequently be done with the wastewater. Figure 3.1 shows these choices in diagrammatic form, related to the three main possibilities for wastewater disposal/reuse, discharge to a natural watercourse, reuse for irrigation and reuse in aquaculture.

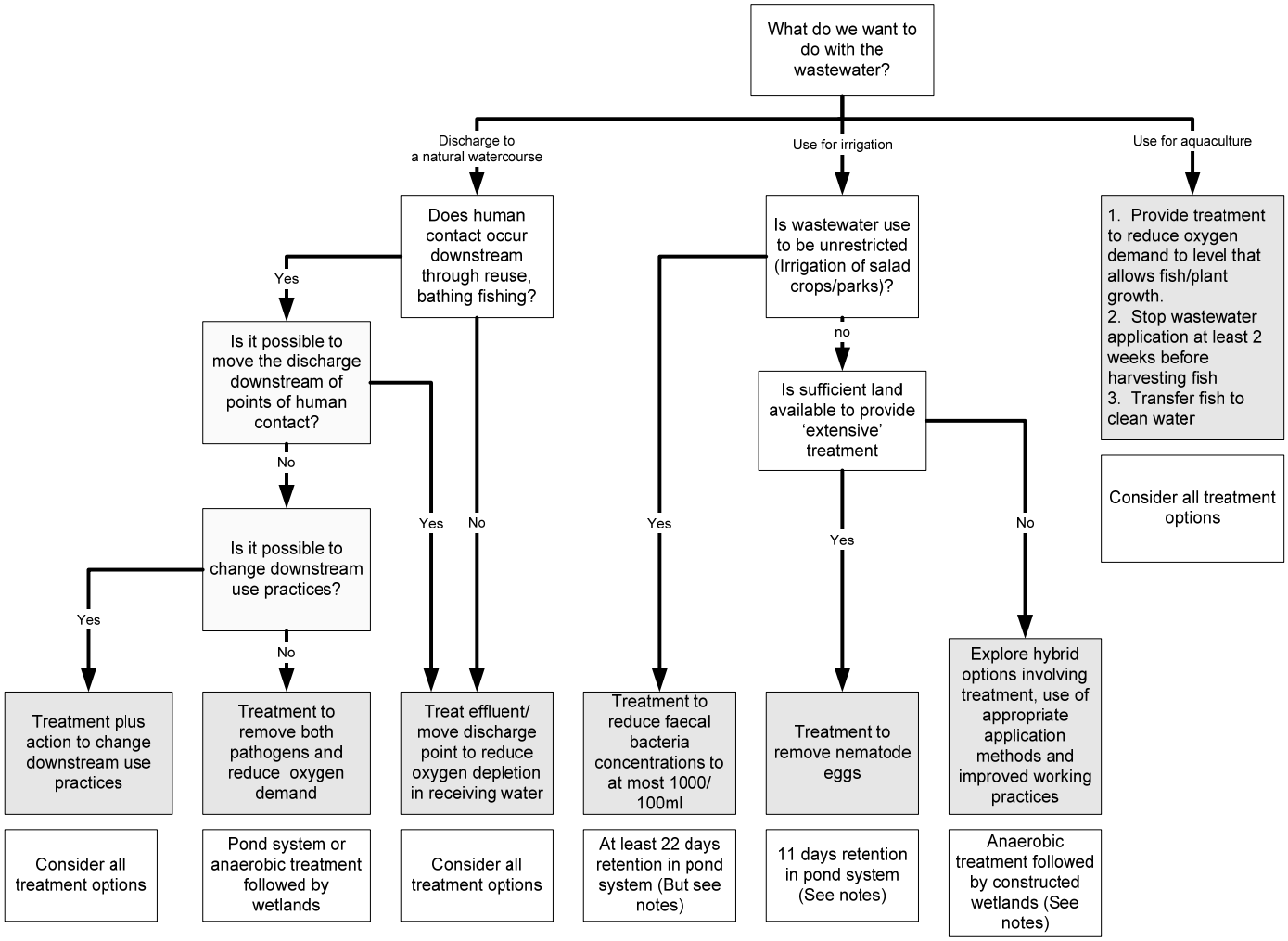

Figure 3.1 - Decision tree for identifying appropriate wastewater management options

The three disposal/reuse possibilities are not necessarily mutually exclusive. Wastewater might be discharged to a natural watercourse from which downstream farmers draw water to irrigate their fields. Excess irrigation water may find its way via field and agricultural drains to a natural watercourse. The outflow from aquaculture ponds is likely to be discharged to a drain or natural watercourse. However, they provide a useful framework for considering wastewater management options. Note the following points about the various possibilities:

Irrigation

Untreated grey water will normally be close to the WHO's requirements for unrestricted irrigation, if not below them, and so can be used for irrigation with little or no treatment. Constructed wetlands are sometimes used to treat grey water but this will rarely be either necessary or particularly practical in developing countries.

The only safe management option for sewage is to provide treatment that will achieve the WHO's requirements for unrestricted irrigation – less than 1000 faecal coliforms per 100ml and less than one nematode egg per litre. The options for achieving these standards tend to be land intensive and may not be feasible in densely populated urban areas with high land prices. Where wastewater is already being used to irrigate salad crops, primary treatment to remove solids may be combined with encouragement to farmers to adopt drip irrigation practices. .

The management options for restricted irrigation are more varied. They include appropriate treatment, changing application methods to reduce risk, worker protection and public health education to ensure that people wash and cook vegetables before consuming them. The best option will depend on the availability of land, the cost of the various options and the likelihood that adoption of improved practices can be guaranteed. (Giving workers protective gear does not necessarily mean that they will use them. Telling consumers to wash and cook vegetables does not guarantee that they will follow the advice).

Discharge to natural watercourse

If downstream human contact is likely when wastewater is discharged to a natural watercourse, the wastewater should ideally be treated to a level that ensures that the receiving water complies with WHO standards. Another option identified in Figure 3.1 is to move the discharge point. This may be either to a point downstream of human contact (often difficult to achieve in practice) or to allow discharge to a larger stream or river, thus increasing the available dilution and reducing oxygen depletion in the receiving watercourse. The option will normally only be possible for fairly centralised systems.

Given the fact that rivers and streams are linear features that may be located some distance from many residential areas, decentralised systems are less likely to be appropriate when the aim is to discharge wastewater to a natural watercourse.

Aquaculture

Aquaculture requires pond loadings that are an order of magnitude below those that are allowable for conventional waste stabilisation ponds (Cross reference to Peter Edwards module). There are situations in which municipal wastewater is used directly in aquaculture ponds either without treatment or following storage in 'primary' ponds that are not used for fish or plant culture.

Box 3.1 – Examples of direct use of wastewater in aquaculture ponds

A well-known example of the use of municipal wastewater in aquaculture ponds is the Kolkata wetlands. In Vietnam, much of Hanoi's wastewater is routed through the Thanh Tri District, where it is used for both irrigated agriculture and aquaculture. In both cases, the wastewater has a high BOD_5 and is used without treatment. Deoxygenated conditions are ensured by restricting the rate at which wastewater is added to the ponds. .

The Mudialy Fisherman's Cooperative, also in Kolkata, adopts a different approach. Here wastewater with a BOD_5 of around 250 mg/litre is introduced to one end of an extensive pond system. The early ponds in the system function as waste stabilisation ponds, reducing the BOD_5 to a level that enables later ponds to be used for fish production. The total aeaa of the ponds is about 80ha and the daily flow is about 23000 cubic metres, giving an average loading of about 72 kgm BOD_5 per hectare, less than 15% of the design figure for facultative waste stabilisation ponds operating at a temperature of 30°C. The loading figure is, of course, an average, obscuring the fact that loadings on early ponds are much higher and those on the fish ponds are correspondingly lower.

All these examples occur where a large amount of land is available, often at some distance from the town or city. Where land is expensive and/or in short supply, the first stage in any aquaculture scheme must be treatment designed to reduce the oxygen demand of the wastewater to a level that allows aquaculture. For decentralised schemes, this will typically involve a combination of anaerobic and aerobic methods, perhaps a septic tank – upward flow filter or septic tank – baffled reactor system followed by either constructed wetlands or ponds.

In areas in which trematode infections are endemic, aquaculture systems can present significant dangers to health. Most of the available literature deals with the dangers to consumers from fish-borne infections, including liver flukes. Cooking the fish is absolutely essential if infection is to be avoided. (See for instance http://www.wpro.who.int/pdf/rcm54/en/rdr/02_MVP_4.pdf. Exclusion of wastewater from ponds for the last two weeks and transfer of fish to clean water for the last few hours before fish are harvested. The former will require that wastewater flows can be diverted between ponds and the latter that there is a clean water pond to which fish can be transferred.

In areas in which schistosomiasis is common, workers are likely become infected if they enter ponds to harvest fish. In theory, the best response to this danger will be to ensure that workers wear waders and other protective clothing. However, such clothing is uncomfortable and it may be necessary to overcome worker resistance to wearing it.

3.3.2 Deciding on the scale at which wastewater is to be managed

Another important decision relates to the scale at which wastewater is to be managed. Figure 3.2 shows how this decision is likely to be influenced by the current arrangements for dealing with wastewater. Note that there will often be more than one option for any given situation. Indeed, the options shown are the most likely rather than the only possible ones. For instance, as already indicated, it

may sometimes be possible and desirable to divert flows that are currently being discharged into a centralised system into a more local system.

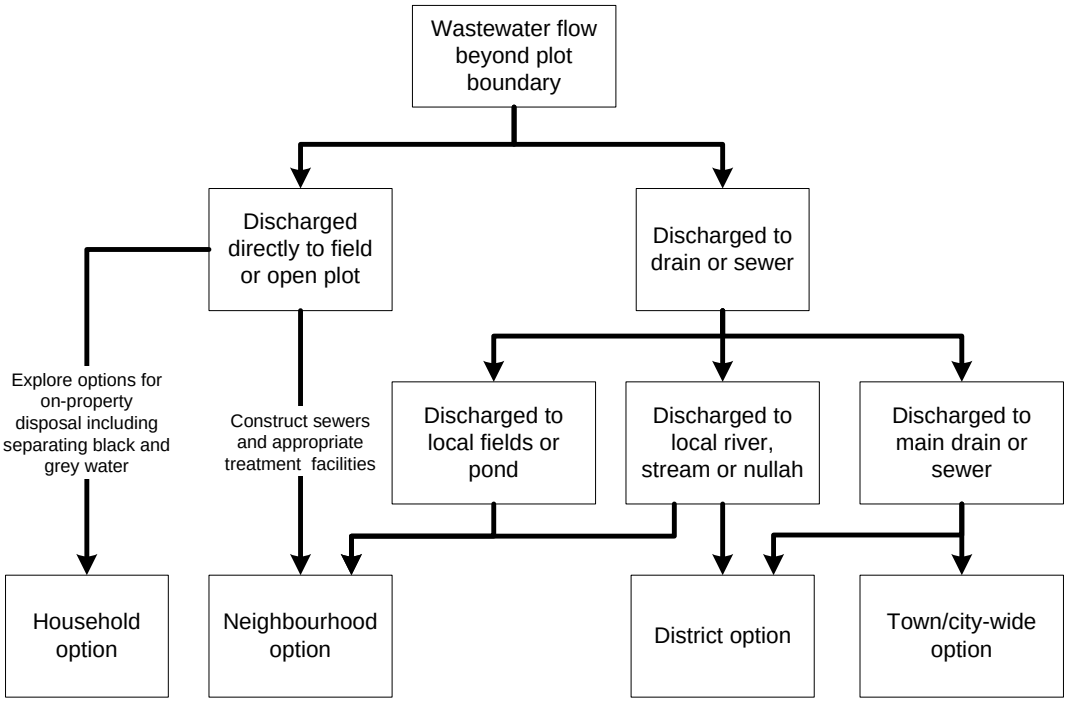

Figure 3.2 - Decision tree for aiding decisions on management scale

Terms such as neighbourhood and district are rather imprecise. The meanings assumed for this Guide are as follows:

Household – A single nuclear family or an extended family living in the same building or on the same plot.

Neighbourhood – An area containing anything between around 10 and around 200 households.

Settlement – A more or less homogenous area, containing perhaps 200 to 1000 households

District – A part of a town or city, often an administrative area or political division but it could be a drainage basin.

Systems serving households, neighbourhoods and settlements can certainly be considered as decentralised. Zonal systems are, to an extent, decentralised although they may share many of the characteristics of centralised town/city-wide systems.

3.3.3 Identifying an appropriate management option

The other key choice to be made relates to the management arrangements to be adopted. Use table 3.1 as a first step to identify which management options are likely to be possible in your local situation.

Table 3.1 Management options at different levels

	Household	Neighbourhood	Settlement	District/ Zone	Town/city-wide
Public	No	Possible	Possible	Possible (Current norm)	Possible (Current norm)
Community	No	Possible	Difficult	No	No
Private	Yes (Individual households)	Possible	Possible (If there is an incentive)	Possible (But rare at present)	Possible (But rare at present)

Where more than one management option is possible, the choice between them should be based on the strength of the different sectors. So, for instance, if initial analysis has shown that the public sector is weak but that strong community organisations exist, community management may be the preferred neighbourhood option. On the other hand, if the public and community sectors are weak, it may be worthwhile to explore private (household) management of household level facilities.

3.3.4 Screening the options

The next step in the process will be to screen the options in order to determine whether they are likely to be appropriate and feasible in the situation in which they are to be implemented. A series of questions to be used in the screening process is given below. The first relates to the suitability of the scheme to achieve its desired objectives while the remainder provide a check-list of the reasons why the scheme might fail or in some other way be unsatisfactory. Each of the questions is then briefly discussed.

- Will the proposed option achieve the intended objectives, either alone or in combination with other options?
- Will the option be allowed by existing or achievable laws, rules and procedures?
- Does the option involve practices, for instance reuse of sludge and/or treated wastewater in agriculture, that may not be acceptable to the community?
- Is there sufficient land to allow implementation of the option? Ask this question both of the land required for treatment and of that required for the implementation of wastewater reuse schemes.
- Is finance available both for implementation and subsequent operation and maintenance? A related question is whether or not there is demand, in the sense of willingness to pay for improved wastewater management.
- Will the option create any environmental hazards for either the local community or the wider environment?
- If the option requires power, is a reliable power source available and is can power costs be met from revenue?
- Are the skills required to operate, maintain and manage the option available?
- Do organisational structures that allow the sustainable exercise of management skills exist?

Will the proposed option achieve the intended objectives?

Where the scheme is designed to achieve health and environmental benefits, check the likely reduction in pathogen and BOD levels and also any reduction in exposure to pathogens that may result from changed management practices.

Legal and procedural assessment

Use the information on existing policies, laws, procedures and standards already collected during town/city wide analysis to assess the feasibility of each option. In some cases, these factors may completely rule out an option. In others, they may increase the cost and hence decrease its viability. An example of the first would be stringent suspended solids standards for sewage effluents, adapted from western standards designed for 'conventional' treatment processes, which might rule out the use of waste stabilisation ponds. An example of the second would be a requirement that all sewers are built by government to approved standards, despite the fact that these standards are unnecessarily conservative on factors such as minimum sewer diameter and minimum cover.

Where the existing legal and procedural framework constrains otherwise viable wastewater management options, consider the possibility of trying to change the framework. While the need for such efforts might be identified in the course of efforts at the local level, they will normally have to be pursued at the municipal level or higher. Nevertheless, they can be included in the overall wastewater management plan.

Acceptability to the community

A scheme may be unacceptable to the community either because it involves practices that they find to be culturally unacceptable, economically unattractive or injurious to their local environment in some way.

Where there is no tradition of wastewater reuse, there may be strong resistance to schemes that involve irrigated agriculture, aquaculture and the reuse of treated faecal solids. If rapid appraisal reveals that wastewater is already being reused, there is unlikely to be any general resistance to the concept of wastewater reuse. However, farmers may resist treatment, perhaps because of its cost and perhaps because they believe that it will result in reduced crop yields.

Where treatment is to be provided, close to inhabited neighbourhoods, planners should ensure that the people living in those neighbourhoods know and accept what is to be provided. Where possible indicate the actual site to be occupied by the proposed facility, perhaps marking out its position on the ground using a marking material such as lime.

In the event that the scheme preferred on 'technical' grounds is unacceptable to the community, it will normally be worthwhile to make some effort to explain it in the hope of overcoming resistance. If possible, community representatives can be taken to see a similar scheme that is already operational. However, if the community is still not convinced by the scheme, it will be advisable to look for alternatives.

Availability of land

When considering land requirements for treatment, it is important to ask both how much land is required and where it is required. The land requirements of anaerobic

treatment options are quite small. For preliminary calculation purposes assume 0.05 m^2 per person equivalent for a septic tank. Increase this by about 50% if provision is to be made for either an upward-flow anaerobic filter or a baffled reactor. This relatively small land requirement can often be provided locally, on-plot, in road verges, under public open spaces and so on. 100 to 200 litres per user equates to

Aerobic treatment requires much more land. Approximate land requirements for waste stabilisation pond and constructed wetland systems to remove sufficient pathogens to allow unrestricted irrigation (22 -25 days retention in a pond system) are approximately 2-3 m^2 per person equivalent and 1.5 – 2.5 m^2 per person equivalent respectively. The land requirement to remove nematode eggs to a level to allow restricted irrigation might be about 60% of these figures[2]. Research in Sri Lanka suggests that similar results can be achieved on much less land, around 0.2 m^2 per person equivalent, with a septic tank – aerated filter unit followed by a constructed wetland (Information provided by Harin Corea).

Simple anaerobic systems tend to work best if they are relatively small in scale. This suggests the option of providing primary aerobic treatment at the neighbourhood level (up to say 50 households) and then providing sewers to transport the effluent to more centralised but still relatively local ponds or constructed wetlands for secondary treatment. The main advantages of this system are:

- Its decentralised approach to primary treatment allows the main sewerage system to be designed to carry settled sewage, thus reducing sewer gradients, depths and excavation costs.
- It is flexible, allowing aerobic treatment to be provided on the outskirts of towns, where affordable land is more likely to be available and where there is more likely to be a demand for treated wastewater for either irrigation or aquaculture.

Provision will have to be made for desludging septic tanks. Another point to be considered is the likely impact of stormwater on the proposed system. Large stormwater flows will tend to disrupt the operation of anaerobic systems and so this type of system is unlikely to work well with systems that already combine storm and foul flows.

Assessment of the availability of land for treatment should be linked with assessment of land availability for either irrigation or aquaculture. Consideration of the total amount of land to be irrigated and/or used for aquaculture can be used, together with information on typical irrigation/aquaculture water requirements, to establish the amount of water required for either irrigation or aquaculture.

Availability of finance

It is important to evaluate the likely costs, both capital and recurring, of each option and consider how these might be financed. The following points are important:

[2] These figures allow for ancillary works, access, banks to pond etc. They are order-of-magnitude figures and would have to be worked out more accurately at the detailed design stage. t

- *It is particularly important to consider operational costs*. Capital costs may be met from a central budget and subsidised in some way but it is unwise to allow for central subsidies of ongoing operational costs. Will community members or farmers pay for the ongoing operation and maintenance of facilities? If not, is there the possibility that they can be met from general municipal funds? Where funds for capital schemes are available, it will sometimes be better to provide a system with relatively high capital costs and low running costs even though theoretical least cost analysis shows that another option with high running costs has a lower present value.
- *Pay particular attention to the options for financing tasks that are required infrequently but require significant effort and expenditure* – for instance the desludging of anaerobic waste stabilisation ponds.
- *Take account of explicit and implicit subsidies*. If land has been made available free of charge for a pilot project, consider whether the cost of additional land will have to be met when developing a full-scale programme.

Environmental issues

Environmental assessment of the various schemes is required to determine whether they are likely to have an adverse impact on the environment as a whole. Most governments have guidelines for conducting environmental assessments and these should be followed as appropriate when assessing each scheme. They will also normally specify the standards to be met when discharging wastewater to the natural environment.

Unfortunately, these standards may be difficult to meet and may preclude affordable action at the local level. In such circumstances, some compromise may be required. A useful question to ask is 'will this scheme harm the environment, be essentially neutral or bring about some improvement'. Where the environment is already grossly polluted, it is arguable that any scheme that brings about some improvement should be acceptable, even though it does not meet the full environmental standards. However, it will normally be wise to consider how it might be upgraded in the future to achieve the required environmental standards. So, for instance, if wastewater is being discharged to an existing drain, it may be acceptable to provide primary treatment in septic tanks (or anaerobic filters) in the first instance because this presents an improvement on no treatment at all. However, the options for adding secondary treatment at a later stage should also be considered at the planning stage.

It will also be important to consider the impact of a scheme on the local environment. For instance, people are unlikely to be happy about the location of an open anaerobic waste stabilisation pond next to their houses but are likely to be much less worried about the provision of a closed septic tank – anaerobic filter in the same place.

When considering the likely impact of the various options on the local environment, make allowance for the fact that management arrangements may be less than perfect so that it will be unrealistic to expect the same performance that might be achieved in laboratory conditions.

Power requirements

One of the requirements for a decentralised treatment option is that it should not, if at all possible, require power. However, there will occasionally be an interest in providing a system that requires some power, either for a specific treatment

technology such as a rotating biological contactor (RBC) or, more frequently, to pump either raw sewage or effluent. In such cases, it will be important to consider the power requirements of the system and to establish the likely impact of power failure on the system or high power costs on the system. If power supply cannot be guaranteed but is essential to the operation of the system, it may be necessary to provide a standby generator. Only adopt this approach if it is clear that no other approach is feasible and affordable.

Availability of skills and adequate organisational structures

This is not perhaps the key factor that is often assumed. It is possible to teach skills and experience shows that systems often fail because of a lack of management will rather than because of a lack of skills per-se. Nevertheless, it will be important to assess the knowledge and skills required to operate each system and ensure that these skills are available with or can be made available to the body that is to be responsible for managing the system. These skills include both the technical skills relating to the operation and maintenance of the scheme and financial and administrative skills.

These skills are only likely to be used effectively if an appropriate organisational structure is in place. So, for instance, it may be that there are people in the community who know how to operate a waste stabilisation pond system but for them to use these skills, there must be an organisation to hire them, direct and supervise their work, ensure that they are paid on time and so on.

3.4 Development of preferred options

The screening process should eliminate clearly unsuitable options, leaving not more than one or two options or variations on an option to be considered further. These options need to be further developed as necessary to allow them to be compared and presented to the various stakeholders.

Formal stakeholders, including government departments, international agencies and the like, will normally require outline proposals, complete with layout drawings, financial costs and benefits, proposed organisational arrangements and an assessment of likely environmental costs and benefits. Community stakeholders may well prefer something a little less technical. It might be appropriate to develop ways of presenting preferred options using a multi-media approach. This might involve an introductory spoken presentation, videos illustrating key points, shared visits to the proposed project area and so on.

It may be appropriate to finalise the choice of option at a workshop attended by all stakeholders. This will help to ensure that there is no subsequent dissent regarding decisions made.

Once the preferred option has been identified, it will normally be further developed by professionals although it will be advisable that they then present the results of their efforts to key stakeholders.

3.5 Finalising the plan

By this stage, there should be one or more proposals relating to specific schemes and projects ready to go ahead. It would be possible to go ahead and implement these individually. However, it will be much better if they can be implemented in the

context of an overall plan for improved wastewater management. This should draw on the results of investigations for solutions to local problems but should also make strong reference to the results of town-level analysis.

It should not be confined to physical proposals but should pay close attention to the actions needed to develop the institutional and legal context for improved wastewater management, raise awareness, develop knowledge and skills and develop an improved information base, all as necessary in the local situation.

3.5.1 Structure and contents of the plan

The plan will normally be a document containing both information on the overall strategy for wastewater management and more detailed information on individual schemes. Figure 3.3 presents a possible structure for such a plan.

The main body of the plan, including the overall framework and the chapters devoted to individual components, should be fairly concise. It can be supported by annexes as required. This will ensure that the plan is accessible to everyone while providing additional information for those who need it. It will be very important that the plan provides adequate spatial data, showing for instance the limits of the areas to be dealt with by centralised and decentralised facilities, the location of major facilities and so on.

The plan should *set priorities* for action and investment**,** and explain clearly how these priorities have been established. Figure 3.3 illustrates the fact that these priorities may be formalised as plan components and that these components will rarely be restricted to the provision of new facilities. For each component, options for improving management arrangements, particularly as these relate to operation and maintenance, should be included.

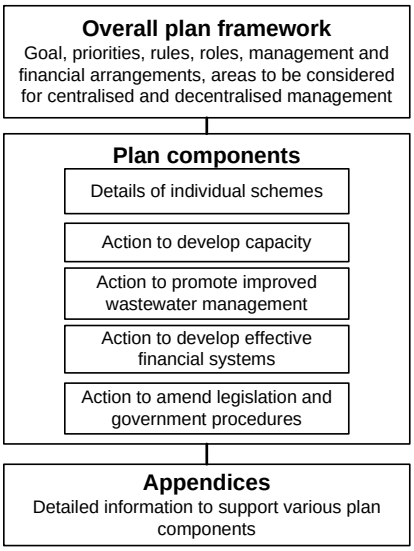

Figure 3.3 – Possible plan structure

It is best if individual plan components include specific objectives and targets, decided in the light of the availability of resources and the constraints presented by the existing situation. Pay particular attention to the objectives and targets for the first year. Achieving them will build confidence among all the parties involved.

Conversely, if early objectives and targets are set at too high a level and consequently not achieved, people will lose confidence in the plan and may ignore it. Objectives do not have to relate only to completed schemes. It will normally be appropriate to identify intermediate objectives, which might be seen as milestones on the way to achieving an overall objective. One such milestone might be purchasing or otherwise acquiring the land required to construct a new treatment facility.

The plan should be written as simply as possible so as to ensure that it is accessible to anyone who might be interested in its contents.

When considering the timetable for implementing the plan, take account of the likely sources and availability of funding. If funding is to be sought from higher levels of government, can it be guaranteed? Is it likely to come on time or might it be delayed? Where there is doubt about the amount or timing of funding, some flexibility must be allowed in the timing of components that depend on external funding.

Do not assume, however, that government will be the only source of funding. The plan should be based on a realistic assessment of what intended users will pay for improved sanitation services and the resources that may be available through NGOs, local businesses and other non-government sources. Where appropriate, it should include some indication of action that might be taken to improve financial systems and the local financial base.

It may be that funds are already earmarked for ongoing programmes and committed government schemes. It may be worthwhile to explore whether any of these funding sources could be used to support plans to improve wastewater management.

3.6 Making the plan 'official'

It is important that both municipal and state authorities formally endorse the plan. Without such endorsement, it will be difficult or impossible to ensure that all concerned departments and agencies work within the framework it has established. Ideally, the plan should have an official status and should be designated as the framework for action by higher levels of government. You may have limited power to make this happen, but you should do everything that you can to have the plan accepted as the official sanitation plan for the town.

In particular, everything possible should be done to ensure that plan components are formally incorporated into the programmes and budgets produced by the various stakeholder organisations. This will help to lock these organisations into the planning process and reduce the probability that they will retreat from the commitments made in the plan

4 IMPLEMENTING THE PLAN

4.1 Some general principles

The process does not end with the production of the plan. Indeed, any plan is only as good as the action that flows from it. No plan will ever be perfect, certainly not at the first attempt, and thinking may change as a result of the experience of implementing the plan. So, the production of the plan should not be seen as the last step in a process but rather an important stage in that process. In many ways, it represents a point of departure and where you arrive will depend on the way in which you travel beyond this point.

When implementing the plan, bear the following principles in mind:

- Do not try to do everything at once. It is better to start one task and bring it to completion than to start several and fail to complete them.
- Pay particular attention to the first steps to be taken towards implementation. Once these have been completed, you are on the road to achieve overall objectives. If they are not completed, the plan will not be implemented.
- Be clear from the start about who is going to take responsibility for implementation.
- Monitor the progress and quality of activities and, where necessary, take action to deal with any problems revealed by the monitoring.

4.2 The different requirements of the various types of change

The wastewater management plan may require changes in attitudes and practices, management structures and routines and physical facilities. In many, but not all cases, the requirement is likely to be for more than one of these changes. It is important to recognise that different approaches are likely to be required for the different types of change.

The implementation of physical changes will normally be time-bound. In other words, there will be a definite starting date, followed by the period of implementation, at the end of which new facilities will have been installed and commissioned.

Changes in management structures and systems will take effect at a specific time but will usually require preparatory actions, which might include training, the preparation of operating instructions job descriptions etc.

Similarly, any changes in legislation and procedures must take effect at a specific time but again there will normally be preparatory actions, drafting the legislation, ensuring that it is included in the legislative programme and so on.

In most cases, attitude change will be a process, in which messages are reinforced by what people see happening on the ground. For this reason, it is harder to tie down attitude changes to specific times and periods. The same is true of changes in operational practices.

These differences mean that different approaches are likely to be required to the implementation of different parts of the wastewater management plan.

4.3 Implementation of programmes to change attitudes and personal practices

If the wastewater management plan proposes action to

- encourage greater separation of black and grey water at source;
- change wastewater reuse practice, perhaps by restricting the crops grown;
- discourage bathing downstream of wastewater discharges;
- improve food hygiene;
- encourage the public to insist that salad vegetables are only grown in clean water;

it will be necessary to consider how these changes are to be implemented. Some of these tasks are likely to be more difficult to implement than others and programmes to change attitudes and practices should only be implemented if there is a clear plan of action and real prospects of success.

The key questions to ask about this include:

- Who might take responsibility for facilitating the required change?
- Who will pay for their inputs and the resources that they need?
- Who will be the target audience
- Who will be responsible for deciding the message and preparing materials?

It is often assumed that NGOs can take responsibility for facilitating change. This does not always have to be the case and government workers have taken leading roles in successful behavioural change programmes. (See for instance Tendler, J. (1997), *Good Governance in the Tropics,* Baltimore and London, Johns Hopkins University Press, pp21 – 45).

Whichever group is given responsibility for facilitating change, it is likely that they will need to receive instruction and guidance relating to the message to be presented and the way in which it is presented.

4.4 Implementation of changes in management practices

Changes in management practices are often difficult to sustain, particularly when existing institutions have developed a conservative risk-averse culture. Since sustained change will be impossible without the support of senior decision-makers, the initial focus should be on convincing these decision makers, both politicians and senior officials, of the need for changes management practices. Once convinced, they can become strong advocates for change.

Changes in management practices can have unforeseen consequences. My introducing changes on a limited scale in the first instance, you can monitor these consequences and, where necessary, introduce modifications before introducing the changes everywhere. If you take this approach, you must monitor and assess the inputs required by the new practices. Pilot initiatives sometimes work because they receive a high degree of attention, which cannot be reproduced when the changed practices are introduced more widely. So, while the pilot is apparently successful, follow-up efforts unexpectedly fail.

Training may be necessary to both explain the need for changed practices and provide guidance on how to implement those practices. As far as is possible, formal

training sessions should be integrated into more wide-ranging capacity-building initiatives, which provide opportunities for 'training on the job' and feedback on the value of formal training in the work situation.

4.5 Implementation of physical changes

4.5.1 Roles and responsibilities

When planning for implementation of physical works, it will be important to clearly define roles and responsibilities. Conventional approaches to implementation distinguish between:

- the *client* – the person or organisation responsible for commissioning and paying for the works;
- the *engineer* - the person or organisation responsible for preparing the scheme and then supervising the works; and
- the *contractor* – the person or organisation responsible for building the works.

It is possible for one person or organisation to undertake more than one of these roles. For instance, a householder who decides to provide a new septic tank to serve his house is clearly the client in that he or she is paying for the septic tank but may also act as the 'engineer' in the sense that he or she is supervising the work of the contractor employed to build it. When government is the client, it almost always employs the engineer, either directly as a staff member of a government department or indirectly as a consultant.

This client – engineer – contractor distinction was developed in the context of conventionally contracted schemes but is also a useful distinction when considering other contractual arrangements. In particular, it is possible for community members to take or at least contribute to any one of the three main roles. Further information on the way in which community members might undertake these roles can be found in Cotton, Sohail and Tayler (1998). More general information on community contracting is available at http://web.mit.edu/urbanupgrading/upgrading/issues-tools/tools/Comm-contracting.html, which also provides links to other web sites on the subject.

When considering the options for implementing works, it is important to be aware of the officially recognised roles and responsibilities. For instance, in most South Asian countries, there are clear rules as to who can provide both the technical and administrative sanction without which a scheme cannot proceed. These rules are absolute and failure to observe them will mean that implementation of a scheme will not go ahead.

4.5.2 Contract documentation

Standard conditions of contract, setting out the roles and responsibilities of the different parties to the contract, are applicable to wastewater management schemes just as they are for any other form of scheme. Special clauses may be necessary to deal with specific issues that might arise while implementing a wastewater management scheme. An example would be a clause requiring that irrigation flows to fields must be maintained during the course of implementation. Such clauses should normally be included in the contract documentation as 'special conditions of contract'.

The location and extent of facilities should be clearly set out in the contract in order to ensure that:

- Quantities can be accurately calculated; and
- Disputes about land requirements and ownership after construction has started can be minimised.

Schemes that are implemented through some form of community contracting arrangement will normally require simple contract documents. Like conventional documents, these should define the location and scope of the work to be undertaken. It is sometimes assumed that partnering, including community partnering, will reduce the potential for disputes between the partners to the contract. A more realistic view is that there are always likely to be disputes between partners with different interests but that it will be easier to resolve these disputes if the roles, duties and rights of the parties are clearly set out in a contract agreement.

4.6 Monitoring and evaluation

Monitoring is predominantly a management tool. It is required while a project is in progress. WHO defines monitoring as '*the periodic oversight of a process, or the implementation of an activity, which seeks to establish the extent to which input deliveries, work schedules, other required actions and targeted outputs are proceeding according to plan, so that timely action can be taken to correct the deficiencies detected*'. Monitoring helps to ensure that any implementation problems are identified and dealt with early. All too often, problems that are neglected tend to become larger and more difficult to deal with over time.

Evaluation is an analytical tool that is used to assess completed initiatives in order to ensure that the lessons can be applied to future initiatives. It has been defined as '*a process that attempts to determine as systematically and objectively as possible the relevance, effectiveness, and impact of activities in the light of their objectives'*. It should not, therefore, be seen as an end in itself but rather as a stage in a cyclical planning process. When evaluating an initiative, ask the following questions:

- How much did it cost and was that cost different from that originally estimated?
- Is it operating as intended and what resources have been required to manage its operation? How have those resources been obtained?
- Has it brought about the expected benefits – in other words, what impacts has it had?
- Are the various stakeholders, not least the intended beneficiaries, happy with what has been done or would they do some things differently if they were to be done again?

Further information on monitoring and evaluation is available at http://www.ifad.org/evaluation/guide/index.htm. While the focus of this document is on rural projects, much of what it contains should be of more general interest.