IETC
International Environmental Technology Centre

PROCEEDINGS OF THE INTERNATIONAL EXPERTS MEETING ON SUSTAINABLE MANAGEMENT OF WASTE WATER AND STORM WATER

OSAKA, JAPAN
6-8 MAY 1998

Organized by
UNEP International Environmental Technology Centre (UNEP IETC)
in collaboration with
WHO Urban Environmental Health Unit (WHO-UEH)
Global Environment Centre Foundation (GEC)
International Lake Environment Committee Foundation (ILEC)

IETC INFORMATION SERIES [1]

United Nations Environment Programme

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PROGRAMME DES NATIONS UNIES POUR L'ENVIRONNEMENT · PROGRAMA DE LAS NACIONES UNIDAS PARA EL MEDIO AMBIENTE

ПРОГРАММА ОРГАНИЗАЦИИ ОБЪЕДИНЕННЫХ НАЦИЙ ПО ОКРУЖАЮЩЕЙ СРЕДЕ

UNEP

International Environmental Technology Centre (IETC)

Our Ref: 1194

Date: 11 December 1998

Dear Madam/Sir

Enclosed is a copy of the "Proceedings of the International Experts Meeting on Sustainable Management of Waste Water and Storm Water" held by UNEP/IETC in collaboration with WHO Urban Environmental Health Unit, Global Environment Centre Foundation (GEC) and International Lake Environment committee Foundation (ILEC), from 6 to 8 May 1998 in Osaka, Japan.

This Experts Meeting was organized to discuss the direction of UNEP/IETC's project "Promoting Sustainable Management of Waste Water and Storm Water" aiming to produce an "International Source Book on Environmentally Sound Technologies for Waste Water and Storm Water Management" together with supplementary training modules. The proceedings summarize the main conclusions and recommendations of the meeting.

Please do not hesitate to contact us, if you have any questions or comments about the meeting as well as our project. I hope that you will find the proceedings useful.

Yours sincerely

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Director

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UNEP International Environmental Technology Centre
Osaka/Shiga, 1998

Preface

The International Environmental Technology Centre (IETC) is a facility of UNEP, which serves the world, particularly the developing and economic transitioning countries. It provides information and information services and capacity building services to promote the adoption and use of environmentally sound technologies for freshwater and urban environment management. Underpinning the Centre's program is a network of institutions and individual experts in these fields who share and support the aim of improving the environment and achieving sustainable development.

The expert meeting on waste water and storm water management held in Osaka in May 1998 is an example of both the value of the IETC network and the consultative approach of Centre. The experts who came together in Osaka for the meeting applied a breadth of experience and insight to what has become a major issue. Their ideas and suggestions on the scope of the proposed IETC project, along with the best ways of presenting the information so that it is user friendly and reaches the decision makers and those who influence their decisions, were invaluable.

The Source Book and Training Material to be produced in 1999 will reflect the experts' input. But much of value came from the meeting that is already quite useful for researchers and practitioners in environment management. This report conveys the essence of the discussions and the advice of the experts to the IETC. We are pleased to share these with you.

John Whitelaw
Director
UNEP-IETC

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INTERNATIONAL EXPERTS MEETING ON SUSTAINABLE MANAGEMENT OF WASTE WATER AND STORM WATER UNEP-IETC, OSAKA, JAPAN 6-8 MAY 1998

I. INTRODUCTION

The United Nations Environment Programme International Environmental Technology Centre (UNEP-IETC) is preparing its new project entitled "Promoting Sustainable Management of Waste Water and Storm Water". As part of the preparations, experts gathered to discuss "Sustainable Management of Waste Water and Storm Water" at UNEP-IETC, Osaka, Japan, 6-8 May 1998. The meeting participants reviewed, improved upon, and finalised the project's proposed programme framework.

This meeting was organised in collaboration with the WHO Urban Environmental Health Unit, the Global Environment Centre Foundation (GEC), and the International Lake Environment Committee Foundation (ILEC).

A. Background

Agenda 21, Chapter 21 states: "By the year 1995, in industrialised countries, and by the year 2005, in developing countries, ensure that at least 50 per cent of all sewage, waste waters and solid wastes are treated or disposed of in conformity with national or international environmental and health quality guidelines." Freshwater was cited as a global priority five years after the Earth Summit by the UN General Assembly Special Session on Environment, (UNGASS, June 1997).

As a subsidiary UNEP body focusing on urban and freshwater issues, UNEP-IETC is rising to this challenge by proposing a project to promote sustainable management of waste water and storm water world-wide. The proposed project addresses two issues: properly managing waste water to avoid further degradation of the water environment, particularly freshwater resources; and increasing access and availability of freshwater through recovery and reuse.

This project complements IETC's general activities, namely, the development of an international Environmentally Sound Technology (EST) directory and related capacity building activities. IETC is also promoting "maESTro," IETC's original computer software for managing and accessing this EST directory database.

Meanwhile, WHO is taking the lead in setting up a "Sewage Clearing-House" under the umbrella of the Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-Based Activities, based on United Nations General Assembly (UNGA) Resolution 51/189. Since WHO and IETC would clearly benefit by sharing available resources and co-operating on their common goals, they are jointly undertaking these two activities. This experts meeting on "Sustainable Management of Waste Water and Storm Water" signalled an initial step in these joint efforts.

B. Objectives

IETC had three goals:

(i) A critical review of UNEP-IETC's proposal for a publication and training tools to promote sustainable management of waste water and storm water in urban areas. This included examining the need for information sources, priorities, opportunities, etc.

(ii) Brainstorming and other guidance about the range of Environmentally Sound Technologies (ESTs) and Sound Management Practices (SMPs) to be covered in the publication and training tools.

(iii) A preliminary review of the inter-links between IETC's project and the "Sewage Clearing-House" now being developed by the World Health Organisation (WHO).

C. Programme

The meeting programme consisted of ten sessions over three days. Most of the sessions featured presentations by participants, followed by discussions. In Session 9, participants were divided into two workshop groups to brainstorm on outlines of the international Source Book and Training Modules, respectively.

Appendix 1 contains the meeting programme, and appendices 3 through 5 for project reviews and papers presented by participants at the meeting.

D. Participants

Persons attending the meeting represented an international cross-section of the many sectors involved in waste water (WW) and storm water (SW) management. They included leading scholars and professionals in the field, officials from relevant international organisations, and potential beneficiaries. The list of participants is attached as appendix 2.

II. PROCEEDINGS

A. SESSION 1—Opening

1. An Introduction to IETC by Mr. John Whitelaw, Director

UNEP-IETC was created as the focus for UNEP's efforts to promote Environmentally Sound Technologies (ESTs) for the sustainable management of urban areas and freshwater resources. The Centre collects information on ESTs from a variety of organisations in many different countries, and makes it available worldwide through an EST Directory and IETC's original software, an interactive EST databank named "maESTro."

The successful acquisition and implementation of appropriate ESTs are recognised as critical for countries' sustainable development. Accordingly, IETC works to increase the management and decision-making capabilities of those responsible for managing cities and freshwater resources—particularly in developing countries (DCs) and countries with economies in transition (EITs)—so that ESTs can be adopted and used effectively. Towards this end, IETC places equal importance on joining forces with partner organisations within the UN system (particularly with HABITAT), as well as with bodies outside that system.

IETC's main interest in this project is to promote environmentally sound management of water resources to prevent their further degradation, and the improvement of resource capabilities through recovery and reuse.

2. Project Overview

The proposed project, originally entitled "Promoting Sustainable Management of Waste Water and Storm Water in Urban Areas" was outlined by the former project head, Mr. Hiroshi Shiroi. The development of an "International Source Book on ESTs for Sustainable Management of Waste Water and Storm Water," together with supplementary training modules, is suggested as the next addition to UNEP-IETC's EST Source Book series, begun in 1996 with the "International Source Book on ESTs for Municipal Solid Waste Management." (2000 copies of this publication have been distributed throughout DCs and EITs to date, and this publication is also available through the Internet.) The Source Book and Training Modules will serve to help administrators and other decision-makers in DCs and EITs better conserve and manage freshwater resources, by improving EST-related knowledge and relevant decision-making skills.

Consisting of regional overviews of current waste water / storm water (WW / SW) management practices in eight world regional areas, sound management practices, and a list of world-wide information sources on ESTs, the proposed Source Book will be a practical guide. The potential beneficiaries of this proposed book include: decision-makers in government, in the private business sector, in communities as well as among environmental NGOs, urban managers and professionals who provide policy advice to decision makers whether at the national or local level in the DCs and EITs; donor agencies and international organisations assisting DCs and EITs; academics and research groups.

In the ensuing discussion, participants questioned whether it is possible or desirable to deal with waste water treatment and storm water management in the same Source Book, and if so, how to best do so. Participants also recognised that different individuals with varying backgrounds may have dissimilar understandings of relevant terminology; therefore, the Source Book's inclusion of a glossary of common terminology would be of vital assistance. Another important question that was raised pertained to whether the Source Book would address primarily on-site or off-site sanitation. These points were discussed further in ensuing sessions.

B. SESSION 2—Project Survey

Prior to the experts meeting, the IETC undertook a questionnaire survey on WW / SW management (please see appendix 6), and Mr. Shiroi presented the survey results. The most noteworthy findings are as follows:

(i) Opinions varied regarding municipal managers' responsibility to be familiar with various technological options for WW / SW management: some respondents indicated that municipal managers should be fully informed about a variety of technical options, while others felt they should know basic principles of advanced technologies, but not the details. Others said that city managers do not necessarily need to know about technologies, but should be aware of their societal implications.

(ii) What are the greatest obstacles to implementing WW / SW programmes in DCs? The lack of properly trained personnel, funds, and basic socio-economic infrastructure were cited most, followed by ill-defined institutional structures and the lack of access to relevant information.

(iii) According to the survey, most respondents believe that centralised sewage systems (such as those found in industrialised countries) are inappropriate for DCs, though they could be appropriate in the long term. It was significant that the definition of the term "centralised sewage" was not clear to all those surveyed.

(iv) Regarding waste water reuse technologies, most of those surveyed felt that they cannot be applied fully in DCs at this time.

(v) Only some of those surveyed were aware of publications similar to the proposed Source Book. The majority agreed that there was a need for such a publication, but suggested that the book should not be too broad or ambitious in scope.

(vi) Suggested references included several publications—produced by the World Bank, UNDP, UNCHS, UNEP/MAP, and other institutions—that also delineate methodologies to select, apply and integrate ESTs.

(vii) Already-existing WW / SW facilities or the local water supply service would be good starting points when selecting technologies for WW / SW practices in DCs and EITs, survey respondents indicated.

(viii) Several training packages similar to the proposed Training Modules were noted: those developed by IRTCUP, UNDP, the World Bank, JICA, Tsinghua University, and California State University. Some respondents were doubtful about the effectiveness of the Training Modules as proposed by IETC, and recommended clarification of the target groups.

(ix) Respondents prioritised local government—both technical people and decision-makers—and the national government as appropriate target trainees for the Training Modules, followed by NGOs and community-based organisations (CBOs).

(x) Popular choices for appropriate training course organisers were donor agencies and international organisations.

C. SESSION 3—Critical Reviews on the proposed Source Book

1. Critique From Dr. Bernd H. Dieterich (Please see appendix 7)

According to Dr. Dieterich, a lot of information is available on WW / SW management technologies, but the involvement of so many different sectors creates confusion. Ideally, the Source Book would be both in-depth and broad in scope, to meet the needs of decision-makers from different sectors—including, for example, technical information, managerial information, information and training for procuring funding, decision-making and planning, etc.

To select appropriate technologies, decision-makers need to be guided toward the "right" decision, which is not a political one, but an appropriate choice regarding the environment and technology. Moreover, the Source Book must clearly define key terms: for example, persons from different backgrounds may take 'sustainability' to mean financial, environmental, social, or political sustainability. The Source Book must be specific, to avoid further confusion.

Along similar lines, although there are already many training courses available in the world, most of them limited, and do not apply to various countries' different situations. Optimal Training Modules accompanying the Source Book require more contact with organisations within the target country.

Industrialised countries, as models, have much to offer decision-makers in DCs and EITs; this does not necessarily include their technologies, but rather, the implications of their histories, the choices they made and other experiences.

The mixed use of technologies (e.g., the mixed use of a conventional sewage system, low-cost sewage system, and on-site/off-site sanitation) is essential for any country or city to cope well with the many different situations that are always present. WW / SW management needs to be considered in the context of each city's overall development or municipal plan. To function optimally, it is vital for a city to have such a master plan, which should exhibit this mixed use of technologies. The most effective plans also map out a dynamic evolution of this mix.

Public works typically compete with other infrastructure development projects for limited financial resources. In most DCs and EITs, financing is the major obstacle to implementing any project. Thus it is important that socio-economic considerations be addressed in the Source Book, including how to respond to changes in socio-economic conditions. Because a country cannot mobilise financial resources from donor agencies without proper Environmental Impact Assessments (EIAs), the Source Book also needs to adequately cover EIAs.

The concept of the project cycle is an important element when identifying and developing a project, and so would be a helpful part of the Source Book. Thinking in terms of the project cycle may aid in identifying information necessary for various target groups involved in the cycle.

2. **Critique from Prof. Xia Huang,** Dept. of Environmental Science and Engineering, Tsinghua University, China (Please see appendix 8)

China's rapid industrialisation and urbanisation have resulted in water shortages in 300 out of 500 of its cities. Over-extraction of underground water is very common in many Chinese cities, as well as in many other DCs. Accordingly, the reuse of waste water and utilisation of storm water as water resources are very keen concerns in these countries. Since DCs' experience with the latter is particularly unusual, inclusion in the Source Book would be useful. As an example, the practice of collecting and pouring storm water into aquifers (after primary treatment) has been attracting more and more attention as a method to increase groundwater storage.

Centralised sewage systems commonly used in industrialised countries may be appropriate for most countries in the developing world, since they are more cost-effective than decentralised systems for reducing pollutants from urban waste water. However, depending on the different circumstances of varying countries or regions, in some cases both a centralised system and decentralised systems may be necessary. To design the optimal sewage system, we have to answer the following questions: should the system be centralised or decentralised? How large should the service area be for one treatment plant? How many WW treatment plants are necessary? What factors should be considered in the selection and planning of a sewage system?

Important factors for planning a sewage system are:

(i) The level of existing development (especially the existing sewage system) in the region;
(ii) Geographic conditions (land, service area);
(iii) Population density; and
(iv) Available water resources/necessity of waste water reuse.

Inclusion of all these aspects in the Source Book would be very beneficial.

3. **Group Discussion on the Source Book**

(a) Scope

One big question for IETC and the meeting participants was whether the Source Book should deal with waste water and storm water together. Opinions were split equally: some participants were very eager that those topics be handled together, pointing out that water has to be treated in an integrated fashion in urban areas. Participants also pointed out that, in many DCs, the separation of those two systems might often be difficult for financial and/or other practical reasons. In many island states, where the water cycle is relatively short, it would also be beneficial to handle the two together.

But other participants expressed reluctance to deal with the two systems together: as the problems were seen distinct, complicated, and each significant on its own, and it may be too ambitious to tackle them together within a single book. Because of the current severity of water pollution in many DCs and EITs, waste water treatment is often considered much more important than storm water management. In many DCs though—especially where rainfall is high—WW treatment plants do not have the capacity to treat all storm water.

Another question raised in the discussion of the Source Book's scope pertained to why it would only focus on urban areas. Participants noted that waste water treatment is also an issue of concern in non-urban areas, especially in countries with few large cities.

(b) Target groups

Participants agreed that the target groups or users of the Source Book should be clearly defined from the outset, since appropriate information to be covered in the Source Book would differ depending on the target group.

The original intention for this Source Book was to introduce general concepts to **decision-makers in national and local governments and donor agencies**, and guide them to where they could find additional relevant information. However, participants suggested that priority also be placed on **the specialists who advise decision-makers, and that NGOs, CBOs, civil society, and technicians involved in water supply and sewage works** are also important target groups. Another significant point made was that it is important to work on the local level, because it is often the weakest in DCs.

(c) Definition of relevant terms

Participants noted that the frequently used relevant terms might have different meanings for different people, in different contexts; therefore, their definitions should be clearly stated in the Source Book. In particular, an "**integrated approach**" is often referred to, but many questioned whether this indicates integrated management, technological, institutional, financial integration, or other possibilities. "**Environmentally Sound Technology**" is also becoming a more common term, but it, too, needs careful defining.

There is much talk about "**sustainability**", but rarely is the meaning specified in terms of financial sustainability, environmental sustainability, social or political. It would be useful, then, for the concept of sustainability also needs to be outlined in the Source Book.

Similarly, there is a need to identify "**decision-makers**" as the term may refer to national or local bureaucrats, engineers, or financial organisations. The Source Book also deals with primarily with "**urban areas**", and this term may vary greatly depending on the country.

(d) Considerations

Participants recommended that independent chapters and sections should be prepared in the Source Book based on the following considerations:

(i) **Demographic and economic conditions.** Certain conditions require special attention, particularly in the case of slum areas or low-income communities; in these densely populated urban areas, people cannot afford to pay for conventional sewage systems, nor for on-site sanitation. In addition, different settings require different types of water treatment, e.g., the centre of a megalopolis, or the fringes of an urban area.

(ii) **Socio-economic conditions.** Countries or regions should be grouped according to their differing socio-economic conditions, and addressed as such in different chapters in the Source Book. In particular, the socio-economic situations of developing countries are totally unlike those of countries with economies in transition.

(iii) **Climate conditions.** As varying climate conditions have tremendous effect on water resources, issues should be organised according to climate conditions.

(iv) **Geographical conditions.** Issues should also be classified according to geographical conditions, especially whether water is plenty or scarce.

(e) Types of technologies

Due to the severity of water treatment problems in low-income communities, one recommendation placed focus on community-based, low-cost technologies. However, another view was that high-cost technologies—e.g., an underground WWT plant—might sometimes be the best option, even in DCs and EITs.

Participants also noted that the Source Book should not be just a list of sources of information on technologies; appropriate interpretation and insights regarding the application of technologies is perhaps more crucial. Therefore, the Source Book should not only address technical aspects, but also provide information to help decision-makers identify criteria, thereby improving their decision-making capabilities. As the subjectivity of each situation makes it impossible to recommend any technologies as "better" or "worse," it would be useful for the Source Book to offer some basic guiding principles about proper technological implementation. This would aid decision-makers in making effective decisions based on their own situation.

(f) Funding and financial issues

Participants all agreed that funding is the greatest problem impeding project implementation in DCs and EITs; thus the Source Book's inclusion of socio-economic considerations and the financial side of technology utilisation is vital. Different sources of funding—such as international organisations, governments, and consumer service charges—should be discussed, including how countries can obtain financial support for projects from funding agencies.

(g) Waste water and storm water as water resources

Participants recognised that waste water and storm water could be important water resources in areas where water shortage is a major concern. This coincides with IETC's main objectives for this project, namely, the environmentally sound management of water resources to prevent their further degradation, and the improvement of resource capabilities through recovery and reuse.

(h) Centralisation versus decentralisation

Centralised and decentralised sewage systems have respective pros and cons. For example, the centralised sewage system commonly used in developed countries is capital-

intensive, with high maintenance costs. At the same time, it is cost-effective in removing pollutants from urban waste water. Decentralised systems typically require smaller treatment facilities, and thus less capital costs. However, one problem with decentralised systems is maintenance, particularly sludge handling problems. Decision-makers must consider each city's unique circumstances when deciding which system to use, or whether both systems should be used together.

(i) Case studies and regional overviews

Participants recommended that the Source Book contain case studies of historical interest: how and why were particular decisions made, and where did they succeed and fail? Participants noted that there are many similarities between low-income settlements all over the world, so case studies from such environments would be particularly useful. Regional overviews would allow decision-makers to consider applying similar approaches as those already implemented in places with comparable conditions.

(j) Others

Participants emphasised the need to decide to what extent and to what depth the Source Book would cover the issues at hand, since one book cannot completely address such a complex subject. Most agreed that the book should focus on factors that influence and guide decision-makers.

Experts at the meeting proposed numerous important additional points. The difference between the proposed Source Book and similar publications (including works published by WHO, UNDP, the World Bank, and other organisations) needs to be clarified from the outset, to avoid "reinventing the wheel." Moreover, great benefits could be had if these and other relevant organisations are involved in the development of the Source Book.

A common obstacle to construction of WW treatment plants is the Not In My Back Yard ("NIMBY") syndrome, and so it needs to be touched upon.

The Source Book should address legislation issues or policies regarding pollution standards and environmental laws—both national and international conventions, as well as international co-operation statutes.

A flow chart could be an important tool to aid in decisions regarding facility or technology selection, and so should be included in the Source Book. The flow chart needs to be relatively simple if it is to be actually used.

D. SESSION 4—Project Review on the Training Modules

1. Critique from Prof. Vladimir Rojanschi, Senior Researcher, Research Engineering Institute for the Environment, Bucharest (Please see appendix 9)

Prof. Rojanschi started his presentation with a general introduction of Romania and the Danube River system, 60% of the total length of which is located in Romania.

Consequently, a great part of Romania's water supply comes from the Danube, and the fact that numerous other nations utilise this river as a water resource gives Romania an international responsibility to monitor and protect the quality of its water. However, industrial and municipal activities have resulted in significant deterioration, since many Romanian cities have no sewage treatment facilities. Many countries have the same kind of problems, varying in accordance with each country's situation. Therefore, those problems need to be addressed in consideration of the local and regional conditions, the country's economy (whether it is in transition or developing), geographic conditions, size of the localities, etc.

The Source Book should serve as an educational, informational and training tool. Optimally, it would address the following spheres: legislation, institutional administration, financing, economics, international co-operation, social aspects, and the involvement of civil society. Prof. Rojanschi suggested that there be two editions of the book, one for administrative and policy people, and the other for technical and training people.

Training activities should be developed as a network, with the network consisting of global centres, regional centres, and national centres. A Cleaner Technology Centre organised at the national level could function as a national centre for training activities, and could also address other environmental problems (such as solid waste, air quality, and so on). With this sort of network training system, we can cover each country's needs at the regional level, while also addressing issues common throughout a continent (e.g., all of Asia, or Africa) as well as global issues.

2. **"An Integrated Approach to Coping with Urban Water Problems" by Prof. Cedo Maksimovic,** Dept. of Civil Engineering, Environmental and Water Resources Section, Imperial College of Science, Technology and Medicine

Prof. Maksimovic introduced the essential features of urban water systems, drawing on the concepts of mutual interaction and integrated interaction with the urban environment. Analysing the notion of sustainable development of waste water and storm water, he focused on resource recovery and strategic planning for the development of individual subsystems; he also pointed out that the subsystems interact with each other, with groundwater, and with receiving water bodies.

Prof. Maksimovic discussed the interaction of storm water and waste water in both combined and separate sewage systems; he opined that broader application of source control measures are necessary in light of the interaction of storm water with waste water's treatment processes, as well as the harmful effects of peak flows (caused by heavy storms) on habitats in receiving water bodies. Such measures include: water conservation in the water supply system; water reuse in waste water systems; infiltration and resource recovery in storm water systems; and the overall improvement of data reliability for better problem-solving capability.

Addressing the problem of pollution control, Prof. Maksimovic presented some promising solutions for pollution management in both developing and developed countries, under the strategy of integrated urban water management.

The potential of Geographical Information Systems (GISs) for both analysis and presentation of results of complex studies was pointed out, highlighting possible applications

for awareness-raising and multi-sectoral group discussions. Prof. Maksimovic presented several examples of GIS application in urban water studies, including leakage detection and quantification, vulnerability of urban areas to flood damage, suitability of source control application.

3. **Critique from Prof. Goen Ho,** Institute for Environmental Science, Murdoch University, Australia (Please see appendix 10)

According to Prof. Ho, the Training Modules should be based on the Source Book, and refer to it as a primary source of relevant information. Trainees need to gain sufficient knowledge regarding technologies, as well as comprehension of the underlying principles behind the technologies. The underlying basic principles tend to be the same, and so a good understanding of these will enable trainees to assess various technologies, existing technologies, as well as new technologies they might encounter in the future. Therefore, these basic principles are a key component of both the Source Book and Training Modules, and should be particularly emphasised in the training.

The Source Book and Training Modules would be most effective if they covered not only technologies, but also the wide range of other aspects—economic, environmental and social issues, etc.—that affect the decision-making process. The need for good urban planning must also be highlighted. Looking at past mistakes also presents great opportunities for learning.

It is too much to cover both waste water treatment and storm water management in one Source Book and Training Package, in Dr. Ho's opinion. Thus he suggested that the scope of the Source Book and Training Modules should be limited to WW treatment.

Learning objectives—"what we want the target audience to learn"—should be clearly stated in the Training Modules, and trainees should be surveyed throughout the course to make sure that they are learning the intended subjects. It is important to design the Training Modules with a good understanding of the teaching and learning processes.

The number of modules will be determined largely by the materials to be presented and the duration of a training course. Training courses of different duration may require different Training Module packages.

4. **Group Discussion on the Training Modules**

(a) Target groups

Participants all agreed that the target groups for the proposed Training Modules need to be identified from the outset. The following four target groups were recognised:

(i) **Decision-makers** at national and local levels, and donor agencies;
(ii) **Technical experts** who are advisors to decision-makers. They include engineers (water specialists), ecologists, social scientists, and financial specialists;
(iii) **Consultants**, including operational and managerial specialists; and
(iv) The **general public**, including the mass media, NGOs, ecological movements, etc.)

(b) Structure

The main subjects of the Training Modules should serve the goal of "development of national and regional strategies on integrated urban water (WW / SW) management." The Training Modules should consist of a main core of modular materials that cover the basics of WW / SW management, accompanied by several additional, specialised modules appropriate to different target groups. Development strategies and policy compliance must be considered when planning the training tools.

(c) Media

Potential media proposed for the Training Modules and accompanying Source Book were:

(i) hard copies,
(ii) CD-ROM,
(iii) video (possibly in combination with other media),
(iv) computer presentation, and
(v) the Internet.

(d) Others

In this session there was again some discussion on system integration. The first question was whether developing countries could afford integrated systems like those prized in developed countries. Some participants insisted on the necessity of an integrated approach that deals with several problems simultaneously, while others criticised the integrated approach, saying that it was often overemphasised. Still others suggested that the integrated approach might be one option amongst several.

E. SESSION 5—Discussion on ESTs (Environmentally Sound Technologies)

1. "UNEP's Operational Definition of ESTs" by Ms. Lilia Casanova, Deputy Director, UNEP/IETC

Ms. Lilia Casanova, Deputy Director of IETC, presented UNEP's operational definition of ESTs, including 'hard' and 'soft' ESTs. The term "Environmentally Sound Technology" (EST) refers to a technology that has the potential for significantly improving environmental performance, relative to other technologies. IETC's mandate is to promote the adoption and use of ESTs to DCs and EITs. Technology transfer is typically a top-to-bottom approach, from developed countries—who are also developers of the technologies—to the recipients, usually countries in the developing world. However, IETC prefers to take the recipients' perspective, particularly focussing on how DCs and EITs can select, procure, and implement these technologies. For IETC, ESTs include both **"hard"** technologies—e.g., instruments and machines—and **"soft"** technologies—e.g., legislation and institutional mechanisms.

It is extremely important for decision-makers in DCs and EITs to select ESTs over other technologies, as ESTs can help prevent or reduce risk to the lives and welfare of people in their countries. Thus decision-makers need to know how to select the best ESTs for their situations. IETC and its sister organization, IE/PAC(the UNEP Industry and Environment

Centre in Paris), have together developed the Environmental Technology Assessment (EnTA) process to determine whether a technology is environmentally sound or not.

While working with its partners in the UN system and with other international organisations, IETC has had the opportunity to examine technologies not usually considered under the common definition of ESTs. Of special interest are "indigenous" or "endogenous" technologies, used for many generations to successfully deal with some of the same problems we face today. Some people have indicated that **"indigenous"** might be perceived as a pejorative term, perhaps giving some the idea that it is tribal or primitive, so **"endogenous"** may be a better term for these traditional technologies. This term has been used in the Commission on Sustainable Development (CSD) documents, referring to "endogenous" capacities.

After Ms. Casanova's presentation, the floor was opened to discussion about whether it would be appropriate or necessary to include "indigenous" or "endogenous" technologies in the Source Book. After a short discussion, participants agreed that the Source Book should be as comprehensive as possible regarding appropriate technologies, regardless of whether those are from developed countries or developing countries; thus, "indigenous" and "endogenous" technologies should be included.

2. **"New Kinds of Toilets, which have Promising Potential for Sewage and Sanitation Challenges as well as Agriculture Purposes" by Prof. Saburo Matsui,** the Director of the Laboratory for Control of Environmental Micropollutants, Kyoto University, Japan

Hundreds of years ago, Japan employed indigenous technology to prevent the eutrophication of lakes and rivers: this technology was a complete recycling system for nitrogen and phosphorus, which may cause the eutrophication of water bodies. Under this system, farmers came to urban areas to collect the urine and faeces of urban dwellers; they then took the human waste back to rural areas and used them as fertilisers on their agricultural lands. The resulting agricultural products were then taken back to cities for sale, and some were given to people who provided the farmers with the fertiliser. This recycling system—which avoided the problem of eutrophication because human waste was not dumped into water bodies—was disrupted several decades ago by the advent of water toilets in Japan.

Toilets in the world today can be classified into two types, water toilets or dry toilets. In arid areas or other areas where water is scarce, dry toilets are more common. Swedish authorities introduced a "new" approach to dry toilets, which entails separating urine and faeces at the originating point. They tried to introduce this new dry toilet to suburban areas lacking adequate water supplies. Under this system, the separated urine is applied directly to croplands as fertiliser, as human urine is pathogen-free and contains the perfect balance of nitrogen, potassium, and phosphorus that plants require for growth. Separated faeces may also be used for agricultural purposes; however, since human faeces are sometime pathogenic, they have to be treated through composting or other methods before application.

The same idea can be applied to water toilets, and a new kind of water toilet has been developed in Japan, equipped with a special seat that collects urine separately from faeces. Separated urine will be sent to a storage tank, and then used as fertiliser; the faeces are

washed away with water and collected through a sewage pipe, then properly treated for final disposal or utilisation.

3. **"Simplified Sewage Design under Current Brazilian Practices" by Mr. Augusto Sergio Pinto Guimaraes,** Partner, Executive and Financial Director, Gaia Engineering, Rio de Janeiro (Please see appendix 12)

Mr. Guimaraes introduced the "simplified sewage" system—generally known as "shallow sewers"—as a low-cost, endogenous technology. The system is particularly suitable for highly populated areas, and is currently benefiting over 1.5 million people in Brazil, Venezuela, and Nicaragua.

Mr. Guimaraes demonstrated two different versions of the simplified sewage system (in contrast with conventional sewage systems): the "condominium sewage" and "block-crossing sewage" systems. In the condominium sewage system, waste water generated from houses within a so-called "condominium block" is first collected in shallow sewage pipes, typically laid down in the backyards of the plot. This waste water is then discharged into an adjacent street sewer—individual houses are not directly connected to street sewers. This method dramatically reduces the necessary length of pipe connections and pipe excavation depth, resulting in low construction costs. However, people's agreement is required to use this system, since sewers may go beneath neighbours' backyards.

The block-crossing system is an even more radical, but less expensive, technology. In this system, one condominium block is connected by a sewer to another condominium block. Thus the number and length of pipes are further reduced and construction costs are even cheaper than with the condominium system. However, the problem is that waste water from the upstream block passes beneath the downstream block, which may not be acceptable to the people downstream.

For conventional sewage projects in developed countries, there are only two actors involved: the water/sanitation utility people who take care of the projects' financing, designing, construction, operation and billing; and the project beneficiaries, who, involvement notwithstanding, are personally unidentified in almost every case. However, for low-cost sewage projects—such as the simplified sewage systems above—in DCs, another two parties need to be involved in the process. The first is the people from local urban agencies, who are to find the links between sewage works and other urban infrastructure components and ensure that these links are duly considered within the sewage project. The second is the social worker, who will connect the community's aspirations, interests and values with the project. In other words, he or she is the one who communicates with and educates local people, the beneficiaries, about how they may benefit from and use the facilities. It is important to recognise that social discussions and agreement among the local people are crucial to successfully implement low-cost sewage projects. The social worker is also the one who will convince financial agencies to fund the project, thereby making the implementation of projects possible.

4. **"Low-cost Technologies in China" by Prof. Xia Huang,** Dept. of Environmental Science and Engineering, Tsinghua University

In China, only a few cities are equipped with a proper sewage system. Even if there are sewage pipes, most waste water goes directly into water bodies, without any kind of treatment. To improve this situation, centralised WW treatment plants may be a good approach, and one where DCs can follow the successful experience of developed countries. For example, a very large treatment plant utilising the activated sludge process was recently constructed in Beijing; however, the construction and maintenance costs of such conventional activated sludge processing plants are very high. For China's economic situation, we are looking for large-scale but low-cost systems to treat large quantities of waste water.

One possible alternative is the anaerobic biological treatment process, which has been very successfully applied in many cases in China. The anaerobic system does not use much energy, and even has the capability to recover energy. The process works very well at high temperatures, which makes the process very feasible in southern China. Especially in rural areas, China has a long history of using the anaerobic process: for centuries, Chinese families have built anaerobic ponds to collect and ferment their wastes, thereby recovering energy for cooking and other purposes.

Other possibilities are natural purification systems, such as stabilisation ponds and land treatment. Costs for these natural treatment systems are only half or less of conventional treatments, and in many cases the quality of effluents can be compared to that of conventional treatment systems. There is a lot of land in northern China, so land treatment may be a suitable system in that region.

Decentralised systems may allow for smaller treatment facilities. In Japan, a decentralised system named "Gappei-Johkaso" (a household wastewater treatment facility that can treat both grey water and excreta by the aerobic system) is a great success. However, one problem with decentralised systems is maintenance, particularly sludge handling problems. The problem is not so serious in developed countries, where there are very good maintenance systems and other services. But in DCs, the maintenance systems have not been perfected, which might become a serious problem after decentralised systems are constructed.

5. Group Discussion on ESTs

Discussion concentrated on what kind of technologies were most appropriate for local communities, particularly low-income communities, and on how as many alternatives as possible may be provided. This would give individuals a choice, thereby involving them in the planning and implementation process.

Recommended Subjects on ESTs:

(i) Low-cost technologies particularly appropriate for low-income communities, such as wetland treatment;

(ii) Basic principles or techniques to resolve conflicts which may occur in the process of installing low-cost technologies, particularly conflicts among people concerned, or conflicts with existing regulatory measures and policies;

(iii) An emphasis on the need to change common attitudes, stressing the importance of co-operation amongst people within communities;
(iv) The possibility of an incremental approach: first installing low-cost ESTs and then shifting to high-cost ESTs;
(v) Procedures facilitating solutions originating in the community concerned, which cost far less and involve the local community more; and
(vi) A new chapter focusing on urban planning.

As a low-cost technology for low-income communities, a decentralised and small-scale sewage treatment system was recommended. Participants, however, also pointed out that decentralised systems may not function well without proper maintenance for the sludge waste generated from the treatment plants.

F. SESSION 6—Methodologies for Technology Selection

The discussion was led by Dr. Dieterich, and the following are the Conclusions and Recommendations agreed upon by the meeting participants:

1. Definitions of Terms

Participants agreed upon the following definitions for terms relevant to methodology selection:

(i) **'Methodologies'** are tools to assist decision-makers and city (or urban) managers in selecting the most appropriate technologies, and also in integrating the selection process into the city's environmental or development planning and management system. Methodologies are also important to help city managers make their own cost estimates of projects—this skill is key for them to negotiate with contractors and make project proposals.

(ii) **'City (urban) managers'** are definitely not politicians, but instead they may be the highest appointed officials. He or she has a technical background and is in a position to suggest project proposals to and advise decision-makers. However, precise definitions of the city manager (as well as the decision-makers they work with) were left to the people actually writing the Source Book.

(iii) **'Integration'** here in this session means integrating one action, e.g., sewage works or solid waste disposal, into the overall environment management system and general development plan of the city.

2. How to Select Methodologies

Participants realised that there are a lot of methodologies available that have already been documented both within and outside of the UN systems. These include socio-economic analytical tools (cost-benefit analysis, indicators, least cost analysis, and risk analysis), planning and management tools (ZOPP workshop, logical framework, PCM, environmental profiling, and strategic environmental assessments), technology assessment tools (EnTA) and EnRA, and several others that were included in the meeting literature. To present a variety of options of methodologies to decision-makers and city managers, some but not all of them

would be included in the Source Book; including all of them would be impractical, requiring a separate Source Book devoted only to methodologies.

3. Need for a Master Plan

Participants recognised the need for every city to have a master plan, regardless of the scale or level of government or whether the city is wealthy or not. Any decision, including technology selection, has to be made based upon such a master plan (in other words, in an integrated fashion); recent information technology may facilitate city planners' capabilities to create such a master plan. It must be pointed out, however, that without financial resources, any master plans are only theories. Therefore the Source Book should also include possible sources of and means to obtain such financial resources.

4. Recommendations

Participants recommended that the Source Book **include methodologies for determining what should be paid for by governments and what should be paid for by the private sector**. Recognising the importance of people from different sectors involved in public projects making group decisions, it would also be helpful to provide **methodologies for fostering co-operation.**

Documentation of veteran professionals' expertise was also deemed to be of benefit, as was **acknowledgement of the many methodological options available.** Consequently, the Source Book's role is not to point to the right one, but to point out the many pros and cons of the many different options.

G. SESSION 7—Case Studies

1. "A Guideline for the Improvement of the Operation and Maintenance of Sewage Works in Developing Countries" by Prof. Hidetoshi Kitawaki, Faculty of Regional and Development Studies, Toyo University, Japan (Please see appendix 16)

As a part of Japanese Overseas Development Assistance (ODA) projects, the Japanese government has developed a series of books featuring guidelines for sewage works, to transfer Japanese experience in this field to DCs. The first publication was published in 1992 to provide DCs with technical guidelines on sewage works and the second in 1995 for guidelines on master plans. Now under preparation is a new book on guidelines for sewage works operation and maintenance (O&M). The book consists of three parts: general information on O&M; guidelines for O&M; and supplemental information, such as a list of source books.

2. "Observation of Failure Cases Found in Cirebon City, Indonesia" by Prof. Kitawaki (Please see appendix 17)

Cirebon City is located on Indonesia's Java Island. A case study there identified several defects in the sewage works, and these defects are typical of those found in DCs. The first was the failure of a simplified sewage system—even a simplified sewage system may fail, if there is no proper system maintenance and operation. For example, with a condominium system, shallow sewage pipes need frequent maintenance (at least once a

week), to avoid clogging problems. In this case, however, the pipes were on private land and went beneath neighbours' backyards, which were often enclosed by a fence and locked gate. It was difficult to gain access for pipe maintenance, and, as a result, the pipes clogged.

In another case, a pump used to pump waste water up to a stabilisation pond broke because of poor maintenance. As a result, the waste water collected in sewers ended up back in the river. In Cirebon City, sewage system operation and maintenance was entrusted to local people's organisations. However, this arrangement did not work well.

After Prof. Kitawaki's presentations, participants emphasised that local people's understanding and co-operation is crucial to the success of sewage systems in DCs.

3. Presentation on Sewer EX by Mr. Augusto Sergio Pinto Guimaraes (Please see appendix 18)

Mr. Guimaraes presented a computer-aided sewer system design programme named "SewerEX." This software was developed to help engineers design sewage lines and networks, and make construction cost estimates. After a topographic map of the city concerned is input into the computer, this programme digitises it; sewage networks can then be designed on the digitised map on computer screen. It is available in Portuguese, Spanish and English. The package is free of charge and disseminated upon request.

4. Selection Process

This group discussion was led by Mr. Guimaraes to identify some of the best case studies and failure case analyses. Participants recognised that the inclusion of good case studies—selected according to certain criteria—is crucial to the success of the Source Book. Participants recognised that the selection and analyses of specific case studies be made elsewhere in the process of finalising the book; nonetheless, the experts made numerous valuable suggestions for that selection process, as follows.

(i) Case study projects must be a **reality**, not a theoretical construction. As IETC cannot afford to fund any new case studies, they must have been **already implemented**. In addition, the case has to be **well documented**, so that the relevant information can be easily obtained.

(ii) Since any project has both successes and failures, case studies must therefore be **presented objectively**. Naturally, case studies must be **illustrative** of and relevant to **the wide range of concepts** put forward in the Source Book.

The following key words were put forth in the discussion as **potential criteria for case studies:**

affordability, cost-effectiveness, performance, integration, indigenousness, sustainability, innovation, adaptability, technical capacity, administrative capacity, location, local people's capacity, social and environmental effects, economic considerations, availability of feasibility studies, recycle and reuse technologies, maintenance, foolproof solutions, multipurpose solutions, privatisation, a mix of technologies, cultural or demographic situations, and replicability.

5. Description Format

Participants noted that the Source Book must provide readers with information regarding other sources, i.e., **where to access additional relevant information** on the case studies presented. Consequently, the presentation of case studies in the book does not have to be long, but instead **concise and effective**. They also proposed that case studies be presented within each chapter in a box format, enclosing a very brief summary of the important elements of each case study, what makes it relevant to the Source Book, and additional reference information. They recommended also that some case studies be dealt with more detail.

6. Others

The following cities were suggested as possible case studies:

Sao Paulo, Rio de Janeiro and Curitiba in Brazil; Mexico City; Melbourne, Australia; Phoenix, USA; Lima, Peru; Karachi, Pakistan; Lake Nakuru, Kenya; Kobe, Japan; Bangkok, Thailand; some small island states; and cities/communities using the simplified sewage systems presented by Mr. Guimaraes.

Participants recognised that some sort of mechanism would be needed to find and put together case studies with respect to key concepts, principles, or conditions. IETC is looking for partners who are interested in contributing to the presentation of case studies in the Source Book.

H. SESSION 8—Information Systems

1. Presentation on "maESTro" by Ms. Annie Chan Wee, IETC staff

IETC's original software "maESTro" is an information management and exchange tool. IETC developed maESTro to fulfill IETC's mission to promote and disseminate information on ESTs to DCs and EITs, and IETC has been actively promoting maESTro at international conferences over the last 18 months. The system now has 80 registered partners—including government agencies, NGOs, academics, individuals, and so forth—and stores information on about 700 technologies and about 400 institutions involved with ESTs.

MaESTro is different from other databases because it is interactive, with communication facilities as well as data management capabilities. MaESTro databases consist of three different kinds of information: on institutions, on information systems, and on technologies. The system has user-friendly interface with and without the Internet; data is also available as hard copy, CD-ROMs, or floppy disks.

The main features of maESTro are: it is free of charge; it enables information networking; has broad dissemination; is regularly updated (at least weekly, and sometimes daily); and uses DIF (Directory Interchange Format), a common format also used by NASA, World Bank, UNEP, and other organisations. The maESTro system can be used for in-house database management, and is an effective data-sharing tool.

IETC has been collecting and compiling worldwide data via maESTro from its global partners, particularly GEC and ILEC in Japan, and GNET in the US. In addition, negotiations are now underway to register the European Union, the Chinese Environment Agency, and other organisations as maESTro users.

2. **Presentation on "WHO's Sewage Clearing-House" by Ms. Annette Prüss,** Urban Environmental Health, WHO (Please see appendix 19)

Ms. Prüss introduced a proposed project by WHO's Urban Environmental Health Unit, called the "Sewage Clearing-House." The Global Programme of Action (GPA) for the "Protection of the Marine Environment from Land-Based Activities" was adopted to protect the world marine environment at the 1995 Washington Conference. Through the conference declaration, many countries committed themselves to: identifying priority areas; setting objectives on how programmes will be addressed; proposing activities and joint activities; and identifying areas where international co-operation and support are needed, particularly regarding capacity-building in DCs. The GPA calls on member states to improve coastal management, reduce pollution emissions to the sea, and provide support for capacity-building and mobilising resources for countries in need of assistance.

The Clearing-House mechanism is a key implementation tool of the GPA. It will provide information components on the categories of: POPs, heavy metals, radioactive substances, oils, litter, pesticides, etc. WHO was designated as the lead agency for the component on sewage. The Sewage Clearing-House will be developed as a kind of pilot programme or model for the other clearing-houses, which will be carried out by other international organisations.

At present, the Clearing-House mechanism is still in the initial planning stages. The system is envisioned as an Internet referral system for decision-makers at national and regional levels, providing access to current sources of information, documentation of practical experience, and scientific and technical expertise via an Internet homepage format. MaESTro will be an important part of this system. It will also have an active interface with users, featuring a function for user feedback regarding what kind of information is missing, what kind of training programmes they feel are necessary, and what kind of links could be added. On-line discussion panels and Q&A services via e-mail are also planned.

Proposed contents of the Sewage Clearing-House are as follows: policies, measures and strategies for pollution prevention/reduction; characteristics, behaviour and effects of pollutants; standards and reference methods for monitoring; sound and cleaner practices and technologies; contact addresses of experts; links to other relevant Internet pages; and training possibilities.

One problem for implementation of this project is how people can utilise the Sewage Clearing-House system if they do not have any access to the Internet. This may be solved by the development of a paper version of the system, or also by an international network of NGOs that could act as foci to make the system available to local people.

3. Group Discussion

In response to the presentation, participants pointed out the need for a close linkage between sewage treatment and the protection of marine environment, and the need for a conceptual "basin approach"—the integral freshwater resources management of the entire catchment area—to establish such a linkage.

I. SESSION 9—Meeting Conclusions on Contents of the Source Book and Training Modules

1. The Source Book

Participants concluded that this book on waste water treatment and storm water management should be different from the previous Source Book on solid waste management, which focuses on descriptions of available technologies. A lot of descriptions of available technologies on waste water treatment already exist, so this Source Book should not focus so much on the presentation of those technologies. It could instead include planning and management of waste water and storm water treatment, and considerations for optimal decision-making regarding, among other subjects, the scope of planning and the technology selection.

The target audience may not be experts who are familiar with various waste water treatment technologies; hence the book should include some basic descriptions of the technologies and their pros and cons. The descriptions of these technologies might take up about one-fourth of the book. Since there are already so many text materials on the subject, it won't be necessary for IETC to produce original descriptions—IETC may abridge or borrow information already available.

About a half of the whole text should dwell on the basic principles guiding technology selection for planning and management of waste water and storm water. There are conflicting viewpoints regarding what sort of emphasis should be given to this text. But whatever the content, it must specifically focus on the selection of technologies and methodologies. Therefore, the process of decision-making should be referred to in each of the case studies given in the body of the main text.

In addition, it would be desirable for the book to include "fact sheets" on technologies. In these fact sheets, some reference could be made to the selection of this technology in a specific case, explaining what process was gone through in the selection of this technology, and pointing out its pros and cons. These fact sheets would be concise, but would include the relevant issues: space, climate, financial considerations, etc.—and why this technology may or may not turn out to be a good decision 10 or 15 years after implementation.

Lastly, there should be good basic background chapters that stipulate the objectives, structure and scope of this Source Book, and how the reader should use this book. We are not just selecting technologies per se, we are making decisions regarding technologies; these decisions may or may not turn out to be sound, depending on how the decision is made. We would like decision-makers to know the various factors, variables and criteria that have to be

taken into careful consideration, with modifications made over time, within the planning framework.

2. Training Modules

(a) Target Groups

A major consideration for the Training Modules is the target group. Participants felt that decision-makers at national and local levels and from donor agencies would be the foremost target group. Technical experts who advise these decision-makers as well as consultants, and operators and managers of WW / SW facilities would greatly benefit from the training; since these parties have much in common in terms of technical background and level of knowledge, they could form a single target group and be trained together. Participants also noted that such training is important for the general public, including NGOs and public relations groups.

(b) Structure of Modules

Structurally, the modules would consist of a core module, materials that are common to all trainee groups. Additionally, several supplementary modules would be tailor-made or ready-made for each target group. Some kind of an interface mechanism would also be necessary, to connect these two different kind of modules. The subjects of individual sub-modules will correspond to Source Book chapters, and they will, of course, interact with the core module and other sub-modules. Ideally, each training group will have an opportunity to choose sub-modules according to their needs.

One recommendation was for the preparation of a library of documents and other reading materials, slides, presentation materials, etc., from which training course organisers may choose to produce the necessary presentation. Participants agreed that the Training Modules should have a loose structure that can be adjusted in accordance with the needs of target group. The ability to draw on available resources from various other sources—including other UN bodies, etc.—would also be beneficial.

The recommended duration of training courses varied from one or two hours to five or 10 days.

(i) For **decision-makers**, the duration would be **one to two days, or even shorter**—one to two hours. The objective of this briefing module is mainly **basic "informing"**.

(ii) The second target groups are **specialists**, including **technical advisors and consultants**; therefore, they need some hands-on-training regarding subjects such as environmental profiling and municipal master plans. The objectives of this training module include **"informing", "learning", "mastering or understanding", and "application"**. For this course, the trainees may take a final examination for accreditation, or obtain an attendance certificate. The duration would **range from two to ten days**, with the possibility of a self-study course on the Internet or through other media.

(iii) Training modules for **the general public** should be **"informing" in nature**, and possibly **in self-study format**.

(c) Terms of Reference

Participants also reviewed terms of reference for the modules. In addition to the contents of modules, training planners need to refer to the objectives of the training and the methods to be used. As Dr. Ho suggested earlier, identifying the lessons to be learned during the training is an important step, as is an explanation to participants as to why the subject is important.

Educational resources for the training would include a brief outline of the corresponding Source Book chapter and supporting materials, including graphics, pictures, video clips, animations, and cartoons—the effectiveness of humour was unanimously affirmed. Regional and / or local examples of technological or methodological success and failures would be extremely helpful illustrations of the principles being described, especially if they are accompanied by pre- and post-project evaluations. Lastly, summaries and checklists would also be useful reference materials for the training.

It was assumed that trainees will have the Source Book; materials provided in the training thus will be different from those in the Source Book, perhaps more detailed studies.

(d) Others

Participants suggested changing the name of the "Training Modules" to "**Informatic Support Tools**", since they will not be used simply for training purposes, but also used for raising public awareness on water environment issues. Another name, particularly for decision-makers and other people who typically hate to be "trained," is "Briefing Tool."

In the small workshop addressing the training modules, participants suggested possible subjects / titles for modules, which most simply could correspond exactly to the titles of chapters in the Source Book. Other proposed titles were in accordance with fundamental subjects—definitions, basic tendencies or concepts, possible scenarios, or ecological and health concerns. Other training modules could be named for the problem-solving procedures they introduce, such as environmental and intra-structural profiles, analytical tools, technologies available (advanced and appropriate), selection and evaluation criteria, and methods of presentation.

Throughout the meeting, numerous participants pointed to the importance of the socio-economic, institutional, financial, and participation aspects of decision-making, and these are good candidates for training module subjects. Another key concern were the specific problems of low-income communities, which is another prime module subject. Lastly, one training module could provide a general overview of WW / SW management and decision—making issues. Participants also suggested that Training Modules include the subject of toxic runoff from storm water in urban areas.

J. SESSION 10—Summary and Conclusion

Mr. Whitelaw expressed his appreciation to all participants for their co-operation in helping IETC more clearly define the proposed project's goals, and how IETC could achieve these goals. He declared his satisfaction at the interesting discussions and success of the meeting.

Waste water treatment is an ancient practice, Mr. Whitelaw noted; for example, as Dr. Huang pointed out, Chinese sewage systems existed 2000 years ago. He noted that the best practice utilises what already exists and builds upon that, rather than reinventing the wheel or just regurgitating what has been done before. IETC and UNEP are not competing with the many organisations already successfully creating and delivering information products in this field; IETC is looking at using what already exists and finding partners to co-operate for mutually-beneficial results. WHO and the World Bank and other multilateral banks were some of the organisations suggested for important collaboration.

Participants in this meeting have become friends of IETC, Mr. Whitelaw said, adding that he hoped all could take advantage of the relationship in a mutually advantageous fashion. He also promised that the participants would be hearing from IETC, especially those who had offered information on case studies. Obviously there would be a gap between the guidance the participants had given IETC and what would come from it, he admitted; IETC would need some introspection.

Mr. Whitelaw concluded his remarks with special thanks to the IETC, GEC and ILEC staff members for working so hard to prepare the meeting, and voiced his personal appreciation to meeting chairperson Ms. Casanova, for leading the meeting so very successfully.

III. APPENDICES

1. Meeting Programme
2. List of Participants
3. Project Overview
4. Proposed Outline of the Source Book
5. Proposed Outline of Training Modules
6. A Brief Summary of Pre-Meeting Survey Questionnaire
7. Comments on the Proposed Source Book by Dr. Bernd H. Dieterich
8. Comments for Discussion by Prof. Xia Huang
9. Commentaries about the Project by Prof. Vladimir Rojanschi
10. Training Modules as an Output of IETC Project by Prof. Goen Ho
11. "Localized Treatment and Reuse of Wastewater: Science, Technology and Management" by Prof. Goen Ho
12. "Design of Simplified Sewerage under Brazilian Current Practices" by Mr. Augusto Sergio Pinto Guimaraes
13 Algorithm for Preparing a Funding Proposal (Source: JICA "Preparation of Development Plans for Environmental Sanitation in Developing Countries")
14. Costs of Conventional, Shallow Sewerage and On-site Sanitation in Natal, Northeast Brazil (Source: Duncan Mara, "Low-Cost Urban Sanitation")
15. Sanitation Technology Selection Algorithm (Source: Duncan Mara, "Low-Cost Urban Sanitation")
16. A Guideline for the Improvement of the Operation and Maintenance of Sewage Works in Developing Countries by Prof. Hidetoshi Kitawaki
17. "Observation of Failure Cases Found in Cirebon City, Indonesia" by Prof. Hidetoshi Kitawaki
18. Low-cost Sewerage Flowchart by Mr. Augusto Sergio Pinto Guimaraes
19. Report of the Technical Meeting on the Globl Programme of Action for the Protection of the Marine Environment from Land-based Activities Clearing-house
20. Draft Outline of the Source Book by Dr. Masahisa Nakamura

APPENDIX 1

Programme: Experts Meeting on Sustainable Management of Waste Water and Storm Water 6-8 May 1998 at IETC Osaka

Session	Time	Topic	Facilitator
Day 1, Wednesday, 6 May 1998			
	9:00	♦ Participants are kindly requested to arrive at IETC by this time	
Session 1 Opening	9:30-10:40	♦ Welcome address and IETC overview by Mr. John Whitelaw, IETC Director ♦ Participants introduction ♦ Introduction of IETC project proposal	L. Casanova
	10:40-11:00	Coffee Break	
Session 2 Project Survey	11:00-12:00	♦ Summary of survey questionnaire ♦ Discussion - current status on information and training needs in developing countries and transition-economy countries ♦ Two experts' critique on the proposed international source book	H. Shiroi
	12:00-13:10	Lunch	
Session 3 Project Review - I	13:10-14:40	♦ Critical review - structure of international source book	J. Whitelaw
	14:40-15:00	Coffee Break	
Session 4 Project Review - II	15:00-17:00	♦ Two experts' critique on the proposed training modules ♦ Critical review - structure of training modules	C. Maksimovic
	17:00-18:30	Welcome reception at the venue, hosted by GEC	
Day 2, Thursday, 7 May 1998			
Session 5 Discussion on ESTs	9:30-10:30	♦ Wrap-up session of the previous day ♦ Discussion - Identification of ESTs, endogenous technologies, where are they?; sound management practices (SMPs), social conditions, economics, project financing	L. Casanova
	10:30-10:50	Coffee Break	

Session 5	10:50-12:00	♦ Discussion - continued ♦ A brief presentation by Mr. Guimaraes on the use of SewerEx, a Windows-based program for designing and costing sewers using the Brazilian sewerage code which incorporate low-cost assumptions	L. Casanova
	12:00-13:10	Lunch	
Session 6 Technology selection	13:10-14:40	♦ Discussion - Methodologies to assist city managers in selecting technologies and integrating them into a system	Bernd Dieterich
	14:40-15:00	Coffee Break	
Session 7 Case studies	15:00-17:00	♦ Discussion - Identification of best case studies and failure case analyses	Augusto Guimaraes
Day 3, Friday, 8 May 1998			
Session 8 Information and sewage clearing-house	9:30-10:30	♦ Wrap-up session of the previous day ♦ A brief presentation by Prof. Kitawaki on the on-going production of operation & maintenance manual for DCs ♦ Demonstration of IETC's maESTro ♦ Introduction - creation of sewage clearinghouse under Global Programme of Action (GPA)	Annette Pruess
	10:30-10:50	Coffee Break	
Session 8	10:50-11:30	♦ Discussion on the implementation of sewage clearing-house	Annette Pruess
Session 9 Small workshops	11:30-12:00	♦ Participants are divided into two groups to prepare outlines for the international source book and training modules	L. Casanova
	12:00-13:10	Lunch	
Session 9	13:10-15:00	♦ Small Workshops - continued ♦ Presentations on the proposed outlines by the groups	L. Casanova
	15:00-15:30	Coffee Break	
Session 10 Conclusion	15:30-16:00	♦ Summary and conclusion	J. Whitelaw
	17:30-19:00	Farewell dinner at Heihachitei (Japanese style cuisine) near Hotel New Otani	

APPENDIX 2

List of Participants
International Experts Meeting on Sustainable Management of
Waste Water and Storm Water
6-8 May 1998

	Name	Title/Position	Organization
Invited experts			
1	Prof. Cedo Maksimovic	Department of Civil Engineering, Environmental and Water Resources Section	Imperial College of Science, Technology and Medicine, London, UK
2	Dr. Bernd.H. Dieterich	Environment Consultant	Divonne-les-Bains, France
3	Prof. Hidetoshi Kitawaki (8 May only)	Faculty of Regional and Development Studies	Toyo University, Gunma, Japan
4	Professor Goen Ho	Director, Institute for Environmental Science	Murdoch University, Murdoch, Australia
5	Mr. Augusto Sérgio Pinto Guimarães	Partner, Executive and Financial Director	Gaia Engenharia Ambiental, Rio de Janeiro, Brazil
6	Prof. Saburo Matsui	Director, Laboratory for Control of Environmental Micropollutants	Kyoto University, Kyoto, Japan
7	Prof. Dr. Vladimir Rojanschi	Senior Researcher	Research Engineering Institute for Environment Bucharest, Romania
8	Prof. Xia Huang	Professor, Dept. of Environmental Science and Engineering	Tsinghua University, Beijing, China
9	Dr. Masahisa Nakamura	Director	Lake Biwa Research Institute, Shiga, Japan
10	Mr. Ivica Trumbic	Director	PAP/RAC, UNEP Mediterranean Action Plan (MAP), Split, Croatia
11	Dr. Antonio Fernandez	Coordinator, Training Promotion Office	UNCRD, Nagoya, Japan
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13	Ms. Annette Prüss	Technical Officer	WHO Urban Environmental Health, Geneva, Switzerland
14	Dr. Muzaffar Malik	Short Term Professional	WHO Centre for Health Development, Kobe, Japan
15	Mr. Kaoru Sasabe	Head, Wastewater System Division	Public Works Research Institute, Ministry of Construction, Tsukuba, Japan
16	Mr. William P. Pfrang	Vice President	Metcalf & Eddy, Inc., Manila, Philippines
17	Mr. Disa Weerapana	Deputy Director	UNCHS (Habitat) Fukuoka Office, Fukuoka, Japan
18	Dr. Shinji Ide (Rapporteur)	School of Environmental Science	The University of Shiga Prefecture, Shiga, Japan
19	Dr. Lilia Robles Austriaco	Manager, Information Resources Centers	Asian Institute of Technology (AIT), Pathumthani, Thailand
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21	Mr. Satoshi Yamamoto (6 & 8 May only)	Staff Officer, Planning Dept.	Osaka City Sewage Works Bureau
22	Dr. Osamu Yamamoto (6 & 7 May only)	Senior Researcher	Osaka City IES
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28	Mr. Satoru Matsumoto	Cooperation Staff	IETC/ILEC
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32	Ms. Midori Hatta	Secretary	IETC
33	Ms. Ryoko Sakuma	Secretary	IETC
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41	Shizuka Hayashi	Coordination Dept.	GEC
42	Haruka Takeno	General Affairs Dept.	GEC
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44	Ms. Sakaguchi (7 May)		ILEC
45	Mr. Ikeda (8 May)		ILEC

APPENDIX 3

PROJECT OVERVIEW

Project Title: PROMOTING SUSTAINABLE MANAGEMENT OF WASTE WATER AND STORM WATER IN URBAN AREAS

Project Implementation: UNEP / International Environmental Technology Centre (IETC)

Project Team: John Whitelaw (Director), Lilia Casanova (Deputy Director), Hiroshi Shiroi (until April 1998), Satoru Matsumoto (since April 1998), Makoto Fujita (since April 1998)

Duration of the Project: 24 months
Commencing: January 1998
Completion: December 1999

Project Budget US$???

Potential Collaborators

UNEP internal / Water Branch, Regional Seas Programme, GPA, Human Health and Well-Being, Industry and Environment, 6 Regional Offices

Partnership to be sought to / Global Environment Centre Foundation (GEC), International Lake Environment Committee (ILEC), WHO, UNCHS, UNDP, World Bank, UNCRD, UNU, UNITAR, International Association on Water Quality (IAWQ), International Water and Sanitation Centre (IRC), World Resources Institute (WRI), Water Environment Federation (WEF), Japanese Ministry of Construction, JICA, JSWA (Japan Sewage Works Agency), Infrastructure Development Institute of Japan (IDI) and other institutions and individual experts

Objectives

(a) Improve management and availability of water resource;

(b) Avoid further degradation of water bodies and the marine environment; and

(c) Improve knowledge and skills base in administrators and decision makers in developing countries and countries in transition to enable (a) and (b).

Results

(a) Improved capacity of the administrators and responsible municipal decision-makers for implementing waste water/storm water programmes;

(b) Strengthened capability of those officials to select, adopt, integrate and apply/manage technologies related to sewage system in implementing urban sewage programmes; and

(c) Better integration of water supply and management of waste water.

Outputs:

(a) Improved knowledge base reflected in IETC EST Information Systems and, for example, an International Source Book on Environmentally Sound Technologies for Urban Waste Water and Storm Water Management, and a publication containing: i) selected in-depth case studies from both developed and developing countries, of innovative and cost-effective technologies for environmentally sound urban waste water and drainage system; and ii) sound practices, including indigenous technology options, which can be applied by developing countries;

(b) Training modules for use by organizations conducting training courses in the respective field of waste water and storm water management or by organizations implementing investment programs in waste water projects;

(c) Information fliers, in a few languages translated, prepared to enhance awareness of local government officials on urban waste water and storm water issues, available information sources and appropriate technologies to address these urgent problems; and

(d) A pilot training course to examine the effectiveness of the training module.

Activities:

(a) Problem identification, in-house consultations, consultation with potential contributors/collaborating institutions and discussions with experts;

(b) Convene Experts Meeting(s);

(c) Selecting information sources in 6 world regions;

(d) Incorporate information into EST information system;

(e) Regional overviews on practices in the 6 regions;

(f) Selecting information on cost-effective technology options in urban waste/storm water programmes from existing databases;

(g) Identifying sound practices in selected locations, partly with attention to "endogenous technologies," and analyzing several cases of "sound practices";

(h) Preparation of publications and training modules;

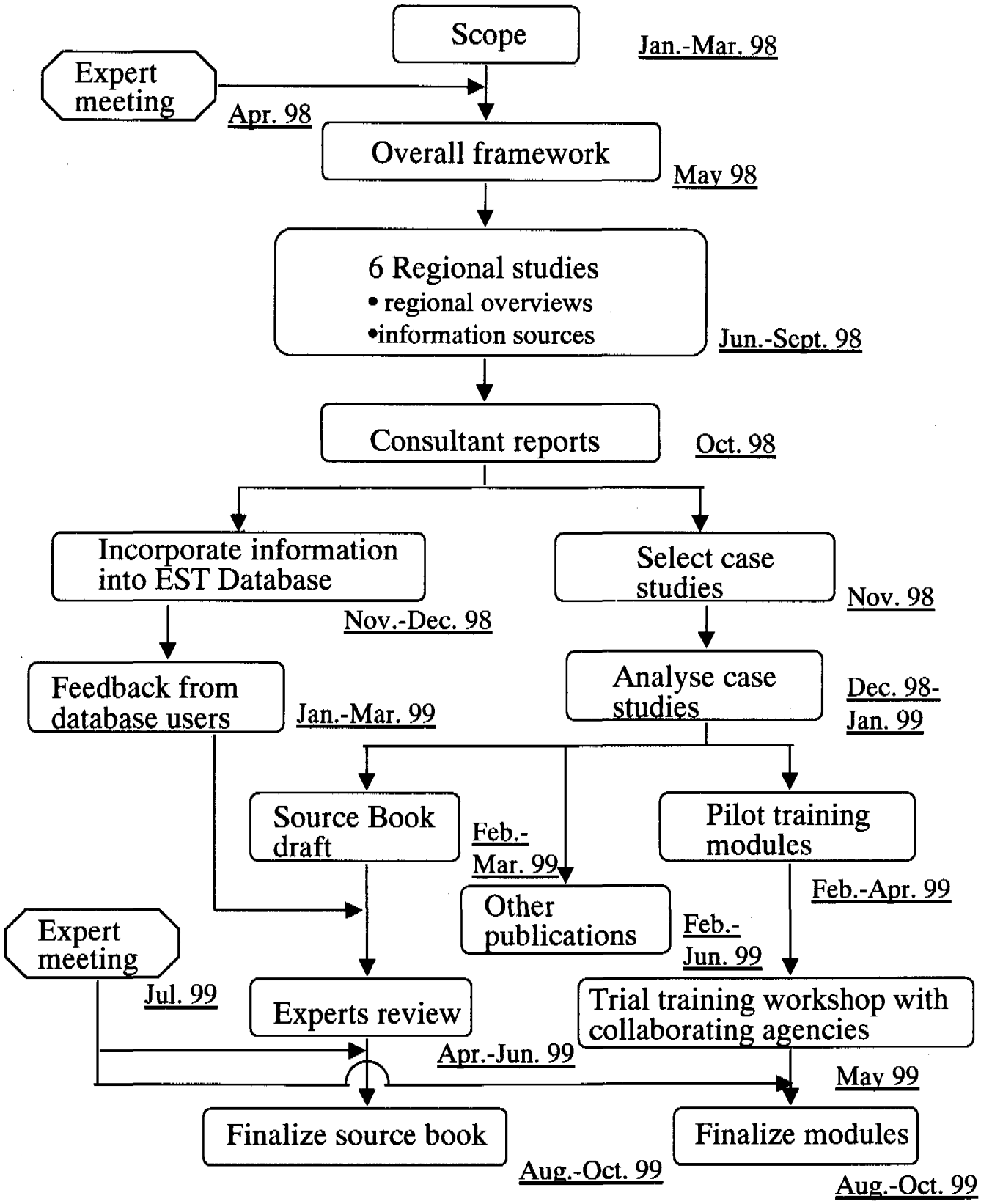
(i) Conducting peer-reviews by experts in the field;

(j) Finalizing all outputs and evaluation report and follow-up actions.

Project Workplan

As per attached flowchart.

Project Implementation Workplan



APPENDIX 4

Proposed Outline*[1] of "International Source Book on Environmentally Sound Technologies for Urban Waste Water and Storm Water Management"

Basic concept of the book

- To become a general reference guide
- Target readers - decision-makers, policy-makers, municipal managers, NGOs and community-based organizations in developing countries and transition-economy countries as well as donor agencies and international organizations
- Easily understandable text with drawings and structured format
- Suggest guidelines in implementing waste water and storm water projects
- Will be disseminated via hard copy and internet

Draft Table of Contents for the International Source Book on ESTs for Urban Waste Water and Storm Water Management

Chapter 1 Introduction
- 1-1 Background
- 1-2 Purpose, structure and scope of the book
- 1-3 How to use this book

Chapter 2 Toward a Framework for Urban Waste Water and Storm Water Management
- 2-1 Basic urban sanitation needs - public health requirements
- 2-2 Environmental degradation caused by human-related activities
- 2-3 Urban drainage requirements
- 2-4 Integrated waste water and storm water management
  - concept of waste water and storm water as part of water management issue
  - waste water and storm water as a water resource
- 2-5 Other basic items to be considered
  - combined or separate system
  - on-site or off-site treatment facilities

Chapter 3 Sound technical / management practices
- 3-1 Drainage and collection
- 3-2 Run-off management
  - drainage control against flooding
  - runoff pollution control
- 3-3 Waste water treatment
- 3-4 Sludge handling and disposal
- 3-5 Water reuse
- 3-6 Institutional arrangements and financing
  - regulatory framework
  - construction and maintenance
  - cost recovery framework
  - privatization and public-private partnership
- 3-7 Social and cultural considerations

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*[1] Tentative and to be modified taking into account views expressed through responses to Questionnaire and the Expert Meeting

Chapter 4 Technology selection, application methodologies and future upgrading
- 4-1 Key engineering considerations
  - nature of waste water in the developing world
  - nature of storm water in geographic locations
- 4-2 Environmentally sound criteria
  - what to consider?
  - how to evaluate?
- 4-3 Examples of concrete methodologies to initiate / rehabilitate waste water and storm water management programmes
- 4-4 Selected case studies

Chapter 5 Regional overviews of the current practices
- 5-1 Africa
- 5-2 Asia and the Pacific
- 5-3 Europe and CIS countries
- 5-4 Latin America and the Caribbean
- 5-5 North America
- 5-6 West Asia

Chapter 6 List of information sources located in each region

Book style:
A4, perfect binding, about 500 pages, as part of IETC Technical Publication Series

APPENDIX 5

Proposed Outline*[1] of Training Modules as an output of IETC project "Promotion of sustainable waste water and storm water management"

A training tool featuring

- modular fashion
- interactive
- accessible in hard copy and internet
- flexible in content and collection

Targets, directed toward

- Target users - international organizations, donor agencies, universities and other training course organizers
- Target trainees - in addition to the users, municipal managers, NGOs and community-based organizations in developing countries and transition-economy countries

Other features

- Each module contains detailed instructions as well as all the materials needed to conduct the workshop.
- Sample exercises which will facilitate learning and creating opinions and feedbacks from the participants.
- A hard copy will consist of 7 volumes (modules) in spiral-binding, loose-leaf format.

The whole training package will consist of following seven modules:

Module 1	The Purpose and Science of Sustainable Waste Water and Storm Water Management in Urban Areas
Module 2	Framework for Integrated Management of Urban Waste Water and Storm Water
Module 3	Understanding Environmentally Sound Technologies for Urban Waste Water and Storm Water Management
Module 4	Selection, Application and Operation of ESTs for Urban Waste Water and Storm Water Management
Module 5	Institutional Arrangements, Financing and Socio-Economic considerations
Module 6	Sound Management Practices - Case Studies
Module 7	Sample Exercises

*[1] Tentative and to be modified taking into account views expressed through responses to Questionnaire and the Expert Meeting

APPENDIX 6

A Brief Summary of Pre-Meeting Survey Questionnaire
International Experts Meeting on Sustainable Management of Waste Water and Storm Water
6-8 May 1998

17 responses have been returned to IETC as of 2 May. This brief summary reports an overview of experts' responses as well as to some critical comments.

Background questions

1. What are your most specialized areas within following categories? (multiple choice)

   1. Wastewater technologies in general 2. Wastewater management/administration
   3. Stormwater/runoff technologies 4. Stormwater/runoff management/administration
   5. Marine pollution control, lakes, rivers, estuary & coastal
   6. Water sanitation, hygiene and public health 7. Water supply
   8. Sewerage equipment & systems 9. Wastewater treatment
   10. Sewage sludge treatment & disposal 11. Wastewater recycle/reuse
   12. Ecology 13. Environmental Impact Assessment 14. Project management in general
   15. Capacity building/training 16. Information technology 17.Economics/Financing
   18. Others (please specify)

   a1: 12 **a2:** 7 **a3:** 4 **a4:** 5 **a5:** 5 **a6:** 6 **a7:** 4 **a8:** 5 **a9:** 10 **a10:** 6 **a11:** 7 **a12:** 2 **a13:** 4 **a14:** 7 **a15:** 8 **a16:** 2 **a18:** 3

2. Regarding practices on wastewater and stormwater (hereinafter referred to as ww/sw) management, which part of the world or countries are you most familiar with?

   1. Global 2. Africa 3. Asia & the Pacific 4. Europe & CIS 5. Latin America
   6. North Amarica 7. West Asia 8. Country specific

   a1: 5 **a2:** 2 **a3:** 9 **a4:** 3 **a5:** 2 **a6:** 1 **a7:** 0 **a8:** 8

General questions

3. In the developing world (developing countries, hereinafter referred to as DCs, and countries with economies in transition, hereinafter referred to as EITs), based on your knowledge and experiences, what are the major problems with respect to human health and the environment that are caused by ww/sw?

Q3 (prevalent or some critical comments only)	
Problems with respect to human health aspect	Problems with respect to environmental aspect
- Drinking water sources, water supply systems - Transmission of water-borne human pathogens through lack of sanitation and inadequate treatment of wastewater/improper disposal.	- Low awareness of local potentials - Inadequate priority - Organic pollution, eutrophication

4. To what extent should municipal managers in the developing world know about technology options when plan and implement ww/sw programmes? Please explain.

Q4 (prevalent or some critical comments only)
The answers were divided into three groups, namely: - have to be fully aware of a variety of technical options - have to know the basic principles, but not for advanced technologies - do not necessarily know technicalities, but should know societal implications
They should have enough knowledge of protection of receiving public water in terms of ecosystems as well as water supply resources.
They have to be aware of modern technologies. However somebody has to provide them the "key messages" in the human reachable to and at the appropriate level.
They must be well informed especially as regards (1) the effects of different technologies on the above-mentioned health and environmental aspects, (2) costs, (3) institutional requirements and (4) their "sustainability implications", e.g. O+M, cost recovery, roles of people and the private and public sectors.
Adequate knowledge of the options is essential. Blindly adopting technologies from other society may not be appropriate.
Technology options are probably too western-oriented. More appropriate designs must be make known. Cost implications and cost recovery should be discussed.
They should have the knowledge of fundamental technologies in wastewater treatment and stormwater management.
They should know endemic technologies in detail and the other roughly.
Not too advanced ones! State of the art technologies in developed countries rely on the infrastructure of their countries, thus may not directly applicable to developing countries.
I do not think it necessary for them to know about technical aspect of ww/sw. However, I think they had better know the social effects of ww/sw problems and solving processes in general.
Municipal managers need to be informed about principles underlying available technologies; all available technologies including small scale systems; low cost technologies (based on sound principles).
The "California Syndrome" affects a myriad of professionals and decision makers of public ww/ws utilities from DCs and EITs, thus making them prone to design ww/sw systems that are not appropriated to their low-income areas but to the First World. In turn, a common people complain regard their 'conviction" to a not-wanted system (e.g., latrines for users who want a more sophisticated system).
They should know the basic principle, advantages and adaptation range.
As much as possible. To what extent they should know may not be so much of an issue as long as the whole of the institution takes care of it.
- Differentiate among sources of pollution: Point or Non-point - Understand health, environmental, economic consequences of pollution - Understanding the systems they're managing in technical, financial and organisational sense.
They should be fully aware of the technical options so that they can make appropriate choices with regard to sustainability, particularly maintenance implications if the technologies are imported.
Necessary technology background is really limited. They should know basic ww/sw technology. Because one of their important assignment is just decision-making for policy of ww/ws.
Municipal manager should be well informed on the technology options, including advantages/disadvantages, consequences, social impact and other factors.

5. What do you think are the major obstacles to implement ww/sw programmes in the developing world? (multiple choice)

1. lack of access to information 2. lack of relevant information being made publicly available
3. lack of socio-economic fundamentals 4. lack of properly trained personnel
5. lack of funds 6. ill-defined institutional structure or institutional arrangements
7. Others (please specify)

a1: 8 **a2:** 8 **a3:** 13 **a4:** 14 **a5:** 14 **a6:** 10 **a7:** 2

6. Do you agree or disagree with following remarks?
(Scale: 5-fully agree, 4-partly agree, 3-can't make judgment, 2-partly disagree, 1-fully disagree) You may wish to describe the reason in each box.

A. Centralized sewerage system in industrialized countries are appropriate for most countries in the developing world.
a5: 1, a4: 2, a3: 2, a2: 8, a1: 2, others: 2

B. Considering the future development of DCs and EITs, centralized sewerage system should be included in their master planning, even if not implemented in short term.
a5: 5, a4: 4, a3: 0, a2: 4, a1: 1, others: 3

C. Wastewater and non-hazardous solid waste should be managed jointly.
a5: 0, a4: 6, a3: 3, a2: 3, a1: 4, others: 2

D. In principle, municipal sewerage should not receive industrial wastewater.
a5: 2.5, a4: 2.5, a3: 3, a2: 3, a1: 4, others: 2

E. Wastewater reuse technologies cannot be fully applied in the developing world at this time.
a5: 1, a4: 2, a3: 1, a2: 3, a1: 8, others: 2

F. Decision-makers in the developing world do not need to understand technologies when ww/ws projects are implemented by contractors from industrialized countries.
a5: 0, a4: 1, a3: 0, a2: 1, a1: 13, others: 2

Q6					
A	B	C	D	E	F
5	5	1	3	1	1
2 "Centralized sewerage system" is not clear. Needs better definition.	Technically centralized- No Management + Development- Yes	4 Yes	4	1 but appropriate technology have to be applied.	1
2 However, there are lessons to be learnt from industrial countries about central areas of cities in DCs.	4 Master plans, whenever needed, should apportion off-site and on-site systems in a phased manner. The limitations of central systems should be discussed.	2 Can be judged on local conditions only.	2 Ditto.	1	1
2 Not necessary	4	1 Totally separate	2 impossible to keep separate	1 If just take more effort	1
2 Cost recovery must be explored (ability to pay)	2 Many railways lead us to believe too costly master planning may not be worth it.	3 I'm fore different institutions in charge but each city/town may differ.	3 This depends on a lot of things.	2 Given proper conditions and preparation, it should be possible.	1 There should be good managers to know what they are moving into.
2	1	4	5	4	1
3	5	4	2	2	1
3 depending on the areas in question for big cities, Yes, but No for rural areas.	4 Yes, particularly for big cities.	4 Yes for integrated management of both.	5 – 4 Yes, to prevent from entering of any hazardous chemicals.	4 mostly too expensive for developing countries.	2 They do not need to understand technologies in detail, but need to know at least the concepts.
I think these questions are hard to answer, since the selection of an appropriate countermeasure generally depends on various conditions.					
1 Large centralised systems are even considered not appropriate in industry countries.	2 It is difficult to see how we can justify backsewering existing cities for centralised treatment.	3 They should be integrated but handles separately.	5 Yes, to facilitate water reuse.	1 There are available technologies for DC.	1 Sound decision making should be based on full understanding/advice.

2 Brazil has been highly successful in developing and building low-cost, waterborne sewerage systems (the so-called condominium sewerage) even for the poor of urban cities, provided they have access to potable water.	2 I'd say "could be" instead.	2 I'd say "could be" instead.	1 Organic sewage from, for instance, food-processing industries and even inorganic effluents from selected industries may be treated in wastewater treatment plants provided these plants are duly designed.	1	1
4 Yes, but the capacity issue is relative to many other factors.	5 I don't know. It can be included, but may not be the crucial issue though.	2 No, but why this question?	1 Depends on the nature of industrial wastewater.	2 Cannot or should not? Depends very much on specific situation.	1 Are there such cases? When you have decision makers they make decisions on technologies to be adopted whether they make correct decisions is debatable.
2 Central treatment facilities' choice depend on local conditions.	2 No, even in industrialized countries there are doubts on the choice of treatment facilities.	4	1 Industrial waste waters, biologically degradable in principle are cleaned together with urban ww.	1 Appropriate technology could be used.	1 Decision makers should be familiar with the technology in order to know if the appropriate technology being used.
1 depends on how "centralized" is defined.	5	1	3	1	1
4 Appropriate for metropolis like the capital, resort cities and so on.	5	3	1	3 It depends on water resources shortage.	4 They don't need to perfectly know technologies.
2 Many developing countries cannot afford centralized sewage system	4 Master plans must indicate short and long term schemes to provide framework for development.	4	4 Treated industrial wastewater at acceptable level can be received.	5 Wastewater reuse at this stage needs necessary safeguard for health and environmental effects.	1 Decision Makers must be well informed on what the technology can do, cannot do and its impact (short and long term) on the local people and the environment.

Questions 7-17 relate to proposed publication "International Source Book on ESTs for Urban Wastewater and Stormwater Management' (please see the outlines as per attached).

7. Are you aware of a similar publication to this book?

   Yes: 4, No: 11, Others: 2

8. What are the title and the publisher (author) of the book?

   - Developing world water / Grosvenor Press
   - No "International". However, there are books available are in some countries which may or may not be applicable to DCs and EITs.
   - WHO (Geneva). Operation and Maintenance of Urban Water Supply and Sanitation Systems, A Guide for Managers 1994
   - Environmental Engineering Manual / Water pollution Control (in Chinese) published by Higher Education Publishing House, China, 1993
   - Municipal Sewage Sludge Management published by ENSIC.

9. Is there a need for a further publication?

   Yes: 5, No: 2

10. How do you think our publication can be differentiated from the book you identified? (multiple choice)
    1. Updated information 2. Globally collected data 3. Regional overviews 4. List of Information sources worldwide 5. Unique technology selection procedure 6. Others (please specify)

    a1: 4, a2: 3, a3: 3, a4: 3, a5: 4, a6: 2

    Other comments: "Depends on who the potential users are and their needs. Should not make one-for-all type publication."

11. Are there any missing subject which should be included in the proposed source book? (please see the attached, again) If so, please specify.

Q11
How to specially cover the semi and urban areas when water is short for water toilet? Water shortage urban area?
Yes, 1. Appropriate technologies, 2. Appropriate training, 3. Means & Ways
Chapter 2: Relationship to the general and urban infrastructure development process, Chapter 3: Looks like a catch-all. Let's discuss, Chapter 4: Should also consider the explicit criteria regarding health, environment, institutional and community capacity, and O+M.
Must include small-scale low technology options.
More on (1) Social aspects, (2) Cost Implications.
Nothing.
Health aspects of ww/sw management.
Toxicity control by ww.
The information is too limited for me to select Y or N.
1) The fundamentals of wastewater treatment/reuse/disposal should be emphasized, because these will undergird correct understanding that will influence choice of technology. 2) Principles of water conservation should be covered (including water auditing)
- If not yet considered, successful case studies with the recommended technologies, fully illustrated and duly supported by technical calculations, community assessment, associated costs and financial feasibility, etc. - Availability of multi-media tools for its user.

1) In Chapter 2, water resource shortage problem should be also stressed. 2) Centralized Sewerage System or Decentralized Sewerage System should be discussed in Chapter 2. It is necessary to discuss how to decide the centralized degree of sewerage system corresponding to geographic condition, population density and available water resource. 3) Storm water utilization as water resource should be included in Chapter 3. 4) In 4-1 of Chapter 4, following items should be also included: Nature of water body receiving treated wastewater, Available water resource.
- Method for assessment of simmilative capacity of the recipient and relevant level of treatment. - Effluent standards depending on the size of urban area and recipients "sensitivity", definition of levels. - Development of urban water plans. - Tools and techniques for urban water planning
Health aspects of urban ww may be described.
Policy making: ww/sw technologies are just tools. Most important thing is how to decide national and local policies.

12. Are you aware of any publication(s) which delineate methodology to select and apply sound technologies and to integrate them?

    Yes: 8, **No:** 8

    (please specify the title and the author)

    - But most discuss philosophy rather than methodology. Let's discuss.
    - There were some published in the 1970s but still not too well designed such as World Bank publications.
    - World Bank "Low Cost Sanitation", "Drainage Guidelines (Technical Paper No.195)"
    -
        1. The book by Sandy Cairncross (London School of Tropical Hygiene) on low-cost drainage;
        2. The low-cost sewerage design manual written by Augusto Sergio Pinto Guimaraes in mid 80's with UNDP/WB funds;
        3. The Prof. Duncan Mara's Book "Low-Cost Urban Sanitation"
        4. Ditto, "Low-Cost" Sewerage;
        5. The WB/UNDP publication "Simplified Sewerage: Design Guidelines"
        6. The World Bank's publication "CHEAP SEWERS GOOD?" by Ms. Gabrielle Watson;
        7. The HABITAT(UNCHS) low-cost sewerage manual;
        8. The series on low-cost sanitation published by The World Bank in the 80's.
    - Environmental Engineering Manual-Water Pollution Control (in Chinese) published by Higher Education Publishing House, China, 1993
    - I have seen something of that nature, but unless the real needs of the potential users are well defined, they usually do not serve the users adequately.
    - Map: Environmental Guideline for Municipal Wastewater Reuse in the Mediterranean Region, PAP/RAC/MAP/UNEP, 1991
    - UNEP/MAP/PAP: Integrated Approach to Development, Management and Use of Water Resources, 1998

13. What do you think should be the starting point when selecting technical options among ww/sw practices to be applied to DCs and EITs?
    (multiple choice)

    1. community's water supply service level
    2. existing ww/sw facilities there
    3. cost recovery projection
    4. geographic condition (land use/service area/population density, etc.)
    5. Others (please specify)

    a1: 11 **a2:** 12 **a3:** 9 **a4:** 9 **a5:** 7

Others:
(Environmental Condition)
(Identification of the ww/sw related problems of the area of concern goal of the programs meteorological condition.)
(Cultural and social factors community aspirations/priorities technical skills base)
(People's preferences and choices)
(available water resource and water demand, present water body quality)
(Policy-Goal for Urban Environment)

14. Are you aware of any specific low-cost, environmentally sound technologies, which you think could be effectively transferred to the developing world?

Yes: 12, **No:** 3

(please specify below or attach relevant literature on this)
Dry sanitation- ecological sanitation in which urine and feces are separated at source and collect separate for reuse and dispose.
Separate must to be discussed.
Publications of World Bank, WHO and IRCs for example, but also of the National Small Flows Clearinghouse, WRC, and others.
Composting toilets, silt traps for stormwater management.
More advanced/improved designed of septic tank. GARNET – network based in UK
Wastewater stabilization ponds, WHO and other enormous books.
Facultative ponds.
My papers are attached (2).
Let me give as an example, considered by myself as still valid, what Carl Bartone, presently WB staff, said to me in Lima, Peru, in 1985, during the Sanitation Seminar held there for demonstrating, with field constructions of what was then the Brazilian sanitation technology for low-income urban areas: "I am sure that for low-income urban areas served with water supply, a sound sanitation system would be a combination of low-volume cistern toilets and shallow sewers". My recollection is that such combination my also be convincing for large areas of Latin America, south Asia, Southeast Asia and perhaps the main core of the largest cities of Africa. For literature, kindly see item 12 above, numbers from II through VII.
- Anaerobic treatment - Natural purification, such as oxidation pond, land treatment system, and so on. - Oxidation ditch - Chemically-enhanced primary treatment - Hydrolysis acidification-aerobic process
Very difficult to answer there are technical approaches which would not require much financial resources but have environmental soundness could be achieved depends on many things including O+M.
Constructed wetlands
Small bore sewers, shallow sewers, in references stated above (Mara)
- Environmental biotechnology - Sequencing Batch Reactor

15. Are you aware of any cases or sound practices using endogenous technologies which have been well-operated or are operating effectively in the developing world?

Yes: 6 **No:** 9

(please specify below or attach relevant literature on this)

- Let me add to that GARNET allows for discussions and information exchange.
- VIP toilet (Ventilated Improved Pit – see Q14). This technology is only culturally appropriate when water is not used for washing after defecating.
- Examples form Brazil
  - leaching pits in the State of Mato Grosso do Sul;
  - superficial drainage in some areas where piped SS are unfeasible (State of Pernambuco);
  - low-volume cistern toilets (manufacturing unfortunately discontinued) -- 400,000 unit sold to the market in the 80's.
  - condominium sewerage, largely used as a valid option (over 500,000 users) – also used in Pakistan (firstly under the lead of Gehan Sinnatamby, who did his field research in Northeastern Brazil) and being promoted in other Asian and African countries.
- Natural purification systems in the Northeastern districts of China. Hydrolysis acidification-aerobic treatment process in Beijing city and Xin Jiang Province, China
- Not personally. I've seen literature from WHO, World Bank, IRC, etc.
- Condominial system, operated in Brazil; Sanitation Promotion Kit, draft, Water Supply & Sanitation – Collaborative Council, Working Group on Promotion of Sanitation/World Health Organization, Geneva (to be published in 1998).

16. Could you identify any typical problem(s), malpractice(s) or poor operation practice(s) on ww/sw management? Please describe their locations and problems.

Q16
Most of Asian urban areas including China.
All around the world. Improper implementation of inadequate technologies.
1. Why "management" only? , 2. In general: Inappropriate design criteria, Dependence on imported materials, Inadequate institutional capacity, Incompetent management, "Political" charges for sewage collection and disposal, Unsuitable consultants.
The adoption of inappropriate high technology options e.g. sewage digesters in countries where they can not be maintained.
Baguio city, Philippines – Design inappropriate, over burdening the system, faculty ODA.
Water quality monitoring system not in use because it consumes electricity (Bangladesh). (The system itself is in good condition)
Few trained operators, lacking responsibility.
Wastewater Handling - Lack of fund, engineers, and responsibility of personnel avoided fixing a mechanical aerator (Bangkok). - Mechanical parts of submersible pumps were not available. OD rotors were stopped operation because of high consumption of electricity resulting in poor effluent (Phuket, Pataya). Stormwater Handling - No institutional systems which decide rivers are public property. Garbage is disposed of at small streams, causing blockage of water flow. Development under no regulations.
Untreated/settled sewage discharged through open drains to streams/rivers (widely practiced in DCs). - a countless number of leaking pumping stations; - given people's lack of money, the absence of housing connections despite the existence of street sewers along the households pathways; - given lack of adequate maintenance, drainage grit chambers full of sediments that work as mere inspection chambers instead; - sludge from leaching pits or septic tanks that are discarded into water bodies, thus creating serious potential sanitary and environmental hazards; - vent pipes that do not exhaust foul air from the pits.

So many cases. Many conventional problems.
Desludging of tanks – Zambia; the local authorities were responsible for that task, but did not have the necessary equipment or infrastructure.

17. What are your general comments on the proposed international source book? Any suggestion/advice on how this can be improved? Please describe.

Q17
It is appropriate to illustrate success and failure case studies in the book.
Yes, slightly different structure. Chapters for target oriented users.
To prepare a Source Book is a good idea. We can better focus and/or sharpen the scope, objectives and the outline after we have discussed content during the meeting. My impression is that the outline gives primary attention to central off-site sewerage systems. Such systems are of limited use in DCs, not so much in EITs. We should give particular attention to this question when we meet.
A tricky task to make it appropriate for both large populations and small countries, such as Pacific islands.
May need a committee of commentators at the draft stage.
To use this book conveniently, it is important to describe many case studies.
(1) Why wastewater and stormwater should be managed in a integral manner? (2) Designing wastwater and stormwater management systems is an engineering work. To what extent can UN be involved?
If the source book is intended to transfer the knowledge on ww/sw to the laymen, it seems to me technically inclined.
- It is desirable to produce a source book that can be used for training purposes. - Feedback should be obtained in due course and source book improved. - It is too ambitious to cover both ww & sw in on book.
The idea is so good that my only complaint is why it hasn't been done earlier.
In generally, the proposed book is quite good. It would be useful to wastewater and storm water management practices in developing countries.
Do people in DCs use such source books? Most of the time they depend on personal network because you need professional interpretation.
It will probably be a very useful and interesting reference book.
- Will be very useful references for target groups. - Needs glossary for the understanding of non-technical target groups.

Questions 18-22 relate to production of **training modules** on the attached proposed outline.

18. Are you aware of any training package(s) related to the sustainable management of urban wastewater and stormwater?

Yes: 8 **No:** 9

(please specify below or attach relevant literature on this)

- IRTCUP module
- No "international". However, some packages are available in certain national and/or technical institutions and in some private sector operational or training enterprises. We must discuss these
- UNDP modules
- Many years ago, the world Bank through its water & sanitation programme produced a package with color slides (CA. 1970).
- JICA Training course "Sewerage Technology" by Japan Sewerage Agency, "O&M" by Sapporo City, "Stormwater Drainage" by Osaka City.
- The WB's training package on low-cost sanitation issued in the 80's.
- 1) Wastewater treatment and reuse training course: co-organised by Environment Simulation and Pollution Control State Key Laboratory, Dept. of Environ. Science and Eng. Tsinghua University and Beijing Water Saving Office, China. The trainees are municipal manager and technician, industrial manager and technician. 2) Wastewater treatment plant operation and maintenance: organised by Gao Bei Dian Municipal Wastewater Treatment Plant, Beijing, China
- The California State University, together with the USEPA, has developed a series of training modules on the subject. These are materials for correspondence education, but can be used for normal training courses. These materials may overlap with the proposed materials. The contact person is Prof. K. Kerri, California State University, Office of Water Program, Sacramento.

19. What is the gap between already existing training package(s) and your assessment of the requirements (please explain)?

Q19
Lack of consistent policy in developing appropriate training tool.
Most of the existing packages are available in the industrial countries and would need adaptation (rather than adoption) to the conditions of Dcs and EITs.
Public education needed.
It's more of appropriate technologies and experiences worth sharing why they succeed or fail.
It is effective to train the trainees in same technology level.
I doubt the effect of training on this subject.
Target trainees: Each group has different needs
China has the biggest population in the world. There exist many people especially in high level, such as decision-making level, needing to be trained. The existing training materials are mostly based on China condition. It would be more significant if regional and global information, case study of successful practice in Foreign countries could be included in training packages.
Training is a living thing. You cannot expect training package to do the job alone. Sometimes the gap can be filled by trial and error.
Training package will be more effective if guidelines are available to meet specific standards and package for specific target groups.

20. In promoting sustainable urban wastewater and stormwater management in the developing world, which groups do you think would be appropriate as target trainees of the training courses by using our modules? Please rank groups below from 1 (most appropriate) to 6 (least appropriate).\

Q20							
A. Local government (decision-making level)	B. Local government (technical/engineering level)	C. National government/ policy maker	D. NGOs	E. Community Based Organizations	F. Research institutions	G. Private sector	H. Others (please specify)
2	3	1	4	6	5		
All							Teachers. This is a serious task.
3	1	1		3	2	3	2/Donor agencies
2	1	2	2	1	3	3	
1	2	4	6	3		5	
2	3	1	4	7	6	5	
1	1				1		
3	5	2	1	4	6	6	
2	3	1	4	4	4	2-3	
1	2	3	4	5	6	7	
1	1	1	1	1	1	1	
2	3	1	7	6	5	4	
Again it depends on what you want to accomplish.							
4	1	4	5	2	2	6	
1	1	1	4	4	2	1	
1		1					
1	2	1	3	5	5	4	

21. In promoting sustainable urban wastewater and stormwater management in the developing world, which groups do you think would be appropriate to undertake or organize training courses using our training modules? Please rank groups below from 1 (most appropriate) to 6 (least appropriate).\

A. Donor agencies (bilateral, multilateral) B. International organizations including UN
C. Local government (decision-making level) D. Local government (technical/engineering level)
E. National government/policy maker F. NGOs G. Community Based Organizations
H. Research institutions I. Private sector J. Others (please specify)

Q21									
A	B	C	D	E	F	G	H	I	J
1			2		3		4		5
4	1		2				3		
1	2	4	3	2	3	3	2	3	
3	2	2	2	2	1	1	3	3	
3	2			1	5		6	4	
	1	4		3	5		2		
1	1	1	1						
6	6	3	5	2	1	4	6	6	
1	1			2			2	3	
4	2	7	8	3	5	6	9	10	1 (Educatio n Institution s)
1	1	1	1	1	1	1	1		
6	1	3	4	2			5		
Whichever groups willing to undertake the tasks which you (IETC) think should be accomplished. You cannot expect to serve everyone well.									
4	1	4	4	3	6	5	2	6	
1	1	1	1	1	4	4		2	
1				1					
2	1			3					

22. What are your comments on the proposed structure of the training modules? Any suggestion/advice on how this can be improved? Please describe.

Q22
Use the group of International Water Quality Association, professional engineers society (IAWQ). This society can meet to provide training activities.
Yes, to be discussed in the workshop.
Module 1: This is the place to review also the place of ww/sw in the urban infrastructure development process, and how to adapt (rather than adopt) experience available in the industrial countries. Modul2: The matter of "integration" needs discussion.
As emphasis on public education is also needed.
Case book or a collection of cases adoptable for workshops may be in corporated. There seems to be a "Divorce" between water supply and wastewater management planning. The design of the modules should avoid this and instead the interactions should be magnified.
It is better to distribute the module to wastewater management and stormwater management. In some countries, construction section is in charge of stormwater management and environment protection section is for wastewater management.
An internet-based training course maybe an alternative. For information, please access below address. <http://www.pitt.edu/~super1/lecture20/index.html>
I don't have enough information to describe my comment on the proposal.
It appears rather ambitious to attempt to cover both stormwater and waste water in one training module.
It is quite good.
Very difficult to answer. Should have clear delineation on expected outcome.
To start with module related to urban water system.
There should be a special module on operation and maintenance.

Others

23. If you have any particular topic(s) or experience(s) which you think would be appropriate to share with other experts at the meeting, kindly describe these below.

- What do colleagues in DCs and EITs need most: Technical information, managerial information, information and training in decision-making and planning, information regarding socio-economic matters, or others?
- Low technology solutions e.g. composting toilets.
- Japanese approach to prepare O/M guidelines of sewage system.
- Community based technologies for integrated water/wastewater/solid waste technologies (i.e. urban village technologies) in the context of using renewable energy, permaculture, integrated biomass system.
- Should develop a system of **information development** rather than information compilation. Information is of value when used and enhanced.

APPENDIX 7

International Source Book on Environmentally Sound Technologies for Urban Wastewater and Stormwater Management

Some Comments
by
Bernd Dieterich

The tentative Outline for the Source Book is a good exposition of the intended content but leaves ample room for details and additions. The Questionnaires completed by participants in the forthcoming meeting will be a starting point for discussing the details and additions. The following comments are made with the aim of contributing to the discussion.

IETC has published in 1996 an International Source Book on Environmentally Sound Technologies for Municipal Solid Waste Management. The Outline for the new book is similar to the Table of Contents of that book. It would be useful to know the experience accumulated so far with the previous book. Is it intended that the new book follows the example of the previous one?

I would like to suggest that the meeting spend some time discussing the following:

- Who are the potential users? This relates to question 20 of the Questionnaire where I have given top priority to local government (technical/engineering level) and national government/policy maker.

- What is the prevailing qualification of the prime users; which type of information do they **not** have at their disposal; and what further training do they need to become more effective? I have indicated some of my views a regards the latter in Nos. 16 and 5 of the Questionnaire, though I have also indicated that by limiting question 16 to "management" we may miss important points, e.g. socio-economic fundamentals, planning in the overall development context, the on-site/off-site choice and, accordingly, the gradual raising of service levels, etc. In response to question 23, I further felt that our colleagues in DCs EITs need most: technical information, managerial information, information and training in decision-making and planning, information regarding socio-economic matter etc.

- We should also spend some time examining other existing sources of information, e.g. those of the World Bank, WHO and IRCs but also others like AIT, WRC, WEF and other national professional associations. Can IETC provide source searches?

- The same applies to training material. International material may be scarce but there is a wealth of national material available, e.g. WTI, EPA,

CABWI/BETWI, ATV and some of the private operators (especially the French ones, e.g. SAUR or CGE).

There are some other basic points which I like to raise regarding the Source Book:

- The Source Book seems to deal primarily with central sewerage and drainage. It is true that these have been neglected during the IDWSSD. Why? Their financing is always troublesome; they are typically public works projects and have to compete with similar projects for the limited resources which are available at the municipal level throughout the world. They are in competition with projects for drinking water supply, electricity and all the other infrastructure development projects which every municipality must undertake. Often sewerage systems are considered the least of a priority. Why? Because the removal of human excreta and of wastewater from human settlements has been neglected for decades, even centuries, and, accordingly, a mentality of "no need to act" may have developed in the minds of both the people and their political leaders. To make matters worse, the rapid and sometimes uncontrolled growth in the peri- and semi-urban areas in the developing countries has aggravated the reluctance to act. The resulting consequences have been disastrous and have upset orderly infrastructure development in many cities and towns around the globe.

- But turning to question 6 of the Questionnaire, we should be careful using the experience of the industrialized countries for two reasons: (1) much of that experience is not well recorded and (2) the problems of funding projects in the developing countries and their O+M. Both of these aspects may lead to wrong "technology transfers". I have scaled the contention that decision-makers not need understand technological implications (always not just when employing contractor from industrial countries) with "1" (fully disagree).

- We must also address some "fads" which have surfaced in question 6: there are no patent approaches to the joint management of wastewater and non-hazardous solid waste, the discharge of industrial wastes into public sewers, and wastewater reuse, among others. Let me explain: I personally have reservations as expressed in the questionnaire.

- Question 6 also raises the matter of master planning. I have found (during a recent research) almost no organization which would still advocate master planning for centralized sewerage systems. But there is a great need to address the phasing of on-site vs off-site development. This, indeed calls for much better planning. INTEP has made some interesting proposals.

I do not want to add more comments before drawing some conclusion though several others could be made. However, based on the above comments, let me make some suggestions regarding the Outline which we are expected to discuss:

- Comparing our "project" with the Source Book on Municipal Solid Waste Management (1996) , it goes without saying the listing of addresses should be an essential part of the new book.

- However, as regards the regional overviews, can we be more specific? And for which use? For instance, can we widen the data base and make them more "telling", and, accordingly, also the coverage? Can we make a more relevant use of the wealth of information available at some of the international organizations, especially the development banks. Should we initiate a renewed effort to collect (quantitative) information for the overviews based on a subject index which we might prepare? I feel this might be advantageous "side-project", including for the governments of the CDS and EITs, and I feel this warrants some discussion at the time of the meeting.

- I also feel that the Chapters 2 and 3 need another look:

  = it is difficult to strike a balance between textbook and pamphlet. Perhaps we might take a look a some "models", such as the UNEP/WHO/WB publication on hazardous waste management. I feel the model of the 1996 IETC publication is not technical enough.

  = I also feel we may want to add a good deal on non-engineering information. A prime item might be the socio-economic fundamentals underlying basic decision-making with respect to wastewater and stormwater management within the overall development context considering the variety of priorities of a region or a municipality, and the tight financial situation in the developing countries.

  = Other non-engineering and/or engineering items might be:

    * the overall infrastructure context of a ww/sw project;

    * project identification and development. The project cycle;

    * less emphsise on the technical aspects of traditional central sewerage systems but more on the two following items;

    * as already pointed out, on-site vs off-site development with a comprehensive planning framework;

* by the same token, much more and explicit emphasise might be given to low-cost sewerage;

* decision-making with respect to integration (see question 6);

* the options for institutional development, including human resources development;

* the options for finance and financial management, cost recovery;

* ditto for operation and maintenance;

* meaningful participation;

* monitoring and surveillance

Some of the above are already referred to in the Outline. The purpose of listing them again is to give them a stronger emphasis.

As regards the training modules, I refer to what is said above.

April 29, 1998

APPENDIX 8

Comments for Discussion

by Xia Huang
Tsinghua University, CHINA

1. Framework for Urban Wastewater and Stormwater Management

1) Wastewater reuse and stormwater utilization as elements in urban wastewater and stormwater management

Urban wastewater and stormwater management has been considered to have functions of meeting public health requirement, prevention requirement of environmental degradation caused by human activities and urban drainage requirement.

However, on the other hand, with rapid industrialization and urbanization, water resource shortage is becoming a significant social crisis in more and more countries and regionals. Over extraction of underground water is very common in many cities. Almost all the countries have already recognized seriousness of water resource shortage, and great efforts have been made to achieve sustainable management of water resource. As key measures to support sustainable management of water resource, wastewater reclamation and reuse has been paid more and more attention. Besides, stormwater utilization as water resource, for example collecting and pouring stormwater into ground after primary treatment to increase storage of underground water, has been attracting more attention as well. For those countries and regionals facing serious water resource shortage problem, wastewater and stormwater management should be integrally considered with water resource, and wastewater reuse and stormwater utilization would be put into the scope of wastewater and stormwater management as its important elements.

Since there was few experience on stormwater utilization in developing countries, some introduction on sound practice related with stormwater utilization in the relevant section of the source book would be useful.

2) Centralized Sewerage System or Decentralized Sewerage System

In general, centralized sewerage system in industrialized countries are also appropriate for most countries in the developing world. Since the system is a cost-

effective way to eliminate pollution of urban wastewater, many developing countries have been establishing a number of large wastewater treatment plants in large cities for treating urban wastewater in which quite of industrial wastewater are usually included. However, depending on different circumstances in different countries and regionals, in some cases centralized sewerage system and decentralized sewerage system need to be combined together.

Toward optimization of the entire system, should the sewerage system be centralized or decentralized? How many sewerage plants should be established and how large should the service area be for one sewerage plant? What factors should be considered in selecting and planning sewerage system? All these aspects need to be discussed.

Important factors for planning sewerage system are preliminarily considered as follows: (1)level of development (existing sewerage collection system); (2)geographic condition(land, service area); (3) population density; and (4)available water resource, necessity and location of wastewater reuse.

2. Key engineering considerations for practice of wastewater and stormwater management

Besides nature of wastewater and stormwater, following aspects need to be considered as well in practice of wastewater and stormwater management .

1)Nature and water quality requirements of water body receiving treated wastewater

Selecting treatment level and corespondent process are basic issues for planning sewerage plant. They not only depend on nature of wastewater, but also on nature and quality requirements of water body receiving wastewater. Different regionals have different environmental standard and water quality requirements. Discharge effluent of wastewater and stormwater should meet the requirements. For strict regionals, advanced treatment process need to be applied.

2) Available water resource and necessity of wastewater reuse

For those countries or regionals facing water resource shortage problem, wastewater reuse and stormwater utilization are considered as key measures to support sustainable management of water resource. In these cases, wastewater or stormwater treatment level and processes will be selected according to quality requirements for reuse water.

APPENDIX 9

Commentaries about the project
"Promotion of sustainable wastewater and stormwater management in urban areas"

The present - day world appears as a picture of contrasts.
The extraordinary development of the spatial technologies and of telecommunications stands in contrast with poverty, lack of hygienic living conditions or with enviromental deterioration.

These "gray spots" must become a priority for the decision makers in order to solve them. In this context the sustainable approach of wastewater and stormwater in urban areas is very present and important, in order to identify the problems, to estimate and to assess them and to find efficient solutions for each case in its turn.

In such an approach it is necessary to find a systematic method, acting simultaneously on several directions:
- legislation,
- institutional administration,
- financial economics,
- education - training - information,
- international cooperation,
- social aspects and civil society involvement.

This is necessary because wastewater and stormwater management is a key issue for several spheres of activities:
- flood protection,
- water sources quality protection,
- hygienic living conditions in urban areas.

This is why I consider that this project proposal will be a success, if we will be able to involve several target groups and of course available funds.

Taking into account that this draft project was well developed and meets all the requirements I wish to propose or suggest aspects to be pondered upon, if they need to be introduced in the project:

A. From the content point of view
- the content should cover all aspects (research and design activity, construction and maitenance, etc.);
- it is recommended to take in view the local and regional conditions (country in transition or developing country, geographic condition, size of the localities,etc.);

B. From the organizational point of view:

- training activity development on the network principle method (global center, regional center and national center);
- organizing "cleaner technology center" at national level that can start-up activity with this project and it can be enlarged with other topics (air, wastes,etc.);

C. From the target groups point of view:

- it is necessary to answer the following questions: Who is it addressed to?; At what level of approach?; What is the timeschedule for its implementation?

The answer to all these questions depends on the UNEP possibilities or other institutions (WHO, UNDP, etc.) to provide the material and financial support at the required level so to resolve the issues in an optimal way.

As a general aspect it should be mentioned that the countries in transition have many needs in this respect. I shall justify this statement by presenting some data specific to Romania, that will be given directly in the meeting.

I would like to thank you for the oppotunity to be present in this meeting, and to involve me in such an important project.

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APPENDIX 10

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Mr Hiroshi Shiroi
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Dear Mr Shiroi

'Promotion of sustainable wastewater and stormwater management in urban areas'

Training modules as an output of IETC project

In response to your email requesting my comments on the outline for the above, I wish to make the following observations and comments.

The idea of IETC producing a training tool which has the features as outlined is commendable. There have been many general and technical books published on the treatment, disposal and management of wastewater and stormwater for the purpose of general education or training, but they are not specifically directed at the proposed target users and trainees. This comment applies equally well to the proposed publication of the International Source Book. My suggestion is to relate the two closely, i.e. to use the source Book as a basis for training. The Source Book will be referred to in the training modules as a primary source of relevant information.

Each module will then contain

An **Introductory** section, where the Learning Objectives are clearly stated, as well as Key Learning Points which highlight the learning content of the module.

This is followed by a **Study Materials** section, with references to relevant materials in the Source Book. It may also contain additional materials which explain certain aspects in more detail, and may also be supplemented with case studies either by reference to the Source Book or with separate case studies where necesssary. Achievement of the Learning Objectives is ensured by including questions and exercises at appropriate points in this section. Before progressing to the next step in this section these questions or exercises should be satisfactorily completed by the trainees.

A **Review** section completes the content of each module. If desired a competency test can be included in this section to make sure that a satisfactory level of knowledge and understanding is possessed by the trainees.

If considered desirable each module may be supplemented by a video of, for example, treatment systems or case studies, although an appropiate place for this supplementation may equally well be in the Source Book.

The number of modules is determined largely by the materials to be presented and the length of a training course. For a one week (5 days) intensive course there should logically be 10 modules to fit with the pattern of one morning and one afternoon session per day, but again it is the materials to be presented that should govern the number of modules and length of training. The content of one module may not logically fit into one morning/afternoon session.

Commenting on a possible emphasis for the training modules, I would like to emphasize the need for trainees to gain not only sufficient knowledge of available technologies, but more importantly a good understanding of the underlying principles behind the technologies. Most of the underlying basic principles are common, and hence having a good grasp of these will enable trainees to assess the specific application of these principles in the technologies. They have therefore the ability to assess not only existing technologies, but also new or other technologies should they face these in their future situations. I suggest therefore that the training modules on the basic principles be more extensive than the coverage in the Source Book.

My only other comment relates to whether we are attempting to achieve too much by covering both wastewater and stormwater in one Source Book and Training package. It is common practice in developing countries for both wastewater and stormwater to be discharged to a common drain to rivers/streams/sea. Good practice would, however, require that they be separated for treatment and reuse purposes. It is also common practice in these countries that solid wastes are dumped to rivers. It is recognised now that it should not be the case. Solid wastes should be separately treated for diposal/recycle/reuse. Industrial wastewater should similarly not be mixed with domestic wastewater, but separately treated first before discharge if desired to treat together with domestic wastewater. Stormwater not contaminated by wastewater is generally much easier to treat and/or reuse. The flow of stormwater varies with season and having a combined system of wastewater and stormwater complicates both treatment and reuse.

I trust that my comments are helpful. Please do not hesitate to contact me if you any query or need clarification or further information. I look forward to meeting with you and to discuss ideas at the coming workshop in Osaka.

Best wishes

Yours sincerely

Goen Ho

29 April 1998.

APPENDIX 11

ELSEVIER

Desalination 106 (1996) 291–294

DESALINATION

Localized treatment and reuse of wastewater: science, technology and management

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Received 3 June 1995; Accepted 28 September 1995

Abstract

There has been an increasing interest in the development of on-site and localized treatment technology for wastewater because it offers householders or a local group of householders the opportunity of reusing the wastewater after appropriate treatment. In an urban village setting the technology provides an opportunity to achieve an integrated management of the water cycle. There are, however, issues that need to be addressed. The science of wastewater treatment is well established but has been applied primarily to large-scale treatment systems. Small-scale systems have been miniatures of large-scale systems rather than the application of the scientific bases for the development of small-scale technologies. There are also issues of whether lay householders can be expected to maintain on-site or localized systems. These issues are discussed and highlighted in light of recent developments in Australia.

Keywords: Wastewater; Localized treatment; Reuse; Science; Technology; Management

1. Introduction

The primary objective of wastewater treatment and disposal is the protection of public health. Wastewater of domestic origin contains pathogens, suspended solids (SS), substances causing biochemical oxygen demand (BOD), nutrients [nitrogen (N) and phosphorus (P)] and a host of other possible pollutants which may need to be removed before the wastewater can be safely disposed. Standards have been developed for the safe disposal of the wastewater as have the technologies to meet them. The technologies that have been developed are generally for centralized large-scale systems associated with reticulated sewerage, and the treated wastewater is for disposal rather than reuse. Options for reuse are recognized as being limited with large-scale systems in urban areas because of the need for a reticulation system for the treated wastewater.

On-site treatment of wastewater for individual houses is a necessity in areas without reticulated sewerage, but interest in on-site treatment is growing [1]. One reason is that the technology for on-site treatment is maturing, and reuse of the treated wastewater is an option. Thus the owner of an on-site system has total control of the

PII S0011-9164(96)00121-X

wastewater and its use. In an urban community where there is a desire to develop an urban village, the treatment of wastewater from a group of houses within the urban village community offers the opportunity to achieve what is desired by such communities, i.e., integrated management of water [2].

The maturing of the technology for on-site wastewater treatment is due in large part to the application of scientific principles to the improvement of the outdated septic tank technology. This paper therefore broadly reviews the scientific principles applicable to on-site wastewater treatment and reuse and assesses available technologies with respect to their science content.

On-site treatment of wastewater may not provide all the answers to the problems of wastewater disposal and reuse. Issues needing to be addressed are, for example, whether individual householders can be expected to maintain a sophisticated wastewater treatment unit in the back yard, and the imbalance between water supply and demand in different seasons. This paper therefore also attempts to discuss issues related to the management of on-site wastewater treatment units, and whether science and technology can provide answers. In an introductory paper like this one can only attempt to cover some of the issues and stimulate discussions in subsequent sessions in the workshop.

2. Scientific principles

The physical, chemical and biological bases for the treatment of wastewater to remove BOD, SS, N, P and pathogens are well established. They have been studied as part of efforts to improve the technologies for large-scale wastewater treatment systems. These are shown in Table 1. They should obviously be applicable to small-scale and on-site treatment systems.

An example of an application to large-scale systems is the conventional primary and secondary treatment utilizing an activated sludge plant. Here raw wastewater is screened to remove large objects, then grits are removed in an aerated sedimentation tank, followed by sedimentation of the smaller suspended solids, producing a primary effluent. Further treatment by aerated microorganisms removes BOD, and sedimentation clarifies the secondary effluent, returning the microorganisms (activated sludge) to the aeration tank. Secondary effluent containing less than 20 mg/l BOD and 30 mg/l SS can be achieved without difficulty. The 20 mg/l BOD and 30 mg/l SS standard was, in fact, based on what could be achieved by primary and secondary treatment of sewage. Disposal to rivers or reuse for irrigation of recreational parks is generally permitted after chlorination to reduce the concentration of pathogens. It has become more necessary now to remove N and P prior to disposal to rivers or onto land because of the need to prevent eutrophication of surface waters.

Ammonium-N in secondary effluent can be removed as ammonia by liming and aeration. Nitrogen can also be removed by biological nitri-

Table 1
Physical, chemical and biological bases for wastewater treatment

Principles	Processes
Physical	Screening
	Sedimentation
	Sand filtration
	Aeration
	Adsorption (activated carbon)
	Membrane filtration
Biological	Removal of BOD:
	Use of aerobic bacteria
	Use of anaerobic bacteria
	Removal of N:
	Nitrification
	Denitrification
	Removal of P:
	Luxury uptake
Chemical	Coagulation and flocculation
	Precipitation
	Chlorination

Table 2
Physical, chemical and biological bases for treatment of sludge

Principles	Processes
Physical	Thickening Vacuum filtration
Biological	Anaerobic digestion Composting
Chemical	Coagulation and flocculation Incineration

fication and denitrification. Similarly P can be removed by chemical precipitation using lime or alum or a ferric salt, or removed biologically.

Sludge from the primary and secondary treatment also needs to be treated prior to disposal or reuse. Again physical, chemical and biological means are available (Table 2).

Needless to say, understanding the physical, chemical and biological bases of wastewater treatment enables us to develop an innovative treatment system to achieve any particular objective or standard by combining physical/chemical/biological units. Innovative treatment systems include combined BOD and N removal in a series of anaerobic and aerobic chambers or alternate aeration and non-aeration of one chamber.

Following secondary treatment and removal of nutrients by liming, recharge of groundwater is possible after coagulation, flocculation, sedimentation, sand filtration (i.e., a rapid sand filter) and chlorination; and even to produce potable water with further activated carbon adsorption and membrane filtration treatment.

3. On-site treatment technology

Current on-site treatment systems have generally adopted the technology of the conventional activated sludge plant for large treatment systems. This is understandable because the effluent standard for reuse for garden irrigation is a chlorinated effluent containing not more than 20 mg/l BOD and 30 mg/l SS, i.e., secondary effluent that can be achieved without difficulty using an activated sludge process. Differences that can be observed are the insertion of a trickling filter in the aeration chamber to cope with variable flows and the infrequent removal of sludge. Thus anaerobic decomposition of sludge takes place in the first settling chamber. It appears that current commercially available on-site treatment units would benefit from a thorough scientific scrutiny of the operation of their components to optimize overall performance.

If removal of nutrients is required for installation of on-site units in nutrient sensitive catchments, P can be removed by alum dosing, and N by nitrification and denitrification in separate chambers or by intermittent aeration of a modified activated sludge set-up. Hyperchlorination of ammonium in secondary effluent theoretically removes N by oxidation to nitrogen gas.

If the effluent is used for irrigation of garden plants, there is the question as to why N and P, which are required by plants, should be removed. There may be an imbalance between plant requirement for the nutrients and the seasons, with a higher requirement in the warmer months than in the colder months. Rather than removing the nutrients, an alternative is to store the nutrients in the soil. Soils containing clay have the capacity to sorb ammonium and phosphate present in secondary effluent. Sandy soils deficient of clay minerals can be amended with clay (or near an alumina refinery, use red mud, residue from the processing of bauxite into alumina).

Effluent stream segregation is a recognized method for the treatment of industrial wastewaters where low-volume/high-strength wastes are segregated from high-volume/low-strength wastes. Treatment of the former can be more effectively carried out in a smaller system, while the latter may not need treatment or little treatment. This situation presents itself when we consider on-site treatment of domestic wastewater where we have a low-volume/high-strength waste from the toilets (commonly called black

water) and a high-volume/low-strength waste from the rest (bathroom, laundry, kitchen), commonly called grey water. Development of on-site systems taking advantage of this should be encouraged. We are now beginning to see dry/composting toilets and proposals for the reuse of grey water.

4. Management of on-site units

Management issues which need to be discussed are public health, maintenance of an on-site unit and rating.

Public health (including the health of owners) is guarded through standard for the reuse of the treated effluent. This standard is well defined now in terms of the number of coliform organisms which should not be exceeded in the effluent. This is turn is related to the degree of treatment (secondary effluent standard) and chlorination with a minimum chlorine residue. If a unit is properly operated, the effluent standard should be achieved. Thus the issue is closely related to the next — maintenance.

Can a lay householder be expected to maintain a sophisticated on-site unit? The answer to this question is dependent on a number of factors. Robustness of the technology is a key factor. On-site units are now designed with reliability as good as modern household appliances (e.g., refrigerators) and can be regarded as such. Regular maintenance is required, e.g., sludge removal. Ideally a regular, say 3-month, maintenance contract should be an available option with the supplier of an installed on-site unit. The cost affordability of this option is dependent on whether a property is in a reticulated sewerage area and hence rated, i.e., whether connected to the sewer or not.

Since on-site units are designed for non-sewerage reticulated areas, the question on rating only arises when sewerage reticulation comes to an area where an on-site unit has been installed. Should a property previously not on reticulated sewerage be rated when reticulated sewerage is available, even though the property has a sophisticated on-site treatment unit? This question will become more relevant when the concept of integrated management of water is adopted in an urban community wishing to develop an urban village.

References

[1] G.E. Ho and K. Mathew, Treatment of sewage from isolated dwellings, in: New World Water 1995, R. Harris, ed., International Review of Water and Wastewater in Developing Markets, Stirling, London, 1995, pp. 90–94.

[2] P.W.G. Newman and M. Mouritz, Desalination, 106 (1996).

APPENDIX 12

DESIGN

of SIMPLIFIED SEWERAGE under

BRAZILIAN CURRENT PRACTICES

AND ITS APPLICATION TO THE

NICARAGUA WATER SUPPLY AND SANITATION PROJECT

Rio de Janeiro, October 1995

Augusto Sérgio Pinto Guimarães

FOREWORD

This text has been primarily compiled to address the professional reader to the major outcomes from sanitary sewerage design prevailing practices in Brazil. For the specific case of the NICARAGUA WATER SUPPLY AND SANITATION PROJECT, under preparation, it has been thoroughly used as a training material for the professioinals of INAA, the local counterpart agency, on the innovative approaches for low-cost sewerage works that have been taken in Brazil. A starting reason for this strategy is the very fact that ongoing Nicaraguan sewerage design codes convey to an overdesign of the installations and field works as a whole with an immediate result over the costs, thus obviating the INAA needs for a more adequate technical tool.

It has been recognized by multilateral lending agencies such as the WORLD BANK that the success achieved by the simplified sewerage approach that has been taken in Brazil is likely to work out in other medium to high-densed urban areas of developing countries, especially where waterborne sewerage is the non-served people's aspiration for their sanitation option.

Moreover, the WORLD BANK has endorsed and labeled the Brazilian simplified sewerage concept as "an intermediate technology" by ranking it between the costliest conventional sewerage and the low-cost, on-site options such as pit latrines, leaching pits, etc. In this way it is worthwhile mentioning that over 1,200 km of simplified sewerage systems have been successfully designed and built over the last 12 years, most of them under the WB-funded Medium-Sized Cities Urban Development and the PROSANEAR Projects, and no operational shortcomings derived from cost reduction measures have been perceived during evaluation exercises. The consolidation of such alternative may be verified by the fact that since late 1986 the Brazilian Standards for Sewerage Design (NBR 9649) implicitly accepts in its items the simplified sewerage as a valid option as its main principles have been adopted there.

This document also introduces the SewerEx, a Windows-based, computer program that has been developed for helping the insertion of Brazilian sewerage current practices to INAA's operations.

1. INTRODUCTION

In the developed world sewerage has not been taken as an object of major attention as its associated construction works are part of the urbanization défault. As a result sewerage works play in these countries a modest role, quite analogous to the

game's referee whose efficacy is directly proportional to his serenity, and not because he eventually distracts the audience's attention from the game stars to himself. In other words sewerage works in the poor areas of the developing world[1] sewerage are normally regarded at the same and flat level of housing, street lighting, public transportation, home electrical energy, telephone availability, etc. In these areas investment cost reductions, though carefully taken into account, quite often leave space for the strength and durability of the structures. In short it might be said that in developing countries when discussing urban infrastructure (and sewerage indeed) the most attention has been given to investment cost reductions whereas in the developed world overall cost reductions in the long run are considered for the decision tool about a given component.

By contrast in the unserved areas of developing countries (uadc), which are this text's source of regard, and where urban infrastructure not hardly is scarce and its costs are usually high for the local economy, the provision of an infrastructure component is quite frequently a good justification for political campaining pledges and official inauguration parties when promises come through. In this way sewerage still has been considered as a low-priority service because it costs too much when its layout follows the conventional rules --its costs under conventional layout are likely to be the highest before other infrastructure components prevailing in the developed world; secondly because unsewered people on one way or another get rid of the sewage they generate, however in most of the cases causing dramatic environmental harm; and thirdly, the ever-increasing design flows in the developing world's urban areas sadly contribute for a larger burden over the present population, therefore acting as an investment brake. Fortunately the fourth excuse -- underground works not considered as a sound political asset -- is being disregarded as urban people's consciousness has improved a lot over the last years.

From the outset it must be confirmed that based on desk and accurate field observations, the Brazilian tradition on the design of sewers whether "conventional" or "simplified" is to believe that for them the shallower the cheaper. This fact well explains why expatriate professionals have recently changed their minds while looking at simplified sewerage. Actually they used to misunderstand the most substantial fact that conducted to sewer cost reduction and by doing so they used to call the simplified sewer as small bore sewer, thus giving the most significant credit

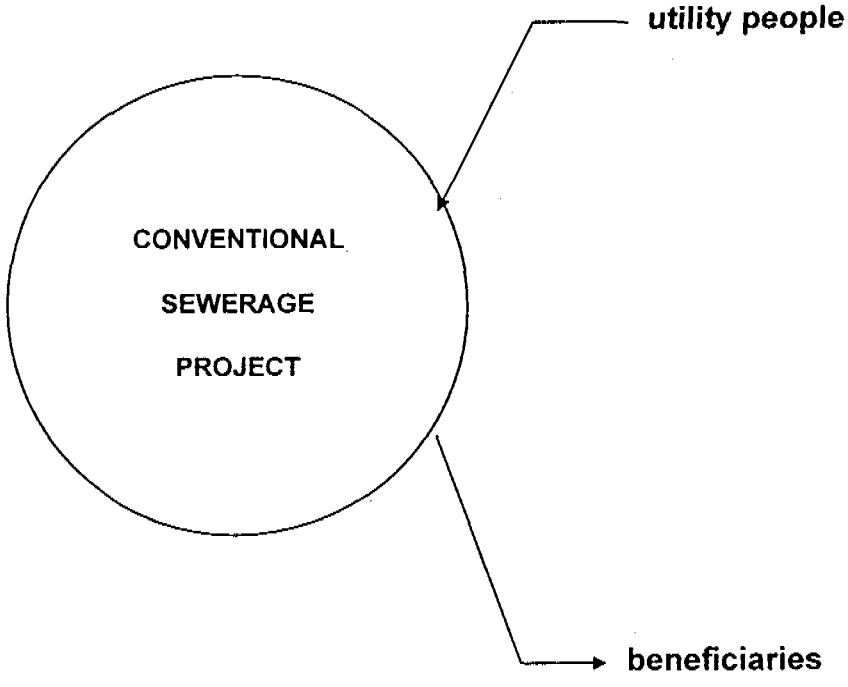
[1] hereinafter unless referred to otherwise the object of attention will be the poor areas of the developing countries. In general even in the more affluent areas of these countries some sort of sewage wash out is available.

to pipe diameter. By contrast no doubts remain that for gravity-powered sewers excavation depth reduction is the most significant cost reduction constraint and as a result these simplified, low-cost sewers are now generally known as "**shallow sewers**".

The reader must also have in mind that this simplified sewerage approach will have to follow a sewer designer's mind should he/she be really interested in serving more people under the existing budget. But at the same time it is a given that the simplifications given below will undoubtedly increase the risks for pipe collapse (Bernard Shaw used to say that "there is no free lunch"), provided that not adequate level of care during sewerage construction and operation phases are accomplished. In other words, it might be said quite candidly that for a conservative professional designing a sewer, the more conservative standards the better for him/her, but also the costlier fr the users.

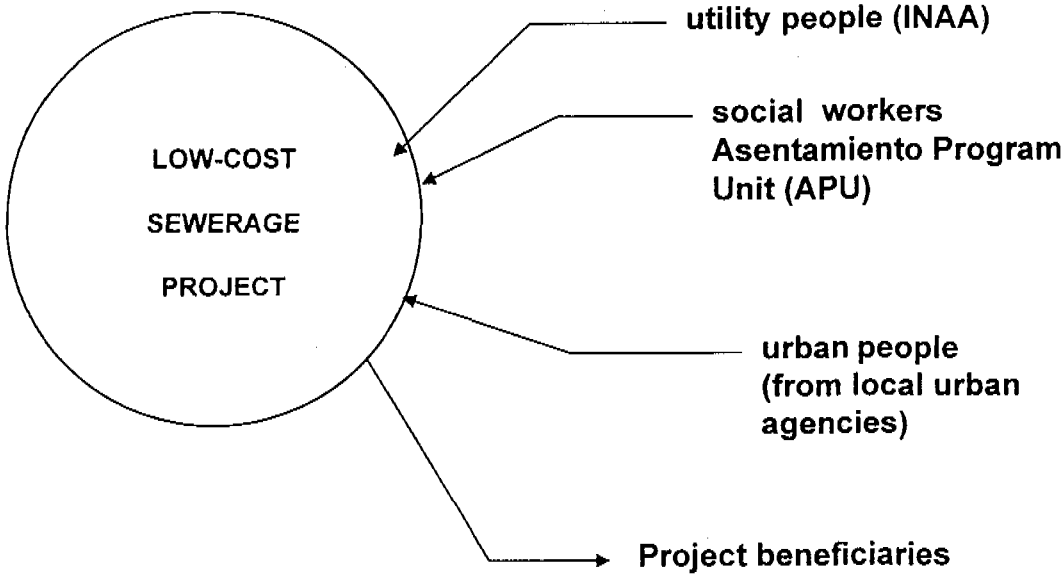
2. SEWERAGE PROJECT ACTORS

- In the wealth countries conventional sewerage project parties comprise only:
- the water/sanitation utility people, who take care of financing, designing, construction, operation and billing activities;
- the project beneficiaries, who are nevertheless personally unidentified most of the times.



In turn for the uadc's this text will address the reader for a newer approach whereby the following participants appear:

- the water/sanitation utility people, but in a distinct prospective, as in simplified sewerage desk designs are quite often superseded by field designs/as built actions -- the so-called "1:1 scale approach";
- the project beneficiaries;
- the people from the urban agency, who are to find the project links with other urban infrastructure components and ensure that these links are duly considered within the sewerage project; and
- the social workers, who will connect the community's aspirations, interests and values with the project's inputs.



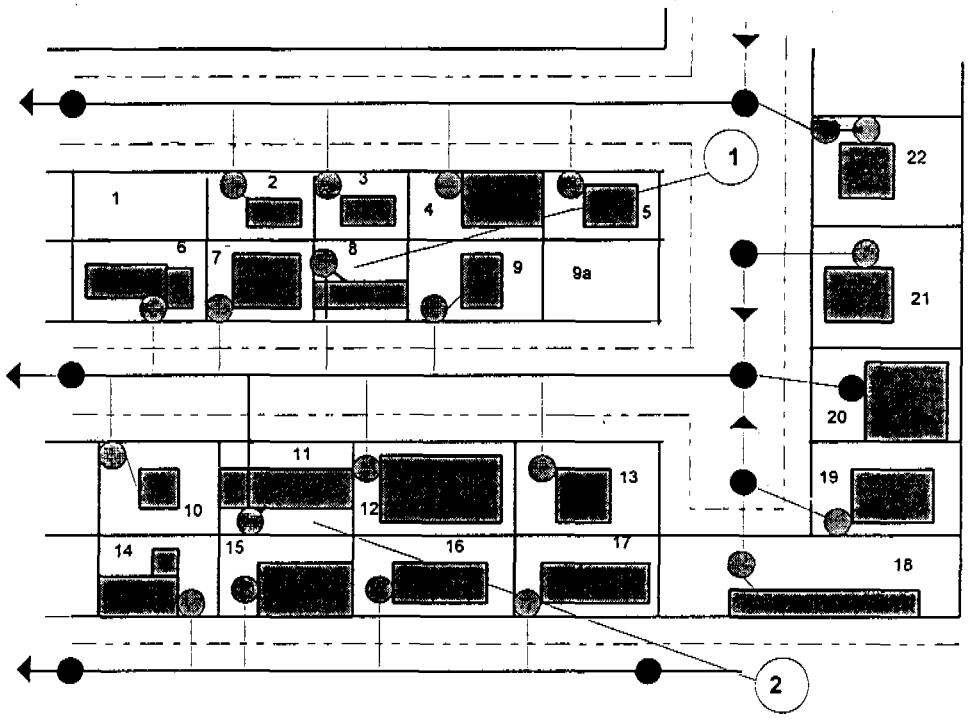
3. SEWERAGE LAYOUT

For a typical block from Managua to be sewered the following sewerage layouts habe been tested:

A -- The **conventional sewerage** (see Sketch 1) , which is prevailing in affluent areas, is based upon the following considerations:

- that within the plot under calculation in the area to be served neither public sewers nor sewage generated from a different plot is allowed;
- that street sewers and trunks are designed under the economy of scale principle, which means that large installations and a small number of disposal facilities may be expected downstream;

Sketch 1
conventional sewerage scale 1:100



note that for this layout households that occupy the whole plot width ((8) and (11)) experience big during the construction of connection works, especially when toilets are placed in their backyards.

note also that double street sewers might have been designed rather than single lines.

captions

●	**street inspection chamber**
◍	**in-plot inspection chamber**
▬	**household**

- that only from **sewerage connections-street sewers downstream** are the pipes properly built and maintained by the local water/sanitation company, which does not feel responsible for any pipe placed from the user's entrance door upstream -- a fact that is very explainable in the developed world areas, where the beneficiaries' community education level may be guessed as adequate, but is quite disastrous in the uadc's as in these areas the existence of both sanitary internal facilities and housing connections are far than a given.

  note: in many Latin-American cities where the full front land occupation occurs, the construction of conventional sewerage only after the household construction is made may present an extra disadvantage as their bathrooms are likely to be placed in the back or even in the backyard of the houses. This fact exposes the house tenant/utility to the inconvenience and costs of having part of the house's floor removed and thus re-laid (see houses 8 and 11 of Sketch 1).

In turn the simplified sewerage's concepts may be summarized as follows:

small sewerage basin, decentralized treatment systems are to be considered against the conventional sewerage's concentrated sewage -- small subbasins are to be considered thus obviating the large number of (small) disposal units as the basic idea is not to deal with large pipes nor with deep trenches;

- the system design and construction must start off from the sanitary internal facility and the housing connection as a means of guarantee even for the poor the whole set of benefits that is expected from sanitation measures;
- excavation depths are taken the highest cost factors and as a result for simplified sewers the shallower the cheaper -- actually and technically speaking simplified, shallow sewerage should be the system's more adequate name;
- simple and cheap inspection chambers are whenever possible to replace the bulky and costly conventional manholes;

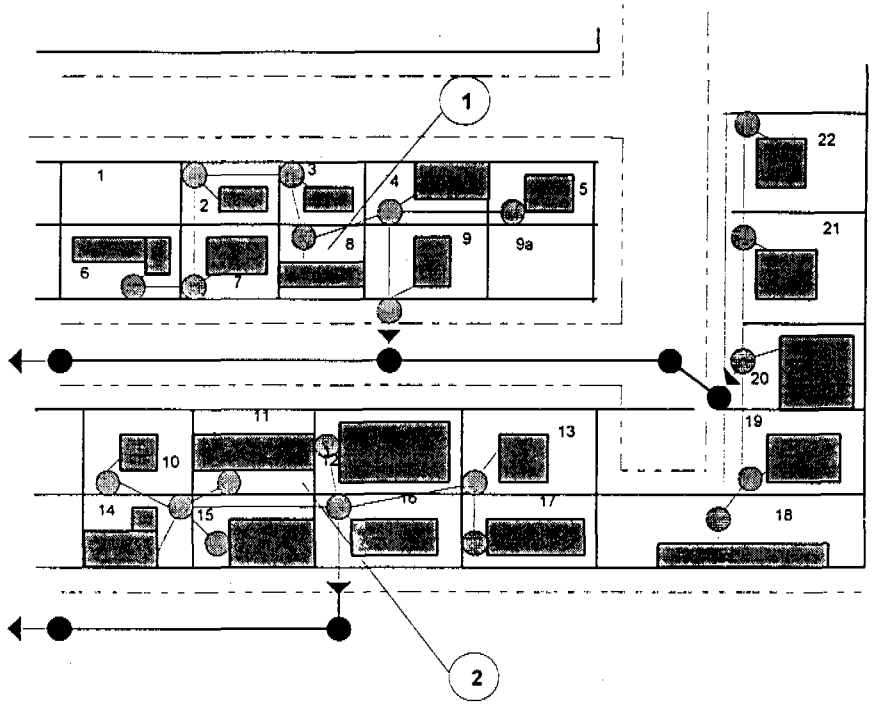
Simplified sewerage lay-out may be presented under one of the following concepts:

B -- the "softer" **condominium sewerage** (see Sketch 2), which is by far the most popular in Brazil, being notable that in its early stages sewage pipes were to be lay down only in the backyard of the plots -- presently this constraint has been disregarded and sewage pipes are being laid down anywhere in the plot

yards that be the most cost-effective solution. Its main characteristics are given below:

Sketch 2

condominium sewerage scale1:100



note that housing connections for plots (8) and (11)

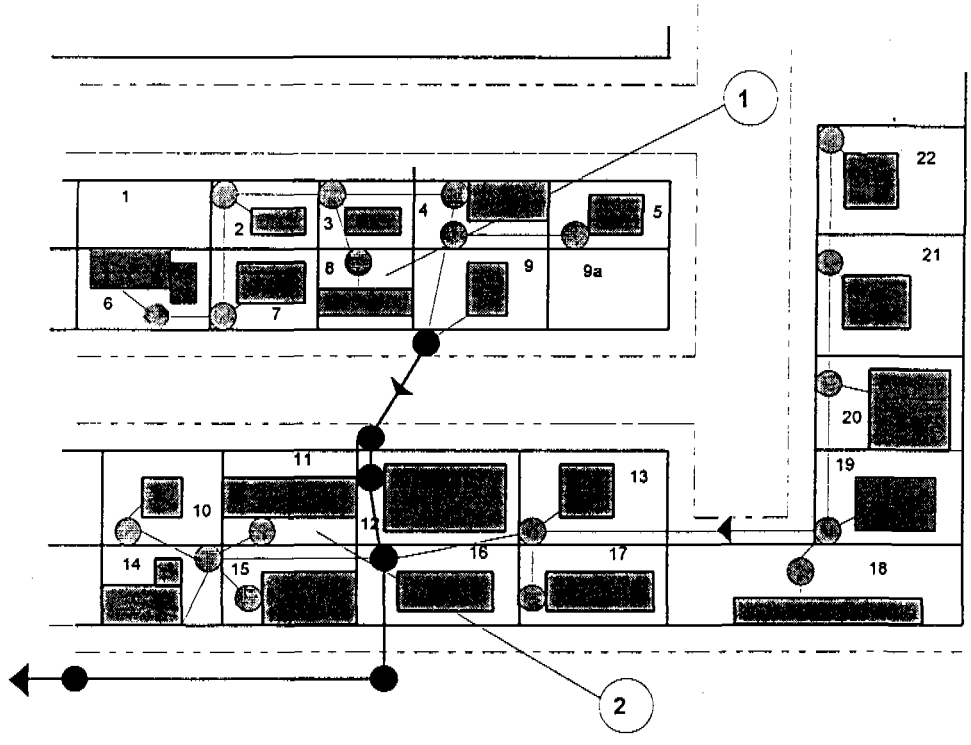
are easily made under this layout.

- the block is the minimum physical unit, i.e, the design will try to optimize the collection cost of all sewage generated inside a given block by: (i) passing it wherever it is the best possible way regardless property division lines (as it already happens in a vertical building -- see below for further comments on this subject) and minimizing connecting lengths; (ii) dramatically reducing minimum pipe excavation depths;
- hydraulic calculations only start right after the internal sewerage leaves the block and is connected to the main street sewer (obviously in this point the street sewer hydraulic calculation takes into account the total upstream sewage contribution) -- from the street sewer upstream pipe construction is to be accommodated in the best possible practical way and a careful as-built drawing is to be filed by the utility;
- the social works that are required to set up "the block condominium", as the roots for the concept are analogous to the ones taken by users of vertical buildings, being clear that in these cases, for a given facility, sewage from upper levels pass by it en route to the groundfloor inspection chamber. But in turn the horizontal condominium may pose threatens to the sewerage in case of household extension works, arrival of a new householder not aware of the system, etc. Actually the adoption of the condominium approach requires a permanent social monitoring work.

C -- the more "radical" **block-crossing sewerage** (see Sketch 3), which is aimed at optimizing the whole condominium system under calculation but on the other hand may bring more inconvenience to some users as large pipes from an upstream block may cross a given plot.

For the sewerage component of the NICARAGUA WATER SUPPLY AND SANITATION PROJECT, under preparation, given average physical and social conditions, it is expected that the option B (condominium approach) prevails.

Sketch 3
block-crossing sewerage scale 1:100



note that housing connections for plots (8) and (11)

are easily made under this layout.

SEWERAGE LAYOUT COMPARISON

The pipe lengths for the 3 sketches are given in the following Table.

	on-site pipes	housing conns.	on-site pipes	housing conns.	on-site pipes	housing conns.
house number	conventional		condominium		block-crossing	
1	0	0	0	0	0	0
2	1	10	5	11	4	13,5
3	1	10	3	9	2	20
4	0,5	10	4	14	5	14
5	0,5	10	0,5	17	0,5	16
6	0,5	9	3	9	3	8
7	0,5	8	3	15	2	16,5
8	0,5	9	3	12	3	8
9	3,5	9	4	7	0,5	7
9a	0	0	0	0	0	0
10	3	10	3	11	3	12
11	1	10	0,5	7,5	0,5	7,5
12	0,5	13	0,5	9	0,5	0
13	0,5	12	2	20	4	19
14	0,5	9	10	8	0,5	9
15	0,5	11	0,5	7	0,5	8
16	0,5	11	2	18	1	0
17	0,5	9	0,5	9	0,5	9
18	3	9	3	7	3	7
19	0,5	13	1	18	4	39
20	0,5	14	4	7	5	19,5
21	0,5	16	2	17	2	15
22	0,5	16	2	17	3	16
	20	228	56,5	249,5	47,5	264

In more practical terms one comparison among the three sewerage layouts (Sketches 1, 2 and 3) may be summarized as follows:

LAYOUT	SOCIAL WORK REQUIRED	ON-SITE PIPES (m)[2]	HOUSING CONNECTIONS (m)[3]	SEWERS (m)
1 Conventional	VIRTUALLY NONE	20,0	228,0	293,0
2 Condominium	HIGH	56,5	249,5	137,0
3 Block-crossing	EXTREMELY HIGH	47,5	264,0	54,0

- investment costs decrease in the 1-2-3 order;
- social works required decrease in the 3-2-1 order;
- on-site pipe length decreases in the 2-3-1 order (note that utility does not take care of on-site pipes for Sketch 1);
- off-site pipe (sewers) length decreases in the 1-2-3 order;
- overall pipe length decreases in the 1-2-3 (541,0 m, 443,5 m and 302,5 m) order;
- inconveniences for the householders decreases in the 3-2-1 order;
- likelihood for pipe maintenance decreases in the 3-2-1 order;
- average excavation depths decrease in the 1-2-3 order;
- number (and costs) of special pipe downstream inpection units and manholes or inspection chambers -- as the case may be --decrease in the order 1-2-3;
- overall investment costs decrease in the order 1-2-3.

As a final comment for this item it shall be stressed that outputs from the comparison performed, though not definitive at all, are highly indicative of pipe length required, social works needed, therefore giving the reader a good idea os the pros and cons of the layout under comparison.

Unit pipe lengths (per number of households -- 23), for the three different layouts under comparison are as follows:

[2] see previuos table for details
[3] see previous table for details

LAYOUT	ON-SITE PIPES/ HOUSEHOLD (m)	HOUSING CONNECTIONS/ HOUSEHOLD (m)	SEWERS/ HOUSEHOLD (m)
1 Conventional	0.9	9.9	12.8
2 Condominium	2.5	10.9	6.0
3 Block-crossing	2,1	11.5	2.4

The conclusions from the assessment of the table above are that:

- for the conventional layout unit on-site pipe length is very short as it corresponds to the household's sewage discharge into the closest inspection chamber;
- for both the condominium and the block-crossing layouts the longer unit on-site pipes as compared with the conventional layout are explainable because the location of the inspection chamber used for household's sewage discharge depends of a downstream factor, i.e, the connection with the neighboring household or the street sewerage, as the case may be.
- given the order of magnitude of the study performed, for the three layouts an unit housing connection length of 10.0 m may be used as a standard for budgets.

5. HYDRAULIC DESIGN'S MAIN ASPECTS

Old-fashioned sewerage design approach takes into consideration the maximum and final flow for design purposes. The intended ingenuity of this approach is to simulate adequate flow conditions (usually pipe 75% full and flow velocity of about 0,6 m/s) for the very last year of the Project's life-time, which may be somewhat justifiable in some of the developed countries' urbanizations where population and flows are reasonably stable. However in uadc's the gap between initial and final flows are likely to be enormous, sometimes being over six fold, thus obviating the needs for a careful study during the Project's early and lower flow times when risks of pipe blocking for low velocities are usually high.

The Brazilian sewerage design standard of 1975 (PNB 567) in a very innovative approach by the late Eugênio Macedo, Sanitary Engineer, introduced a wise hydraulic simplification (valid especially when pipe invert is not either too low or too

high) whereby the pipe highly tedious and variable hydraulic radius influence was substituted as follows:

$A \sim k R^2$, where k is a constant.

By doing so, the Manning formula for circular pipes was dramatically simplified so as to disregard the influence of R in the flow. Moreover, with the initial flow Q_i the line slope was calculated and with the final flow Q_f the pipe diameter would come out. Even more, Mr. Macedo introduced the concept of self-cleansing velocity for the initial design flow so as to ensure the pipe blockage free flow.

Later on, in the early 80's, Mr. Amarílio Pereira de Souza, Sanitary Engineer, eventually introduced in Brazil the mean minimum sewer tractive force approach in the new revision for Brazilian sewerage design code (NBR 9649), whereby a sewage flow in a sewer was to be guaranteed by a force that would be able to flush down the project's sand particle, being this the heaviest solid inside it. It is noteworthy mentioning at this point that said concept and equation was derived by Einstein Jr. when studying river sedimentation; later Shields reshaped it; and in the 70's Shen, from Fort Collins, Colorado, USA, put it on a more simplified and easier to use mode.

6. BRAZILIAN NBR 9649 STANDARD'S MAIN FEATURES

- unit flows must be calculated with a view over: (i) present situation of real water consumption (provided water is supplied continuously to the community to be benefited by the sewerage project) for initial flows; and (ii) projected urban situation for final flows -- though being apparently a bit silly and obvious, it has been a tradition in developing countries to copying without adapting developed countries' patterns that cause overdesign and wastage of project's (normally scarce) financial resources.
- for each line (a stretch between consecutive inspecting units) both initial (Q_i) and final (Q_f) flows must be known for calculations -- with the initial flow the line slope will be calculated and with the final flow the line diameter will be sized.
- Q_i(l/s) may be given by $Q_i = \dfrac{q_w \cdot pop \cdot (s/w) \cdot k_1 \cdot k_2}{86{,}400} + Q_r$,

where $q_w \rightarrow$ water per capita consumption (lcd);

$pop \rightarrow$ population to be served in the sanitation basin;

$s/w \rightarrow$ sewage/water factor, that might be taken as 0.8;

$k_1 \rightarrow$ water daily peak factor (1.2);

$k_2 \rightarrow$ water hourly peak factor (1.5);

obs $\rightarrow$ more accurate figures for s/w, k_1 and k_2 may be taken from field surveys;

$Q_r \rightarrow$ infiltration flow (see below).

- so as to make computing calculations easier for conventional sewerage design it is recommended the adoption of unit flows (q_i (l/(s.km), q_f (l/(s.km) and q_r(l/(s.km)) for a given sanitation (sub)basin to be sewered;
- infiltration flows are required to be considered -- for PVC pipes and inspection chambers smoothly finished an unit infiltration flow q_r of 0.1 l/(s.km) is acceptable. Clay pipes may require an infiltration flow rate as high as 0,5 l(s.km).
- concentrated flows Q_c are to be adopted whenever special sewage contributions are evident.
- therefore restoring Q_i for a given line under calculation may be as follows:

  $Q_i = ((q_i + q_r) \cdot L) + \Sigma Q_{Ci}$,

  where L is the length of the line under calculation.
- an analogous procedure would arrive at Q_f.
- minimum internal diameter is 0.1 m (4").
- unless superseded by field observations the line calculation minimum flow is 1.5 l/s. The reader shall note that this is the expected attenuated flow from the discharge of a flush toilet into a sewer. In other words, this is the sewer unblocking assumption, that makes as a condition for laying down a sewer the existence of at least a single toilet household that may contribute with one discharge daily.
- Manning coefficient "n" for sewer line calculations is assumed as 0.013 regardless the pipe material as in the long run the so-called "boundary layer" that coats the pipe will be always the same. For calculations, Manning's equation, as given above will be used:

  $$v = 1/n \; I^{1/2} \; R^{2/3},$$

  where $v \rightarrow$ flow velocity (m/s);

  $I \rightarrow$ pipe slope;

  $R \rightarrow$ hydraulic radius (m).

  The following continuity equation is also to be used:

$$Q = A\ v,$$

where $Q \rightarrow$ design flow (m^3/s);

$A \rightarrow$ wet area (m^2);

$v \rightarrow$ flow velocity (m/s).

Merging the above equations will give

$$Q = A\ 1/n\ I^{1/2}\ R^{2/3}$$

- every sewer line is to be calculated so that its mean tractive force σ be always equal or higher than 1,0 Pa.
- the minimum line slope $I_{0\ min}$ that meet the two aforementioned constrains may be approximately given by $I_{0\ min} = 0.0055\ Q_i^{-0.47}$, for Q_i (l/s).

  Actually, $\sigma = \gamma\ R_H\ I_0$,

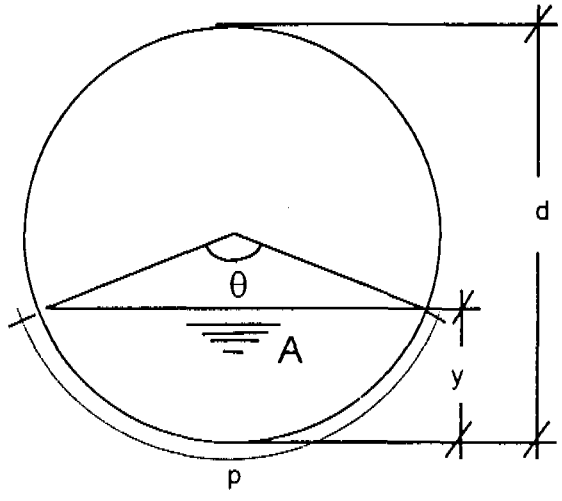
  where $\gamma = 10^4\ N/m^3$;

  $R_H \rightarrow$ hydraulic radius; and

  $I_0 \rightarrow$ line slope.
- nevertheless it is strongly recommended that for a more precise (computational) calculation be Q_i and any flow under design taken from the Manning's full equation.
- maximum line allowable slope is the one that conveys to a line final velocity v_f of 5.0 m/s.
- when, for a given line, v_f is faster than the critical velocity v_c the line's invert must not be higher than half the pipeline diameter so as to guarantee adequate pipe ventilation.
- invert line, that are to be calculated under the assumption of uniform and permanent flow, must not be higher than 75% the pipeline's diameter for Q_f.
- whenever, for a given flow, the downstream line's invert is higher than the lower invert of the upstream pipes that convey for a given inspecting unit, this height must be subtracted from the downstream line so as to level them.

7. COMPUTATIONAL SUPPORT ASPECTS

Working with Manning formula demands some sort of algebraic maneuvering, so as to allow the professional apply some converging iterative equation solving method. One feasible approach is to use hydraulic equations that may derive from the trigonometric relations shown below.



$R = A/P = D * (\theta - \sin\theta)/ 4\theta;$

$A = D2 \ (\theta - \sin\theta) / 8.$

Then it is recommended to arrange these three equations with Manning's and continuity's, should the results be input to some computer-aided sewerage design software. This arrangement which will result in the following new equations:

$$VN1 = (\theta - \sin\theta)/\theta^{0.4} = 22{,}6 * (n\ Q/I0{,}5)^{0.6} * D^{1.6};$$

$$VN2 = (\theta - \sin\theta)/\theta^{1/7} = ((1007{,}93684 * Q * n)\ /(D^{13/6} * \sigma^{1/2})^{6/7};$$

$$VN3 = (\theta - \sin\theta)/\theta^{0.4} = ((2^{13/3} * Q * n)/(D^{8/3} * I^{1/2}))^{3/5}.$$

For solving these equations it is suggested to generate a column with the results of the θ equations for a list of θs and by using the result of the right side of the hydraulic equation, to find the θ that solves the problem. With θ and other givens the flow characteristics are found.

For the Nicaragua Water and Sanitation Project, under preparation, the SewerEx, a Windows-based computer program for sewerage design and costing. It has also been developed envisioning to encourage the participation of INAA professionals in the non-conventional, low-cost sewerage approach by using an updated technical tool. The two attached screen printouts give a flavor of said computer program.

8. CONSTRUCTION ASPECTS

- before the choice is made, the designer should run a thorough cost-effectiveness comparison between street single lines and street parallel lines, also stressing the pros and cons of adopting either alternative.
- especially when crossing narrow streets and/or streets non-used by heavy vehicles, conventional and expensive manholes are to be replaced by simpler inspection units. Nevertheless use of manholes is still mandatory when pipe depth is higher than 3.0 m;
- on pipe onsets inspection chambers may well be replaced by simpler inspection/cleansing units. Recent experiences recommend that this units be hookable to water pressured hoses from maintenance vehicles for eventual pipe blockages.
- for a given inspection chamber, drop pipes are to be employed when the downstream line is placed 0.5 m or lower regarding the lowest incoming pipe;
- pipe excavation depth should be the shallower possible till a level that do not put the sewer in jeopardy. For practical purposes a minimum depth excavation of 0.30 m is recommended. The reader shall note that street double lines, that are quite often laid down the sidewalks, in general require shallower excavation depths than single ones as the latter may be subject to heavy vehicle loads. This fact is to be duly explored by the designer towards the project cost effectiveness.

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9.2 AUGFER (Sewerage Design Software), Rio de Janeiro, 1978, Augusto Sérgio Pinto Guimarães and Fernando Carvalho Seixas Filho.

9.3 REDES DE ESGOTOS SIMPLIFICADAS (Simplified Sewerage) -- Manual Técnico 1, MDU (Ministry for Urban Development and Environment) and PNUD (United Nations Development Programme), text technically coordinated by Augusto Sérgio Pinto Guimarães, 1986, 243 pages, Brazil;

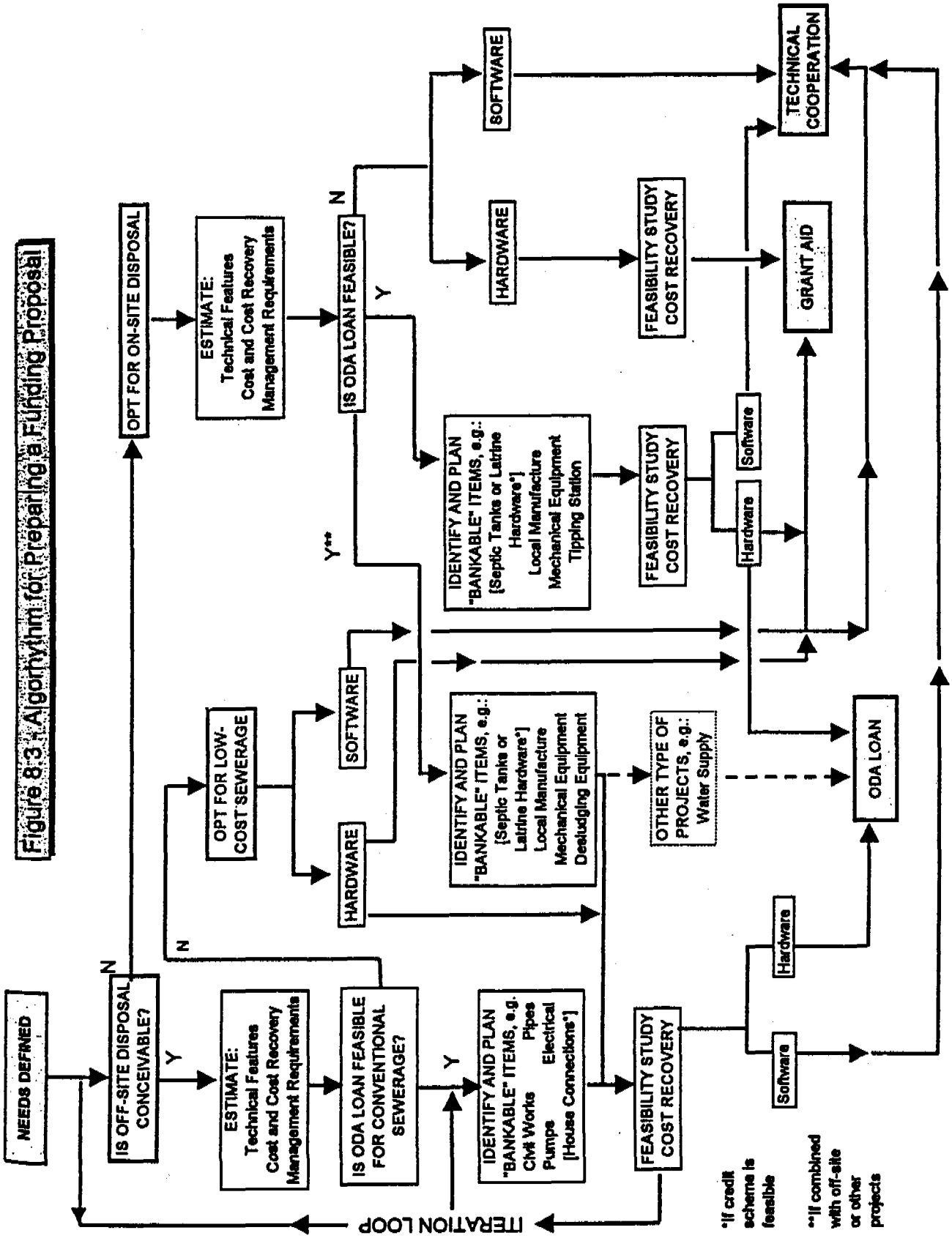
9.4 PROJETO DE REDES COLETORAS DE ESGOTO SANITÁRIO (Sewerage Design Code), ABNT (Brazilian Technical Standards Association) -- NBR 9649, 1986, 10 pages, Brazil.

9.5 **PROGRES** (Sewerage Design Software), Rio de Janeiro, 1987, Rita de Cássia Perrot de Melo -- sanitary engineering graduation work, under supervision by Augusto Sérgio Pinto Guimarães.

9.6 **PROGRES II and CUSTOS** (Sewerage Design and Costing Software), Rio de Janeiro, 1990, Rita de Cássia Perrot de Melo, under the supervision by Augusto Sérgio Pinto Guimarães, for The PRO VITA FOUNDATION).

9.7 **DIMENSIONAMENTO HIDRÁULICO DE COLETORES DE ESGOTO USANDO AS FÓRMULAS DE MANNING OU DE COLEBROOK** (SANARE -- Revista Técnica da SANEPAR, Curitiba, v.3, no. 3, p. 1-52, Jan 1995), Celso Savelli Gomes.

APPENDIX 13 Source: JICA "Preparation of Development Plans for Environmental Sanitation in Developing Countries"



block, usually under both pavements (sidewalks) rather than in the middle of the road, as is the case with conventional sewerage.

Costs are low (section 9.5), and can even be lower than on-site sanitation (Figure 9.2). The low costs of simplified (especially condominial) sewerage are due, as in the case of settled sewerage (Chapter 8), to shallow excavation depths, small diameter pipework and simple inspection units in place of large manholes.

Simplified sewerage has also been called shallow sewerage, but this is not a good description as the sewers in settled sewerage (Chapter 8) are also laid at shallow depths (and simplified sewerage uses small diameter sewers, which is why small-bore sewerage is no longer a good description of settled sewerage). (In Portuguese, simplified sewerage is called *redes*

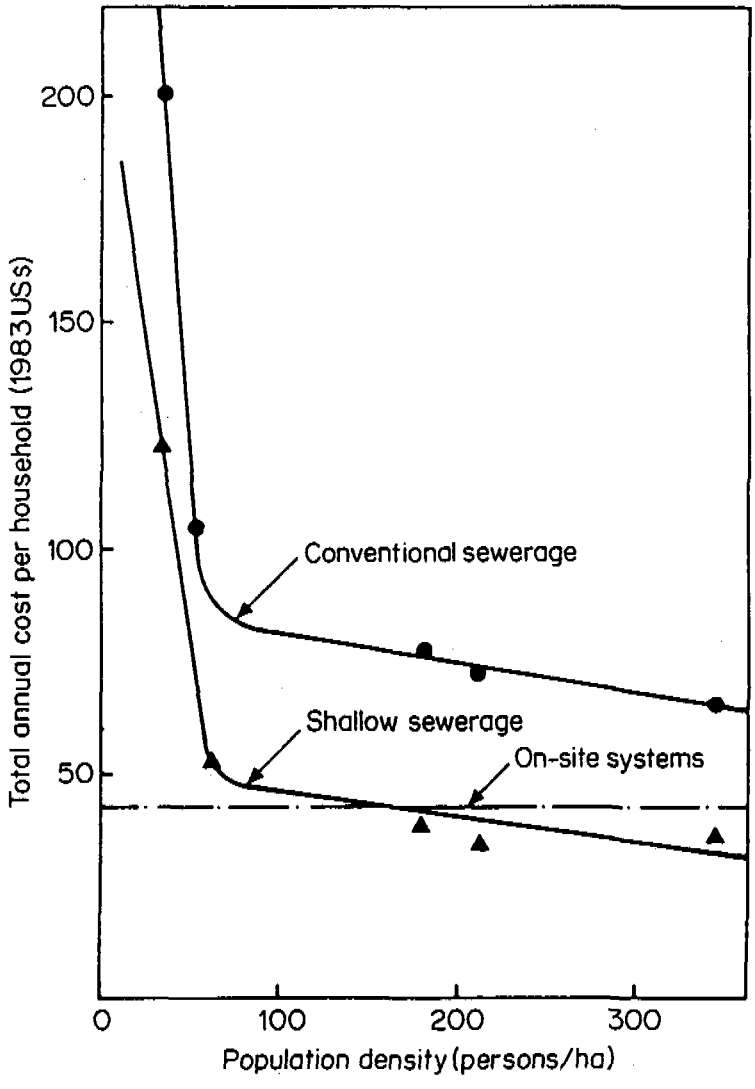


Figure 9.2 Costs of conventional, shallow (i.e. simplified, and, in fact, condominial) sewerage and on-site sanitation in Natal, northeast Brazil as a function of population density. Simplified sewerage became cheaper than on-site sanitation in this case at a population density greater than 160 persons per ha

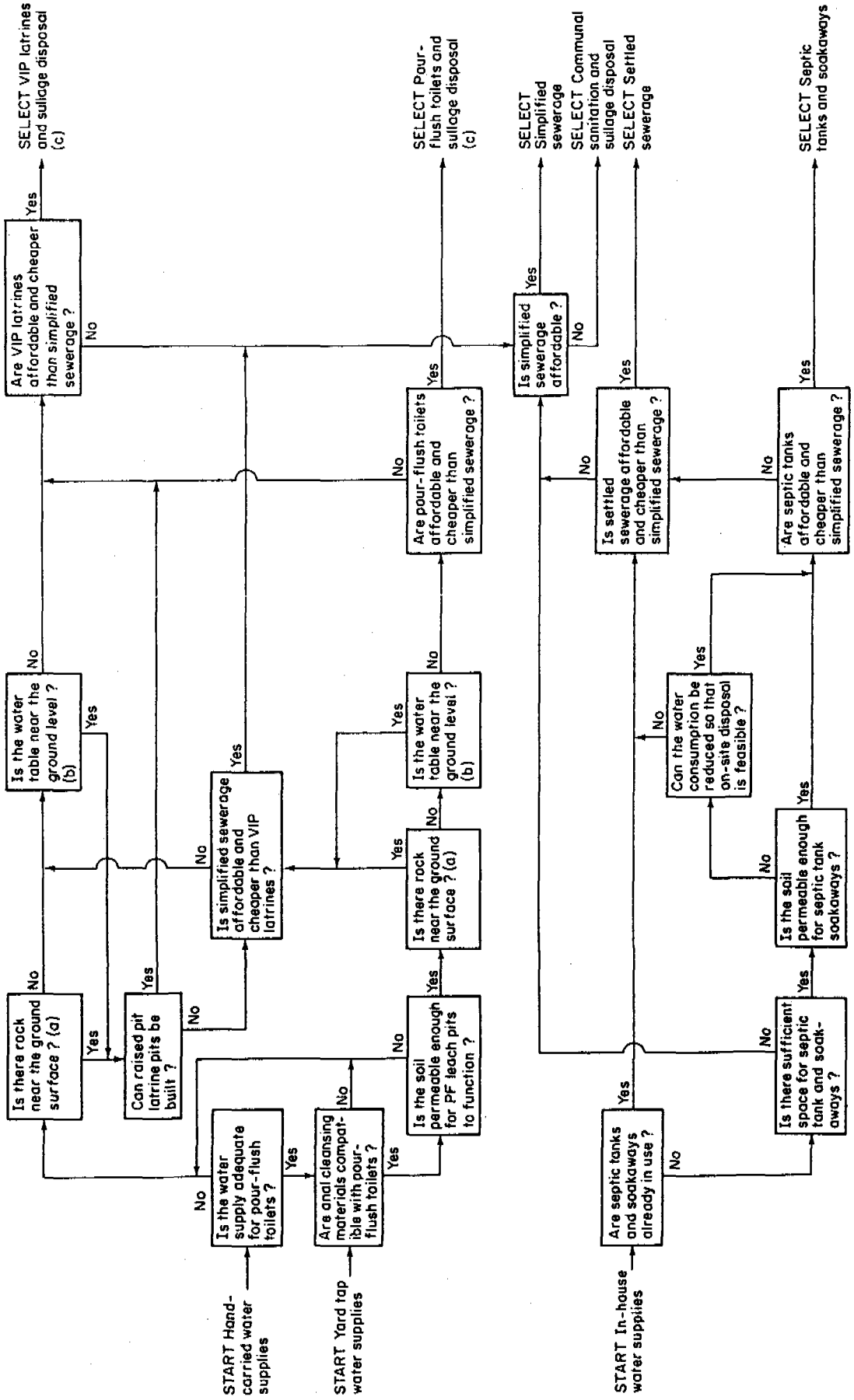


Figure 13.1 Sanitation technology selection algorithm. Notes: (a) to < 1 m; (b) to within 0.5 m either permanently or seasonally; (c) decide between single pits and alternating twin pits

APPENDIX 16

A Guideline for the Improvement of the Operation and Maintenance of Sewage Works in Developing Countries

Committee

Chairman: Prof. Kitawaki, Toyo Univ

Chaired by Members from:

Ministry of Construction, Japan International Cooperation Agency,
Japan Sewage Works Agency, Tokyo Metropolitan Government,
Sapporo Municipal Government, Kyoto Municipal Government,
Japan Sewage Works Association,
Japan Sewage Treatment Plant Constructors Association,
Japan Sewage Treatment Plant Operation and Maintenance Association

Secretariat: Infrastructure Development Institute, Nihon Suido Consultant

Schedule

- Fiscal Year 1 (1996.12 ～ 1997.3)
  - Mission Statement
  - Preparation for the Collection of Information

- Fiscal Year 2 (1997. 4 ～ 1998.3)
  - Composition of General Framework
  - Collection of Information (Japan, developing countries, overseas development agencies, etc.)
  - Writing of a Rough Draft for the Guideline

- Fiscal Year 3 (1998. 4 ～ 1999.3)
  - Collection of Information (supplemental)
  - Completion of the Final Guideline

Detailed Outline of the Guideline (Rough Draft)

Part I

Chapter 1 General

1-1 Purpose

The scope of sewage works projects goes beyond mere development of facilities. The success of such projects depends on how the facilities developed are operated and maintained over the long run. The fundamental concept of operation and maintenance (hereinafter called "O&M") is to fulfill the role of sewage works, such as urban storm drainage, public health maintenance and environmental conservation, through optimization of the facilities developed.

What are needed for this concept to take root in developing countries are long-term human resources development and persistent efforts that sustain it. Today, various supporting organizations and international bodies are shifting their focus of assistance from mere facility development towards non-structural approaches illustrated by human resources development and institutional setups. Under such circumstances, Japan also has an ODA scheme to send experts through JICA (Japan International Cooperation Agency) to developing countries as a means of assisting the O&M of sewage works, which can be regarded as a typical non-structural approach.

This guideline is intended to provide guiding principles for the JICA experts sent to developing countries so they can give advice and instructions to local staff in carrying out the O&M of sewage works.

1-2 Scope of the guideline

This guideline is concerned with sewage works which refer to facilities developed for urban drainage and sewage collection and treatment systems in principle. Note that some of on-site treatment and sanitation facilities are also included.

1-3 Definitions of words and terms

Chapter 2 Expected contribution of O&M experts

2-1 Expected contribution of O&M experts

2-1-1 Principal roles of O&M experts

This chapter deals with the following tasks, which are defined as the principal roles of O&M experts:

(1) Provision of technical instructions and advice regarding the proper and effective maintenance of the sewage facilities developed
(2) Feedback of O&M expertise to local staff in charge of planning and design of sewage works
(3) Provision of instructions and advice regarding the failings that are causing technical problems, such as the lack of financial resources and unstable organizational structures
(4) Assistance to human resources development

Note that Chapter 5 deals with (1) to (3) of the above four roles, focusing particularly on (1) and (2).

2-1-2 Collaboration with local staff

This section is concerned with the JICA experts' responsibilities in identifying their local counterpart to collaborate with in executing each task. It is suggested that the local counterpart can be identified through a clear understanding of who (e.g. top level managers, O&M managers, supervisors, operators and trainers) are concerned with what tasks related to the O&M of sewage works (e.g. institutional development, managerial, financial, technical and training tasks).

Note that Chapter 5 focuses on technical issues and is thus intended to be helpful for O&M experts to give instructions and advice to supervisors, operators and trainers in particular.

2-2 Acquirement of necessary information

It would be difficult for the JICA Experts to obtain necessary information efficiently in developing countries due to an inadequate number of organizations having a sufficient collection of information. It may also take time to contact relevant Japanese organizations to request information. The guideline provides lists of who to contact and references that would be used in dealing with O&M issues.

Chapter 3 Present conditions of sewage works in developing countries

This chapter first outlines the socio-economic situations that underlie the sewage issues of developing countries. It then describes the differences in the purpose, concept, implementation system and facility conditions of sewage works between these countries and Japan.

3-1 General conditions

3-1-1 Socio-economic situations of developing countries
3-1-2 Natural characteristics of developing countries
3-1-3 Distinctive roles of sewage system at each phase of national development
3-1-4 Life style and cultural background
3-1-5 Characteristics of sewage
3-1-6 Amount of wastewater
3-1-7 Effluent quality standards

3-2 Implementation system for sewage works projects in developing countries

3-2-1 Administration of sewage works
3-2-2 Implementation system for sewage works projects
3-2-3 Financial situations
3-2-4 Community involvement

3-3 Sewerage facilities in developing countries

3-3-1 Sewage facility development
3-3-2 Collection systems
3-3-3 Wastewater treatment systems

Chapter 4 Facts and issues on the O&M of sewage facilities in developing countries

The O&M issues in developing countries can be categorized broadly into the following: technical problems i.e. lack of expertise in O&M; functional issues of facilities; and institutional and financial issues that underlie the former two. This chapter is concerned with the facts and issues that are particularly notable in developing countries.

4-1 Facts and issues on sewage facilities

4-1-1 O&M of sewers
4-1-2 O&M of treatment plants
4-1-3 O&M of pumping stations
4-1-4 O&M of on-site treatment facilities

4-2 Facts and issues on the institutional framework for the O&M of sewage works

4-2-1 Organizations responsible for O&M
4-2-2 Financial sources for O&M
4-2-3 Human resources development (training of O&M personnel)
4-2-4 Support and cooperation systems
4-2-5 Inadequate laws and regulations
4-2-6 Storage of sewerage inventories, records, and specifications
4-2-7 Public relations through promotional efforts
4-2-8 Ethical issues
4-2-9 Lack of equipment and parts
4-2-10 Developing countries' dependent attitude towards foreign aid
4-2-11 Inadequate standards and guidelines

4-3 Concluding remarks on the facts and issues on the O&M of sewage facilities in developing countries

Part II

Chapter 5 Guideline

(1) The tasks involved in the O&M of sewage works range widely. They include general affairs management, budget execution, sewage rate and charging system management, asset management, public relations, instructions for house connections, monitoring of and instructions for industrial wastewater, facility maintenance and operational control, inventory maintenance, water quality control, environmental conservation and emergency measures. This chapter covers general subjects related to the overall tasks, focusing particularly on technical issues.

(2) The chapter is mainly concerned with what are distinctively different from Japanese practice. For example, the chapter focuses on the treatment systems common to developing countries, and when explaining systems common in Japanese practice, e.g. the conventional activated sludge process and oxidation ditch system, it merely touches upon the points to be noted in the context of climate and rainfall differences.

(3) While developing countries share many common O&M issues, the organizational, institutional and meteorological conditions differ from country to country. It is thus difficult to show globally applicable indexes or comprehensive ideas. Therefore, the explanatory parts of this guideline are limited to a simple presentation of various numerical values and examples. Through experimental application of these numerical values and examples which appear in references for this Chapter, the JICA experts will be able to establish relevant guidelines and/or training materials best suited for use in the countries they are sent to.

(4) The structure of this guideline is modeled on "the Guideline for Operation and Maintenance of Sewerage System" (edited by Japan Sewage Works Association, in Japanese). The following list contains the other literatures to be referred to when compiling the explanatory parts of this guideline:

- *OPERATION AMD MAINTENANCE OF URBAN WATER SUPPLY AND SANITATION SYSTEMS/ WHO*
- *MANUAL FOR OPERATION AND MAINTENANCE OF SEWAGE WORKS*

(THAILAND)/ JICA

- *WASTEWATER STABILIZATION PONDS - PRINCIPLES OF PLANNING AND PRACTICE/ WHO*
- *A GUIDE TO THE DEVELOPMENT OF ON-SITE SANITATION/ WHO*
- *LINKING TECHNOLOGY CHOICE WITH OPERATION AND MANINTENANCE FOR LOW-COST WATER SUPPLY AND SANITATION/ WHO*
- *MAINTENANCE AND OPERATION OF RURAL WATER SUPPLY AND SANITATION SYSTEM: A TEACHING MODULE PREPARED BY WEDC AND CEHA*
- *OPERATION AND MAINTENANCE OF WASTEWATER TREATMENT PLANTS VOL. 1&2/ US-EPA*
- *OPERATION OF MUNICIPAL WASTEWATER TREATMENT PLANTS- MANUAL OF PRACTICE WEF*

A draft of the guideline is shown below.

5-1 General

5-1-1 Fundamental idea of O&M work

The fundamental idea of O&M work is to fulfill the purpose of sewage works by optimizing the functions of facilities such as sewers, pumping stations and treatment plants.

5-1-2 Scope of O&M work

The tasks involved in O&M work include general affairs management, budget execution, sewage rate management, asset management, instructions for house connections, monitoring of and instructions for industrial wastewater, facility maintenance and operational control, inventory maintenance, water quality control, environmental conservation and emergency measures.

5-1-3 Organizational structure of O&M work

- Organizations should be established which have enough numbers of personnel for executing proper O&M work.
- Appropriate personnel should be appointed on the basis of competence and qualifications in an adequate and rational way.
- The role of each job classification should be clearly defined, and the framework in which responsibilities are undertaken should be established.
- It is advisable to seek outsourcing opportunities when it seems to be an advantageous alternative from the viewpoint of economy and efficiency enhancement.

5-1-4 Financial sources for O&M work

- Proper sewage rates should be implemented, which also should be collected without fail.
- The amount of uncharged influent such as infiltration should be monitored.
- Continuous efforts to reduce O&M costs should be encouraged.

5-1-5 Training of technical staff in charge of O&M work

Continuous training should be implemented for technical personnel to sustain the standard of O&M work.

5-1-6 Procurement and storage of equipment and parts

Relevant procurement procedures should be established to manage equipment and parts properly. It is also necessary to keep adequate storage spaces and carry out inventory control.

5-2 Sewerage inventories

5-2-1 Compilation of inventories

- Surveys should be carried out on existing facilities when developing sewerage inventories.
- It is desirable that the inventories consist of survey records and drawings.

5-2-2 Storage and updating of inventories

- Inventories should be kept in extreme security with separate backup copies.
- When any modification is made on facilities, inventories should be updated as correctly and swiftly as possible.

5-3 O&M of sewers

5-3-1 Procedures for the O&M of sewers

Sewers should be operated and maintained properly, according to an established set of procedures consisting of inspection, cleaning and dredging, and renovation and repair.

5-3-2 Maintenance inspection

- Sewers should be inspected regularly.
- Besides physical matters such as sediment and sewer damages, inspectors should be on the alert for wrongly connected pipes and illegal connections.
- Safety of inspectors should be ensured at any time.
- Status of inadequate sewer capacities should be identified, based on sewage planning and the results of surveys on the amount of sewage.

5-3-3 Cleaning and dredging

- Removal of sediment should be carried out according to the results of inspection and surveys.
- Sediment in major sewers should be removed before rainy seasons.

5-3-4 Renovation and repair

- Execution plans for renovation and repair should be formulated according to the results of inspection and surveys.
- When formulating the execution plans, positive precautionary measures such as protective works should be included from the life-cycle point of view.
- Renovation and repair work should be executed based on the plans thus formulated.

5-3-5 House connections

- Publicity efforts should be made to disseminate the importance of proper maintenance of house connections among the public.
- Wrongly connected pipes and illegal connections should be prevented through regular inspection of house connections.

5-3-6 Trouble shooting

Swift and proper actions should be taken in the event of troubles.

5-4 O&M of pumping stations

5-4-1 Screens and grit chambers

Proper flow velocities should be maintained through daily inspection.

5-4-2 Gates and valves

- Gates and valves should be activated at least once a year to confirm that no abnormal conditions such as leakage are being developed.
- Gates and valves should be cleaned and painted regularly.
- The operation instruction should be clearly indicated nearby to prevent incorrect operation.

5-4-3 Pumps

- Where supplementary pumps are installed, they should be operated in turn so as to be activated at least once a week.
- The following points should be remembered when operating pumps:
  - Pressure gauges and ammeters should be monitored at all times to ensure that everything is being normal.
  - Special attention should be paid in the monitoring of ammeters to prevent the motors from being overloaded due to the clogging of foreign materials.
  - It is advisable to leave discharge valves fully open during the operation of pumps.
  - When pumps are first operated after repair work, they should be filled with water to remove air from the sewers.
- A table listing standard inspection items and frequencies is provided for reference. (N.B. The table is not attached here.)

5-4-4 Renovation and repair

- Execution plans for renovation and repair should be formulated according to the results of inspection and surveys.
- When formulating the execution plans, positive precautionary measures such as protective works should be included from the life-cycle point of view.
- Renovation and repair work should be executed based on the plans thus formulated.

5-4-6 Trouble shooting

Swift and proper actions should be taken in the event of troubles.

5-5 O&M of treatment plants

5-5-1 General considerations

- Adequate numbers of O&M personnel should be assigned.
- Operation manuals for equipment should be compiled.
- Relevant operational systems should be established for each of ordinary, unusual and emergency situations.
- Design and as-built drawings/specifications should be preserved.
- Operational status should be recorded in daily reports.
- Related laws and regulations must be complied with.

5-5-2 O&M of treatment plants with processes common in Japan

- Japanese guidelines should be referred to in the O&M of ordinary treatment plants.
- However, note that differences in natural conditions such as climate between Japan and the respective developing country should be properly taken into account.

5-5-3 O&M of stabilization ponds

- Daily duties consist of the monitoring and recording of air temperature and meteorological conditions, and visual observation.
- Weeding and extermination of injurious insects and animals should be performed at appropriate times.
- Water quality should be monitored regularly to improve the treatment performance.
- Bottom sediment should be dredged at appropriate times.
- Maintenance staff's safety should be ensured. It is preferable to enclose the ponds with fences as a safety precaution for local residents.

5-5-4 O&M of aerated lagoon

- Daily duties consist of the monitoring and recording of air temperature and meteorological conditions, and visual observation.
- In the visual observation of mechanical aerators, full attention should be given to find floating objects such as floodwood that would cause damages. In the case of diffused aeration, ruptures in diffuser tubes and dead spaces are the objects of visual observation.
- Weeding and extermination of injurious insects and animals should be performed at appropriate times.
- Water quality surveys should be monitored regularly to improve the treatment performance.
- Bottom sediment should be dredged at appropriate times.
- Maintenance staff's safety should be ensured. It is preferable to enclose the ponds with fences as a safety precaution for local residents.

5-5-5 Renovation and repair

- Execution plans for renovation and repair should be formulated according to the results of inspection and surveys.
- When formulating the execution plans, positive precautionary measures such as protective works should be included from the life-cycle point of view.
- Execution of renovation and repair work should be based on the plans thus formulated.

5-5-6 Trouble shooting

Swift and proper actions should be taken in the event of troubles.

5-6 Electrical installations

5-6-1 O&M of electrical installations

- Electrical installations should be inspected according to their environments, operational statuses, loading conditions and criticality at appropriate times.
- Standby generator systems should be provided so as to deal with power failure without delay.

5-7 On-site treatment facilities

5-7-1 O&M of on-site treatment facilities

- The sludge produced from on-site treatment facilities should be discharged appropriately, and treated at night soil treatment plants where possible.
- When processing such sludge at a sewage treatment plant, much attention should be taken in speeding up the progress of sludge sedimentation in treatment ponds. Precautionary measures in such cases include increase of dredge frequencies.

5-8 Water quality control

5-8-1 Effluent quality control

- To conserve the quality of receiving waters properly, treatment facilities should ensure that proper treatment functions are maintained and that regulations related to water quality are conformed to.
- In particular, where treated wastewater and sludge are reused for agricultural purposes, special attention should be given from the environmental and sanitary points of view.

5-8-2 Water quality monitoring

- Water quality should be monitored at appropriate times to check the performance of treatment plant and conform to regulations.
- Monitoring records should be preserved in a proper manner.

5-8-3 Pretreatment facilities

- Effluent standards should be established against the discharge of industrial wastewater into public sewer systems. Development of industrial pretreatment facilities should also be made mandatory.
- Discharge from pretreatment facilities should be monitored regularly.

5-9 Safety and sanitary control

5-9-1 Safety and sanitary control

- Because O&M work involves hazardous operations such as works on underground or high sites and inside ponds or tanks, and the handling of electrical and mechanical equipment, much care should be taken to ensure the safety of workers.
- In addition to many kinds of pathogenic organisms that are naturally contained in sewage, local characteristics of sanitary conditions should be taken into account. All the personnel in charge of O&M should be fully aware of the importance of thorough sanitary control.
- Where poor working conditions such as oxygen deficiency or production of poisonous gas are expected, special efforts should be made to ensure the safety of workers through assessment of risks.

Part III

This part provides necessary pieces of information and their sources for the JICA experts, which would be useful in giving local staff instructions and advice regarding the O&M of sewage works.

APPENDIX 17

May 8, 1998

Observation of Failure Cases Found in Cirebon City, Indonesia

Hidetoshi Kitawaki,
Toyo University
(Formerly the coordinator, INTEP)

The International Environmental Planning Center (INTEP) at the University of Tokyo carried out a field surveys in Cirebon City at Jawa island of Indonesia from 1993 – 1996, to identify problems in sewage system. INTEP found out the following points, which is commonly found in developing countries.

- Failure in simplified sewer system

Generally, shallow sewer pipes with less gradient should be maintained frequently to avoid sludge accumulation in pipes. People have to open manhole every week and flush with some bucketful of water. It takes peoples time and lead to the damage to concrete made manhole lids. As a matter of fact, the topographical condition of the Cirebon City is almost flat with slope around 0-3% and with 6m high above sea level.

According the survey results, total area surveyed is around 2ha and has 427 peoples with 91 families. This area called as "Perumnas (newly developed housing complex)" had been developed since 1972 as a residential estate of the City. The average water consumption was about 157 l/capita/day in 1996.

As individual sanitation facility of the area, pour-flush toilet connected to sewer line is most popular system. Almost houses are connected to sewer lines. They discharge their gray and/or black water into sewer lines. However, it has been observed that some of them discharge to road side gutter directly without any pre-treatment. For security reasons, people block backyard paths by constructing gates. As sewer pipes are constructed in the paths, workers sometimes cannot desludge from such pipes.

- Failure in privately maintained sewer pipes

In the Perumnas, operation and maintenance was entrusted to peoples organization, which didn't work well. It caused clog in pipes and people chose to connect wastewater discharge pipes directly to roadside gutters as mentioned above.

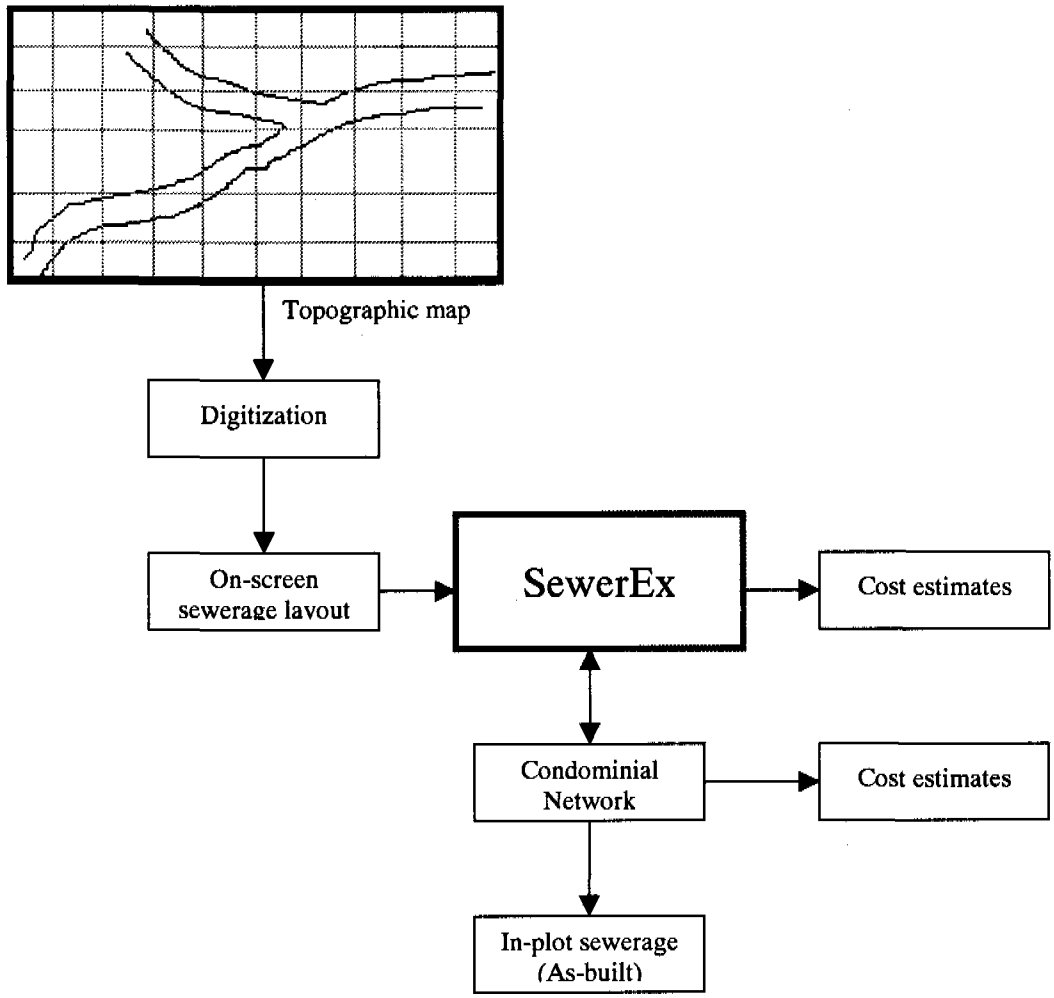
As a final wastewater treatment facility of the area, one oxidation (stabilization?) pond was supposed to pump-up the wastewater has been constructed. However, the pond has not been used for many years, due to a pump has been under out of order. In the long run, the sewer line was cut off at a point just before the pumping station, and all gray and black water collected into the sewer lines from this area is discharging at this point into a canal, which is flowing beside the pond into a nearest sea, whereas stabilization pond is empty. The Cirebon Municipal water Supply Enterprise (PDAM) is planning to undertake O/M directly.

- Summary

1) Clogging problems exist in the sewer lines and the road side gutter.
2) There is no organization for O/M for the sewerage and the road side gutter.
3) Desludging activity has been carried out by the community rarely.
4) There is no periodical inspection in the area.
5) An oxidation pond as final treatment facility has been out of ordered.
6) All gray and black water are discharging to a canal directory.
7) There exist water born diseases like diarrhea and skin.

APPENDIX 18

Low-cost sewerage flowchart



APPENDIX 19

Technical Meeting on the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities Clearing-house

UNEP(WATER)/LBA/C-H.1

Geneva, 26-27 September 1996

REPORT OF THE MEETING[1]

Draft, 16 October 1996

I. INTRODUCTION

1. The Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, adopted in Washington, DC, in November 1995, called for the creation of a clearing house mechanism, as a referral system through which decision makers at the national and regional level are provided with access to current sources of information, practical experience and scientific and technical expertise relevant to developing and implementing strategies to deal with the impacts of land-based activities.

2. Paragraph 46 of the Global Programme of Action called for the establishment of "an inter-organizational group composed of relevant international organizations to coordinate the basic design and structure of the data directory as well as its linkages to information-delivery mechanisms. This group would be responsible for establishing a common format for the individual source-category components and for cross-referencing among components. It would include representatives of each lead organization responsible for coordinating development of individual data-directory components, those responsible for information-delivery mechanisms, and experts on information technology and other relevant fields."

3. The United Nations General Assembly draft resolution on institutional arrangements for implementation of the Global Programme of Action, prepared by Government representatives at the fourth session of the Commission on Sustainable Development (New York, 18 April-3 May 1996) calls upon States to take action in the governing bodies of relevant intergovernmental organizations and programmes, so as to ensure these organizations and programmes take the lead in coordinating the development of the clearing-house mechanism with respect to the source categories agreed in the Global Programme of Action.

4. As a first step to establishing the above-mentioned inter-organizational group, the United Nations Environment Programme (UNEP), as Secretariat of the Global Programme of Action, convened an ad hoc meeting with representatives of the Food and Agriculture Organization of the United Nations (FAO), International Atomic Energy Agency (IAEA), International Maritime Organization (IMO), Intergovernmental Oceanographic Commission (UNESCO-IOC), United Nations Development Programme (UNDP), United Nations Industrial Development Organization (UNIDO), World Health Organization (WHO), and the World

[1] Due to lack of sufficient time and that the meeting considered discussions on these issues premature, items 7-8 of the agenda were not discussed and are therefore not included in the report.

Meteorological Organization (WMO) and UNEP (Regional Office for Europe, the Division of Environmental Information and Assessment and the UN System/Wide Earthwatch, the Global Environment Facility Unit, the International Environment Technology Center, and the Water Branch), in Geneva, 15-16 May 1996 (UNEP (WATER)/LBA/IS-IA.1/6). These agencies agreed to collaborate with available resources; however, they also pointed out that their active participation in implementation of the Global Programme of Action will depend on action by the governing bodies of each agency.

5. The present technical meeting was convened by UNEP in response to the recommendations of the above ad hoc meeting, to prepare the initial specifications for the clearing-house drawing on established systems.

II. OPENING OF THE MEETING

6. The meeting was opened by Mr. Arthur Dahl, Deputy Assistant Executive Director, Division of Environmental Information and Assessment (DEIA) and Coordinator UN System/Wide Earthwatch, UNEP, on behalf of Ms. Elizabeth Dowdeswell, Executive Director of UNEP, at 10:00 hr on Thursday, 26 September 1996. He briefed the participants of the background and purpose of the meeting.

7. The meeting was attended by representatives of six Governments (Australia, Canada, The Netherlands, People's Republic of China, Poland and United States of America), three United Nations agencies (UNESCO-IOC, WHO and UNEP) and five regional programmes [Coordinating Unit for the Mediterranean Action Plan (MAP), South Asia Cooperative Environment Programme (SACEP), South Pacific Regional Environment Programme (SPREP), Oslo and Paris Commissions (OSPAR), and Black Sea Environmental Programme (BSEP)]. In addition, the Chemical Industries Branch of Industrial Sectors and Environment Division of UNIDO and the Consortium for International Earth Science Information Network (CIESIN) provided comments/information in writing.

8. The full list of participants is attached as Annex I to the present report.

III. ORGANIZATION OF WORK AND ADOPTION OF THE AGENDA

9. The meeting was chaired by Mr. Arthur Dahl. Mr. Omar Vidal of UNEP's Water Branch acted as technical secretary and rapporteur. The meeting adopted the agenda on the basis of the provisional agenda (Annex II). The list of documents available to the meeting is attached as Annex III.

10. The representative of UNEP's Water Branch briefly reviewed the events leading to the present meeting, particularly on actions taken by UNEP, as Secretariat of the Programme of Action, in cooperation with Governments, agencies/programmes and intergovernmental and non-governmental organizations, since the adoption of the Global Programme of Action in Washington.

IV. REVIEW OF SPECIFICATIONS FOR THE CLEARING-HOUSE AND RELATED POLICY AND DEVELOPMENT IN UN INFORMATION SYSTEMS

11. The chairman introduced Working Paper 2, which is attached as Annex IV. The paper pointed out that paragraphs 42-49 of the Global Programme of Action provided detailed guidance on the form and content of the clearing-house mechanism, as follows:

"Clearing-house

"As a means of mobilizing experience and expertise, including facilitation of effective scientific, technical and financial cooperation, as well as capacity-building, States should cooperate in the development of a clearing-house mechanism, i.e., a referral system through which decision makers at the national and regional level are provided with access to current sources of information, practical experience and scientific and technical expertise relevant to developing and implementing strategies to deal with the impacts of land-based activities. The referral system would be designed to allow decision makers to establish rapid and direct contact with the organizations, institutions, firms and/or individuals most able to provide relevant advice and assistance. It would therefore be a mechanism for responding to requests from nations' Governments on a timely basis. The clearing-house would consist of three basic elements:

(a) A data directory, with components organized by source-category, cross-referenced to economic sectors, containing information on current sources of information, practical experience and technical expertise;

(b) Information-delivery mechanisms to allow decision makers to have ready access to the data directory and obtain direct contact with the sources of information, practical experience and technical expertise identified therein (including the organizations, institutions, firms and/or individuals most able to provide relevant advice and assistance);

(c) Infrastructure - the institutional process for developing, organizing and maintaining the directory and delivery mechanisms.

"Data directory. The data directory would include a component for each source-category delineated in this Programme of Action. Each such component would contain descriptions and contact information for each existing database and source of practical information and technical expertise. The descriptions and contact information would allow decision makers to determine which sources of information, experience and expertise are most relevant in a given situation and to contact these sources quickly. A key prerequisite for maintaining the directory is regular review of the descriptions and contact information to ensure that it is up-to-date. For each source-category, the relevant databases and sources of information, experience and expertise are likely to be dispersed among a large number of institutions and repositories, including global and regional organizations and national Governments, the private sector and non-governmental organizations. These institutions and repositories should be fully involved in the development of the data directory component for that source-category. In this way, the directory and its components should be built upon, not replicate, the work of organizations such as the World Bank, the United Nations Development Programme (UNDP), UNEP, including the UNEP International Cleaner Production

Information Clearing-house (UNEP/ICPIC), the International Atomic Energy Agency (IAEA), the International Maritime Organization (IMO), the Food and Agriculture Organization of the United Nations (FAO), the United Nations Centre for Human Settlements (UNCHS) (Habitat), the United Nations Industrial Development Organization (UNIDO), the World Health Organization (WHO) and the Arctic Monitoring and Assessment Programme (AMAP). It should in addition make full use of the Small Island Developing States Network (SIDS-NET). Where appropriate, it should also draw upon the work of other intergovernmental and non-governmental organizations and the private sector.

"Each data-directory component should be organized so as to identify:

(a) Sources of current information, practical experience and technical expertise on:

(i) the nature, pathways, fate and effects of the contaminants or other forms of degradation, including data-quality assurance techniques;

(ii) Standards and reference methods for monitoring contamination, as well as its concentrations, or other forms of degradation, including biological-effects monitoring and data-quality assurance techniques;

(iii) Policies, measures and strategies for action, including mobilization and generation of resources, that have been successfully applied (and those that have been unsuccessful) in addressing activities generating the source-category contaminants or other forms of degradation (what works and what does not); and

(iv) Economically rational, environmentally sound and cleaner practices, techniques and technologies to prevent, mitigate and/or control adverse impacts on the marine environment of land-based activities;

(b) Sources of relevant information:

(i) In international and regional organizations (including non-governmental organizations) with relevant expertise and experience; and

(ii) Concerning intergovernmental and private sources of assistance, scientific, technical and financial, including such matters as the terms and conditions for the provision of such assistance.

"Information-delivery mechanisms. The clearing-house mechanism must include simple and widely available means of gaining entry to the directory and retrieving information from its components, including directing inquiries to the organizations, institutions, firms and/or individuals most able to provide relevant advice and assistance. In other words, the data directory must be easily accessible to decision makers on a real-time basis. The objective would be user-friendly access to the data directory and its components through electronic means. The World Wide Web on the Internet offers such a basic access mechanism. It is recognized, however, that the Internet is not universally available. It is important, therefore, to also use and build upon existing information-delivery systems, including the UNDP network

of resident representatives, INFOTERRA, and linked regional systems including the secretariats of regional seas and other regional conventions.

"Infrastructure. The development, organization and maintenance of the data directory and its components and the delivery mechanisms have both specific (source-category) and general dimensions. At the general level, an inter-organizational group should be established by the relevant international organizations to coordinate the basic design and structure of the data directory as well as its linkages to information-delivery mechanisms. This group would be responsible for establishing a common format for the individual source-category components and for cross-referencing among components. It would include representatives of each lead organization responsible for coordinating development of individual data-directory components, those responsible for information-delivery mechanisms, and experts on information technology and other relevant fields.

"For each source-category component of the data directory, a lead organization should be designated to convene or designate a group of experts to develop the content of specific entries for that component. Issues such as ensuring that entries meet quality and relevance criteria and keywords or search items relevant to the source-category would also be the responsibility of each group of experts. There would be provision to reconvene each such group periodically to update the source-category component, including ensuring that the sources of information, practical experience and technical expertise are relevant and do represent the best sources.

"Recognizing that many developing States may not have the necessary capacity to benefit from the clearing-house mechanism, this process of implementation should provide for capacity-building, including technical training and infrastructure development.

"The clearing-house mechanism should be designed to include feedback functions to provide for its refinement and evolution to meet the needs of its users. These feedback functions include:

(a) Identification of data and information gaps and recommendations as to how to address such gaps;

(b) Identification of training and infrastructure requirements for those using the clearing-house mechanism;

(c) Provision for establishment of links between the clearing-house mechanism and regional agreements, institutions and centres holding information, experience and technical expertise of specific relevance to the regional concerned."

Intersecretariat/interagency consultation on implementation of the Global Programme of Action

12. Working Paper 2 also summarizes the results of the joint interagency/intersecretariat consultation on implementation of the Global Programme of Action mentioned in paragraph 4 above. The consultation decided to start the gradual development of a clearing-house mechanism making use of existing systems and experience. The consultation reviewed paragraphs 42-49 of the Global Programme of Action and recognized that the proposed

clearing-house would require human and financial resources which are not now fully available. It was agreed to approach the issue pragmatically, starting now with what could be done within existing resources, and also working to ensure that efforts to raise the substantial new funding necessary to implement the Global Programme of Action would make more resources available for the clearing-house mechanism. The first step should not involve an advanced system, but rather concentrate on what can be done by adapting and making wider use of existing materials, including the Internet. The mechanism can then grow through a step-wise approach in quality and quantity, as it demonstrates its usefulness.

13. The consultation agreed that this initial phase of the clearing-house should emphasize access to sources of information and expertise, rather than trying to directly provide technical information. This could include institutions and individual experts in relevant fields, methodologies, national and regional decisions and actions, legislative texts, regulations and standards, and bibliographic references to useful documentation. Information useful for funding activities of the Global Programme of Action and for "brokerage" between needs and sources of assistance should be assembled by the Global Programme of Action Coordination Office in UNEP.

14. Because many different user groups and sources of information are involved in the broad area of land-based activities affecting the marine and coastal environment, it will take some time to identify all information sources, and to respond to the requirements of users. It was essential that the clearing-house should reflect and respond in a practical way to user needs. Thus, it would be desirable to allow it to evolve organically in response to those needs, rather than investing in an elaborate system that might not subsequently prove cost-effective.

15. UNEP's Water Branch has overall responsibility for implementation of the clearing-house, to be given specifically to the Global Programme of Action Coordination Office once it is in place. The intersecretariat/interagency consultation served as the first ad hoc meeting of the inter-organizational group to design the clearing house system, as proposed in paragraph 46 of the Global Programme of Action.

V. SUMMARY OF PRESENTATIONS AND ANALYSIS OF EXISTING SYSTEMS

16. Participants summarized the activities and experiences of their Governments/ agencies/programmes relevant to the clearing-house.

COUNTRIES

Australia

17. As part of implementation of new national policies on coastal management, a major programme has commenced to make information available on the Internet. Based on needs identified through market research, a system of World-Wide Web (WWW) interfaces is being finalized for launching within the next two months. The system is based on a distributed network which draws together the marine and coastal information resources of many organizations. Major components will include meta database on data holdings, details of experts, bibliography, policy and legislative information, and geographic information. The

GPA - Clearing-house mechanism
Demonstration project for sewage

1. Background

The "clearing-house mechanism" is a referral system which provides access to current sources of information, practical experience and scientific expertise relevant to developing and implementing strategies to deal with the impacts of land-based activities. It should ideally be built-up on Internet.

The target user is a mid-level officer in a national or regional authority.

In more detail, the information and expertise referred to should include the following:

- Characteristics, behaviour and effects of pollutants
- Standards and reference methods for monitoring contamination
- Policies, measures and strategies for pollution prevention/reduction
- Sound and cleaner practices and technologies
- Contact addresses of experts
- Possibilities for mobilization of resources
- Training possibilities

This system should permit feed-back operations of users.

2. Description of work to set up the demonstration project for sewage

Setting up the project consists in several basic steps:

1. Identify the users' needs of information
2. Investigate the users' possibilities of access to electronic networks (e.g. Internet)
3. Design the system
4. Identify existing data bases and information
5. Sort and filter the information
6. Link the system to data bases/information
7. Test operation of the system
8. Continuously up-date the system

APPENDIX 20

An International Source Book of Environmentally Sound Technologies for Wastewater Management

-Toward Making a Sound Decision for the Under-served Communities -

(Draft Outline)[1]

Executive Summary

1. Introduction[2] (3 pages)

2. Background (5 pages)

- A general statement on wastewater management, especially in the developing countries
- Background leading to the publication of the book, and IETC objectives and mandates
- The reasoning as to the application of these principal objectives to wastewater management at this particular time. What's new? **<With due emphasis on how developing countries may wish to begin to engage themselves more rigorously with the planning of piped sewerage systems, the subject not having received as much emphasis in the IDWSSD.>**
- Collaborating international agencies and experts
- Nature of publication (purpose, structure, organization, and scope of the book)
- How to use this book
- Others

3. Assuring environmental soundness and sustainability of wastewater management[3] (12 pages)

- **Meeting the Basic Needs and Requirements**
  - Fulfilling the basic sanaitation needs – public health requirements
  - Protection of the quality of receiving water bodies
  - Urban drainage and flood control requirements

- **Environmental soundness[4](Environmental management considerations):**

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[1] Whether or not to include in the title "stormwater" is still to be debated. The current outline has little mention of stormwater.

[2] The usual type of introduction, including a discussion of the organization of the book and of the training modules, users, and other information e.g. some of the "Guideposts" listed on page 1 of Ms Casanova's "input".

[3] In this Chapter, IETC would (1) explain its basic approach to EST in the light of sustainable development and (2) then discuss what the application of this approach to wwm implies, e.g.

[4] Wastewater management is per se (!) a technology for protecting the environment and, as such, will always have a positive environmental impact. It has been developed with that objective in mind. Yet, in contrast, some of its features need assessment and prevention of a potential negative environmental impact. Further, for optimizing its

(1) as regards potential negative environmental impacts, the book might discuss:

siting of STP (locational effects, public reaction to odor and other public nuisances)

health; occupational health (including dispersion of aerosols containing biological agents)

noise and smell

sludge (usual lack of consideration on final disposal of sludge, heavy metal accumulation)

eutrophication (removal of nutrients limited in conventional secondary treatment systems, cost vs benefit associated with enhanced quality of water)

industrial wastewater (what industries to be allowed to discharge, hazard of combined treatement of industrial wastewaters containing nonbiodegradable toxics, pretreatment requirements)

impact of "make-shift" and / or intermediate solutions (**to be discussed also in depth in Section 4 and 5;** this has a lot to do with the initial condition out of which development of a plan is to be elaborated and with the level of aspiration or the target level of achievement of the project within a given time horizen)

others

(2) as regards the potential of "integration" , the book might consider:

stormwater and flood water management

<Maybe we should have a discussion in a Box form on stormwater management, in relation to Xia Huang paper and other discussion on the subject. Also we should have a brief historical overview of the role of sewerage, and how the combined sewer concept came about as in the case of the City of Osaka.)

other special disposals (e.g., solid wastes in general, oil and grease, detergents, kitchen)

special wastes management (e.g. hospital wastes)

industrial wastewater management (linkage with regulatory programs of industrial wastewater effluent control, relocation of industries to industrial parks, allowing or disallowing wastewaters from small – marginal , pretreatment requirements, etc.)

housing codes and their implications (zoning, urban planning, provision of sewerage accompanied with conversion of on-site non-flash toiltet to flash toilets, etc.)

water supply, esp. reducing water consumption, joint management (financial, etc.)

river basin developmentz (e.g., comprehensive basin-wide planning of sewarage system – BPSS, Japan)

(Prof. Maksimovic presentation on integrated management may be introduced, illustratively in a Box format., as a trend of emerging

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positive impact, the "integration" with other matters should always be investigated. In other words:

importance in developing countries.)

- **Sustainability:**

  compatibility of national and regional development policy (social, economic and environmental)

  compatibility with water resources development

  sound financial basis (subsidy included)

  energy requirements, demand on electricity, etc.)

  linkage with water pricing

  ppp

  effective O+M

  participation and involvement (in various phases of planning, construction and O&M)

  timely planning extensions

  indigenous technologies

  <This subject may be introduced in other sections as well, but has to be discussed with sound philosophical basis. Linking with "sustainability" may be one way to highlight the concept.>

  others

4. Practices and options (100 pages)[5]

- **Past and current practices to be described in terms of:**
  - Problamatic issues of such grossly inadequate sanitation facilities in urban fringe areas, rural areas, etc., in developing countires and other issues (IDWSSD related reviews , Agenda 21 reviews)
  - Some recent encouraging experiences
  - Retrospective review of experiences in developed countries
- **Technology options based on:**
  - Social and economic status of the subject project
  - System scale, spacial requirements and site availability, cost and affordability
  - Community needs and acceptance
  - Specific treatment requirements (target substance, treatment level)
  - Unconventional wastewater sometimes found in devleoping countries including treatment of desalination wastewater, etc.)
  - O&M human resource requirements and considerations
- **Development of soft and hard alternatives, some factors to take into account:**
  <Using Fact Sheets as needed, including description of pros and cons>
  <Description with area maps showing coverage, alternative technologies used, etc. as examples.>
  - Factors affecting temporal and spacial system scale
    - ✓ community-based vs. regional system, etc.

[5] This Chapter would review the technological options and current practices. As regards the latter, it would also provide the rationale. Technology would include both "hardware" and "software"! (see also page 2 of Ms Casanova's "input").

- ✓ consensus building within and among communities
- ✓ mobilization of resources
- ✓ political decision-making
- ✓ land acquisition
- ✓ phasing, expansion, synchronization of sewer system and treatment systems

✧ Linkage with development policy
- ✓ social, economic, environmental
- ✓ national, regional and community levels

✧ Community acceptance
- ✓ coping with public syndromes
- ✓ role of stakeholders

✧ Operations and management principles
- ✓ privatization schemes
- ✓ institutional arrangements
- ✓ legal/regulatory measures, including standards

✧ Economics and the dynamics of technology use
- ✓ the stepwise and / or incremental evolution of wwm in an area in keeping with socio-economic fundamentals (see Fact also INTEP-paper).
- ✓ economies of scale
- ✓ financing and cost recovery
- ✓ criteria for mobilizing external financing resources (e.g., EIA)

5. Making choices and decisions (150 pages)[6]

◆ **Major Planning Issues**

✧ Socio-economic fundamentals

✧ Community needs and aspirations

✧ Engineering considerations

<Using Fact Sheets as needed, including description of pros and cons, using existing literature such as those presented in or to the Meeting, e.g., "Planning Issues and Perspectives in Regkonalization of Wastewater Systems" by Nakamura, etc.>:

□ Sewer system configurations and functions
- ✓ on-site vs. off-site system
- ✓ conceptual basis of a sewerage system
- ✓ combined sewer system and stormwater management
- ✓ advantage of a separate system

□ Treatment of wastewater

[6] The socio-economic fundamentals, institutional and participatory constraints and other factors(Ms Casanova's "input" on its page 3.) Analysis of the factors and conditions which call for an adoption of existing technologies and / or the development of new ones for wastewater management in developing countries. The choices and decisions called for at the various stages of the planning process and / or the project cycle.
Two aspects would be given particular attention: (1) tools which have been developed and can be used, and (2) the information which must be available and /or created before these tools can be used, and when.

- ✓ wastewater quality and system design
- ✓ industrial wastewater
  - an integrated domestic and industrial system
  - industrial wastewater system
- ✓ stormwater and detention basins

- □ Innovative thinking in freshwater management
- □ Etc

◆ **Planning Procedure**

<To emphasize that the track record of transfer of "technology" from developed to developing countries on this subject has been rather miserable due to serious lack of integration of non-engineering factors specific to the subject project, the serious weakness observed of the project promoters in the past. >

✧ Situation analysis

<To describe cases of situation analysis, in a Box format, regarding the provisions in waste management at the outset of the plan making, i.e., how the needs arose, what aspects were regarded as problems or failures of the existing systems, etc. To include those cases reported in the Meeting including the Romanian case reported by Dr. Vladimir Rojanshi, and a paper submitted by Dr. Kitawaki on Cirebon City in Indonesia, etc.>

✧ Scope of planning
- □ target population, region, or activities
- □ the level of service to be provided over periods
- □ planning horizon, etc.

✧ Concept of Alternatives
- □ alternative scopes of plan
- □ technology alternatives (see below)
- □ alternative implementation schemes

✧ Formulation of a feasible plan

✧ Planning scenarios and consequences (Within the contect of long range master plan)

◆ **Basis for Selecting Alternatives Technologies**

✧ Water and waste management

✧ Wastewater and stormwater management

✧ Pollution prevention and minimization

<Mainly using Fact Sheets including description of pros and cons>

- ◆ Basics for wastewater treatment
  - ✓ Natural purification system, etc.
  - ✓ Wastewater origin, composition and significance
  - ✓ Conventional treatment technologies
- ◆ Technical options (or EST options) for
  - ✓ Drainage and collection
  - ✓ Run-off management
  - ✓ drainage control against flooding
  - ✓ runoff pollution control
  - ✓ Sewage conveyance

- ✓ Wastewater treatment
- ✓ Sludge handling and disposal
- ✓ Water reuse
- ✓ Some innovative technologies (including those described in "Ecological Alternatives in Sanitation, Sida Sanitation Whorkshop, Balingsholm, Sweden, August 1997")

- Endogenous technologies and alternatives
- Low cost systems
  - ✓ for low income communities (ex: use of wetlands, etc.)
  - ✓ for large cities (ex: anaerobic biological system)

- Basic principles and considerations to guide technology selection
  - ✓ socioeconomic fundamentals
  - ✓ key engineering considerations
  - ✓ environmentally sound criteria
  - ✓ obstacles/constraints (e.g., NIMBY syndrome; NIMTO)
- Others: underground treatment systems

- **Institutional Considerations and Alternatives**
  - Regulatory framework
  - Institutional requirements
    - construction phase
    - operation of facilities
    - maintenance of facilities
  - Human resource requirements
    - construction phase
    - operation of facilities
    - maintenance of facilities
  - Financing and cost recovery framework
  - Privatization and public-private partnership
  - etc.
- **Decision-making**
  - **Criteria:**
    - affordability
    - socio-cultural appropriateness
    - incremental approach in meeting service demand
    - potential conflicts with
      - existing zoning regulations
      - development standards
    - potential social conflicts
    - etc.
  - **Processes**
    - Decisions in the government hierarchy
    - Social concensus and planning facilitation
      - community initiatives (ex: community participation approaches, self-help approaches, etc.)
    - Compromising conflicting views
  - **Roles of the professionals**

- municipal engineer
- consulting firms
- funding agency personnel
- others

■ **Decision making tools**
<Mainly using Fact Sheets, including description of pros and cons>

- Socioeconomic analytical tools
  - Cost-benefit analysis; indicators; least cost analysis; etc.
- Planning and management tools:
  - perception surveys, environmental
  - profiling
  - rapid assessment for urban management
  - strategic environmental assessment
  - community action planning
  - performance planning and budgetting
  - indicative cost estimation
  - human resource development; etc.
- Technology assessment tools: EnTA; EnRA
  - innovative techniques/ideas
  - information technologies

6. Case studies, including an analysis (30 pages)

◆ Appropriate examples
Brazil, Japan, China, Taiwan, Australia, SIDs, Indonesia, Pakistan, etc.

7. References and addresses (100 pages)
<Should make sure that the past activities of agencies like World Bank, WHO, IRC, AIT, WRC, WEF, properly acknowledged and referred and cited.>

List of information sources (with addresses, including internet sites) located in each region

Regional overviews?
(Overviews based on commonality in technology selection)

Glossary

References

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The International Environmental Technology Centre (IETC) was established by the United Nations Environment Programme (UNEP) in April 1994. It has offices at two locations in Japan - Osaka City and Kusatsu, Shiga Prefecture.

The Centre's main function is to promote the application of Environmentally Sound Technologies (ESTs) in developing countries and countries with economies in transition. IETC pays specific attention to urban problems, such as sewage, air pollution, solid waste, noise, and to the management of fresh water basins.

IETC is supported in its operations by two Japanese foundations: The Global Environment Centre Foundation (GEC), which is based in Osaka and handles urban environmental problems; and the International Lake Environment Committee Foundation (ILEC), which is located in Shiga Prefecture and contributes accumulated knowledge on sustainable management of fresh water resources.

IETC's mandate is based on Agenda 21, which came out of the UNCED process. Consequently IETC pursues a result-oriented work plan revolving around three issues, namely: (1) Improving access to information on ESTs; (2) Fostering technology cooperation, partnerships, adoption and use of ESTs; and (3) Building endogenous capacity.

IETC has secured specific results that have established it as a Centre of Excellence in its areas of speciality. Its products include: an overview on existing information sources for ESTs; a database of information on ESTs; a regular newsletter, a technical publication series and other media materials creating public awareness and disseminating information on ESTs; Local Agenda 21 documents developed for selected cities in collaboration with the UNCHS (Habitat)/UNEP Sustainable Cities Programme (SCP); advisory services; Action Plans for sustainable management of selected lake/reservoir basins; training needs assessment surveys in the field of decision-making on technology transfer and management of ESTs; design and implementation of pilot training programmes for adoption, application and operation of ESTs; training materials for technology management of large cities and fresh water basins; and others.

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