NEEDS ASSESSMENT GUIDANCE TO DEVELOP NATIONAL PLANS FOR DOMESTIC WASTEWATER POLLUTION REDUCTION

Planning Guidance to Fulfill the Requirements of Annex III to the Protocol Concerning Pollution from Land-based Sources and Activities to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region

Wider Caribbean Region
United Nations Environment Programme

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Table of Contents

Chapter Page

1 INTRODUCTION 1-1

1.1 United Nations Environment Programme Role and Responsibility Related to Protection of the Environment....1

1.2 Goal of the Needs Assessment Guidance Document....1

1.2.1 Who Can Benefit From Using This Guidance Document?....2

1.2.2 What is a Sewage Needs Assessment?....3

1.2.3 What is the Purpose of This Sewage Needs Assessment Guidance?…3

2.1 Discharge of Domestic Wastewater....1

2.2 Effluent Limitations....2

2.3 Industrial Pretreatment....4

2.4 Household Systems....4

2.5 Management, Operations and Maintenance....4

3.1 Need for Pollution Mitigation and Control....1

3.2 Planning Goals....2

3.3 The Planning Framework....2

3.4 Getting Started....4

3.4.1 Securing Funding for Program Development....5

3.4.2 Securing Commitment to Participate in a Planning Process....5

3.4.3 Recruiting Staff....5

3.4.4 Identifying Planning and Management Boundaries....6

3.4.5 Developing a Work Plan....6

4.1 Collecting Available Secondary Information....1

4.2 Developing Database and Information Management Systems....1

4.3 Identifying Issues and Needs....2

4.3.1 Institutional Framework and Capacity Building....4

4.3.2 Applicable Policy, Laws, and Standards....4

4.3.3 Public Health Considerations....4

4.3.4 Sensitive Marine Environments....4

4.3.5 Domestic Wastewater Effluent (Discharge) Sources....4

4.3.6 Priorities for Water Pollution Mitigation and Control....5

4.3.7 Pollution Prevention and Resource Conservation....5

4.3.8 Management, Operations, and Maintenance, and Monitoring of Treatment Facilities and Ancillary Structures....5

4.3.9 Stakeholder Identification and Participation....5

Chapter **Page**

4.3.10 Economic Instruments and Financial Resources....5
4.3.11 Integration with Other Water Sector Policies and Other National Plans....5
4.4 Understanding the Needs....7
4.4.1 Summary of General and Specific Needs....7
4.4.2 General Needs....8
4.4.3 Specific Needs....17
4.5 Preparing the National Baseline Assessment Document....47
4.5.1 National Baseline Assessment Objectives....47
4.5.2 Documentation Considerations....48
5.1 Prioritizing Needs....4
5.2 Elements of the National Plan....5
5.3 Strategies for Managing Wastewater....6
5.4 Integration With Other Water Policy Sectors....7
5.5 Process for Adoption of the National DWMP....8
6.1 What is an Action Plan?....1
6.2 Specific Tasks Developed in the Action Plan....2
6.3 Other Consideration in the Development of Action Plans....3
7.1 Monitoring to Assess Progress....1
7.1.1 Monitoring to Assess Planning Progress....2
7.1.2 Monitoring to Measure Water Quality Achievements....3
7.2 Evaluation....4
7.3 Adaptive Management....5
8.1 Information Management....1
8.2 Outreach....2
8.2.1 Who is the Community and Why is Their Input Important?....3
8.2.2 What is the Community Organization Process....3
8.2.3 What Approaches to Involve the Community....3

REFERENCES **R-1**

Appendices

Appendix A Annex III of the LBS Protocol

Table of Contents

Appendix B Needs Assessment Checklist

List of Tables and Figures

Tables

1.1 Key Principals for Policy and Decision-Makers to Support Municipal Wastewater Management

2.1 Types of Domestic Wastewater Management Requirements Under Annex III
2.2 Definition of Class I and Class II Waters
2.3 Timeframe for Meeting Effluent Limits
2.4 Discharge Limits for Class I and Class II Waters Based on a Monthly Average
3.1 Benefits Derived from Managing Coastal Domestic Wastewater Discharges
3.2 Considerations for Development of National Plans
3.3 Key National, Provincial and Municipal Government Requirements for Domestic Wastewater Management

4.1 Issues and Data Needs for the Baseline Needs Assessment.
4.2 Stakeholder Involvement Process
4.3 Funding Analysis
4.4 Types of Legislature Authority Needs
4.5 Types of Governance Needs
4.6 Indirect and Direct Discharges
4.7 Considerations to Classifying Receiving Waters
4.8 Steps in Conducting a Collection System Evaluation
4.9 Steps in Water Reuse Management
4.10 Level of Treatment
4.11 Class I and II Treatment Trains
4.12 Treatment/Disposal of Liquid Effluent from Household System
4.13 Treatment/Disposal of Septage from Household System
4.14 Operation and Maintenance Program Implementation Process
4.15 Typical Information Included in a Domestic Wastewater Needs Assessment
4.16 Categories of Domestic Wastewater Management Facilities
4.17 National Needs Survey Project/Infrastructure Cost Categories

5.1 Planning Roles for National, Provincial, and Municipal Governments
5.2 Example of Ranking Considerations for Planning
5.3 Basic Elements of a National Domestic Wastewater Management Plan
5.4 Time Horizons for Planning
5.5 Types of Domestic Wastewater Discharge Management Strategies
5.6 Integration of Domestic Wastewater Discharge Management with Other Water Sector Management Activities

7.1 Example of Monitoring Indicators for Planning
7.2 Evaluation of Monitoring Results

8.1 Information Management Tools and Applications

Figures

1.1 Limits of the Wider Caribbean Region
1.2 Type of Sanitation Service Provided in Largest Cities in Latin America and the Caribbean
3.1 Domestic Wastewater Management Planning Framework
4.1 Phase 1 - Issue Identification and Baseline Needs Assessment
4.2 Discharge Identification Decision Tree
4.3 Effluent Limitation Decision Tree
4.4(a) Domestic Wastewater System Decision Tree (Collection System)
4.4(b) Domestic Wastewater System Decision Tree (Treatment System)
4.5 Industrial Pretreatment Decision Tree
4.6 Household Systems Decision Tree
4.7 Operation and Maintenance Decision Tree
5.1 Phase 2 – Plan Preparation and Adoption
6.1 Phase 3 – Action Plan and Project Implementation
7.1 Phase 4 – Monitoring and Evaluation
8.1 Phase 5 – Information Management, Education, and Outreach

Chapter 1
Introduction

The Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region was adopted in 1983 at Cartagena de Indias, Colombia (http://www.cep.unep.org/pubs/legislation/cart2.html). Known commonly as the Cartagena Convention, it provides a framework for cooperation for all countries of the Wider Caribbean Region to work collectively for the protection of their common marine environment (Figure 1.1). On 6 October 1999, in Oranjestad, Aruba, a protocol to the Cartagena Convention was adopted on land-based pollution (http://www.cep.unep.org/issues/lbsp.html. The Protocol Concerning Pollution from Land-based Sources and Activities (LBS Protocol) requires the development of plans, programmes and measures to achieve an effective means of preventing, reducing and controlling pollution of the marine environment from land-based sources and activities. The LBS Protocol encourages a diverse set of measures, including use of the most appropriate technology and management approaches such as integrated coastal zone management. The LBS Protocol identifies policy, institutional, technical, outreach, and funding considerations that should be addressed in the development of plans, programs, or measures. Annex III of the LBS Protocol addresses requirements for the reduction of pollution associated with domestic wastewater, one of the priority categories defined in the LBS Protocol.

1.1 United Nations Environment Programme Role and Responsibility Related to Protection of the Environment

The role and responsibility of the United Nations Environment Programme (UNEP) is to coordinate cooperation among all countries in the region, strengthen national and subregional institutions, coordinate international assistance, and stimulate technical cooperation among countries. In its role and responsibility towards assisting the countries of the WCR to fulfill the requirements of the of the LBS Protocol, the Regional Coordinating Unit (RCU) of UNEP Caribbean Environment Program (UNEP CEP) contracted Tetra Tech EM Inc. to develop this ***Needs Assessment Guidance*** document. The goal in developing this Needs Assessment Guidance is that it will serve as a tool for regional governments, as they proceed to fulfill the domestic wastewater requirements of Annex III of the LBS Protocol (Annex III). The Needs Assessment Guidance provides guidance in the development of programmes, plans, and measures to evaluate sewage management needs and lists of options to resolve wastewater discharge impacts. In following this guidance, governments will have the an overview of the how to begin planning to implement the general and specific requirements of Annex III.

1.2 Goal of the Needs Assessment Guidance Document

The goal of this Needs Assessment Guidance is to assist WCR governments in meeting the requirements of Annex III, as well as, any government working towards protecting and preserving the marine environment by addressing domestic wastewater management needs.

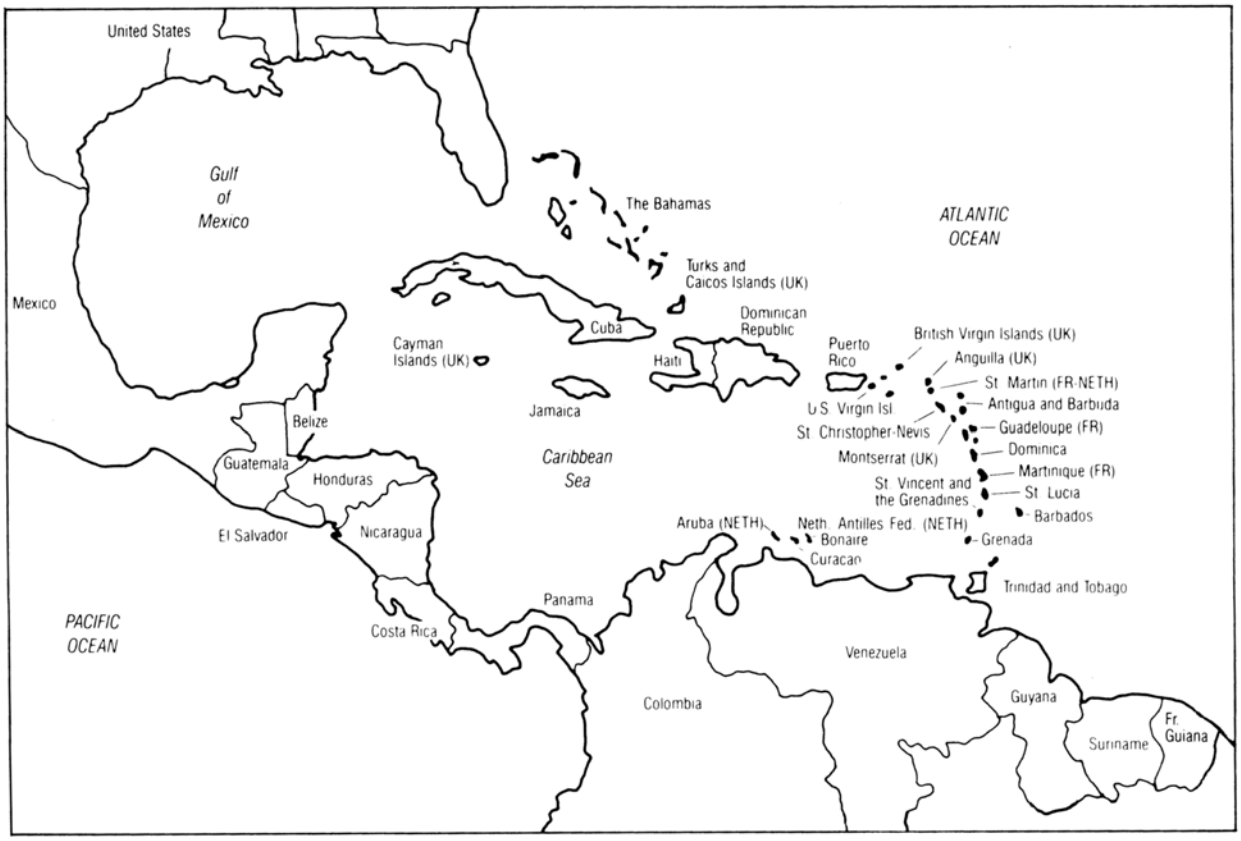


Figure 1.1 Limits of the Wider Caribbean Region

In addition to the central and eastern Caribbean island countries, the WCR includes the countries in Central America, those north of South America, and those in the Gulf of Mexico, including Mexico, Cuba, and the United States (Texas, Louisiana, Mississippi, Alabama, and Florida).

1.2.1 Who Can Benefit From Using This Guidance Document?

This Needs Assessment Guidance is intended to be used by local professionals who already have some experience in the technical area of domestic wastewater management and planning. It should be helpful to introduce a broad sector of government, private-sector, academic, non-government, and community leaders to the fundamental planning concepts and considerations required to establish or expand a domestic wastewater management program based on community needs and cost effective and environmentally acceptable alternatives. Although the document is focused on meeting the requirements of Annex III, its' scope is general, so that it can be used by anyone to address broad domestic wastewater management needs. It is intended to benefit users, since it provides a five part planning framework that can be used by small or large communities working at any level of government and planning tools such as definitions, flowcharts, checklists, case studies, and resources for additional information.

Chapter 1
Introduction

1.2.2 What is a Sewage Needs Assessment?

A sewage needs assessment is a comprehensive profile of the program planning needs to manage sewage. The profile includes information on what sewage infrastructure exists now, what are the management needs at the various community levels to provide adequate coverage, and what are the options and costs for addressing these problems. For example, to proceed with program planning, each country of the WCR must identify the extent of the problem, types of domestic wastewater pollution control facility needs, and respective capital costs. This information would include needs associated with: planning, design, and construction options for domestic wastewater facilities; program development and implementation; one-time capital costs, as well as on-going operation and maintenance (O&M) costs; and receiving water monitoring and management assessment of the selected project option.

1.2.3 What is the Purpose of This Sewage Needs Assessment Guidance?

This Needs Assessment Guidance is a valuable source of information for planning compliance with Annex III. It may be used by national, provincial, and local governments in program development, planning, and management activities. It is useful for government to seek funding from international donors or allocate funds based on defined needs. It is also useful to industry, non-government organizations (NGO), trade associations, and academic institutions to project future technology, policy formulation, and investment needs and opportunities.

Preparing a needs assessment does not necessarily imply a commitment to fulfill all or any of the needs identified at this phase of planning, but it does serve as an initial step and good faith expression towards fulfilling the requirements of Annex III and serves as a baseline of information from which to launch the planning process. This sewage Needs Assessment Guidance document is designed to assist governments and other stakeholders of the WCR in complying with Annex III by providing the following:

- Establishing a recommended framework for national assessment and planning
- Identifying typical issues and information needs relevant to Annex III
- Providing tools such as checklists, schematics, illustrations and other aides in planning
- Introducing elements of follow-on planning phases to assist in understanding the importance of early-phase information needs
- Providing case studies illustrating the application of the planning tools or environmental, social, or economic considerations.

The orientation of this document is towards the development of national plans to meet Annex III requirements, much of the guidance is also applicable to development of regional or municipal plans, although independent of the completion of national plans. This Needs Assessment Guidance is also consistent with UNEP's Global Programme for Action (GPA) recommendations for decision-making on municipal wastewater management (UNEP 2000). Table 1.1 identifies key principals recommended by UNEP's GPA that policy and decision-

makers should consider in municipal domestic wastewater management programs; further information on the GPA can be obtained from their web page (http://www.gpa.unep.org).

Key terms are defined in this Needs Assessment Guidance when they are first introduced or their application is addressed to ensure better understanding of the concepts. The Needs Assessment Guidance is based on the assumption that each country that is a Contracting Party to the Cartagena Convention and concerned with implementation of the LBS Protocol will have different levels of needs in order to comply with the LBS Protocol requirements, but that all these nations will need to begin to assess their needs at the national level.

Table 1.1 Key Principals for Policy and Decision-Makers to Support Municipal Wastewater Management

1.	Secure political commitment and domestic financial resources as absolute prerequisites for appropriate wastewater management.
2.	Create an enabling environment for sustainable solutions at both national and local levels.
3.	Develop integrated and demand-driven management systems combining the collection and treatment of wastewater with drinking water supply and the provision of sanitation services.
4.	Prevent pollution at the source, use water efficiently, and apply appropriate low cost technologies for wastewater treatment.
5.	Make water users and polluters pay for services based on social equity and solidarity to reach cost-recovery.
6.	Use time-bound targets and indicators for environmental integrity as well as o public health or economic welfare to make actions successful.
7.	Implement measures step-by-step while exploring alternatives to reach long-term management goals.
8.	Involve all stakeholders through partnerships from the very beginning to secure their commitment.
9.	Link the municipal wastewater sector to other economic sectors, e.g., tourism, to ensure financial stability and sustainability.
10.	Introduce innovative financial mechanisms, including private sector involvement.

This document is designed to assist all governments of the WCR, and as such, its guidance is suitable for nations with a wide range of existing wastewater management systems—from community sewer and treatment systems to no service at all. Figure 1.2 illustrates the diverse levels of service for domestic wastewater management throughout Latin America and the Caribbean (WHO and United Nations Children Fund 2000). Other sources (Pan American Health Organization, 2001) report that 51.5 percent (%) of households in the Caribbean Region lack sewer connection and only 17 % of these are connected to acceptable disposal. Although the methodologies regarding the nature and extent of domestic wastewater treatment varies between these reports, it is clear that a significant percentage of the population in the region is inadequately served.

Chapter 1
Introduction

In performing a sewage needs assessment, it's essential to consider the adequacy of existing systems, as well as, the lack of such systems. In making progress in developing and implementing sewage systems, these existing systems may not be complete or ideal, but so long as they are cost-effective and environmentally acceptable, the region will incrementally make progress towards improving existing water quality, and achieve many benefits.

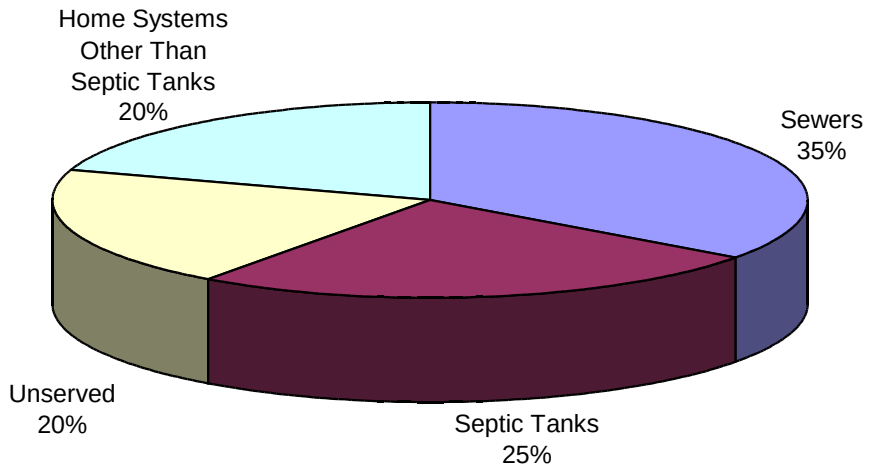


Figure 1.2 Type of Sanitation Service Provided in Largest Cities in Latin America and the Caribbean (WHO and UN Children's Fund 2000)

Chapter 2
Overview of the Requirements for Fulfillment of Annex III

Pollution management is implemented to mitigate adverse impacts on the environment by preventing, reducing, or controlling pollution into a receiving site. Domestic wastewater pollution is managed by establishing and enforcing appropriate regulations coupled with application of appropriate collection, treatment, and disposal technology. Annex III sets forth requirements for all countries in the WCR to manage domestic wastewater pollution. This section provides an overview of the requirements and explanation of their application. For a more detailed description, please refer to the complete copy of Annex III of the LBS Protocol provided in Appendix A.

The objective of Annex III is to prevent, reduce and control pollution from domestic wastewater into coastal marine waters of the WCR by managing domestic wastewater discharges. Annex III addresses five domestic wastewater management areas, which are described below and summarized in Table 2.1.

Table 2.1 Types of Domestic Wastewater Management Requirements Under Annex III

Discharge of Domestic Wastewater: Regulate domestic wastewater discharges; locate, design, and construct wastewater facilities and outfalls; encourage and promote domestic wastewater reuse and reduction of discharges; promote use of cleaner technologies; and develop plans to implement requirements of Annex III. Compliance should be attained within a 20-year schedule, based on when the respective country signed Annex III.
Effluent Limitations: Ensure that (1) a nation's domestic wastewater management plan is designed to comply with Annex III effluent limitations for Class I and II waters, (2) all discharges take into account impacts associated with total nitrogen and phosphorus requirements, and (3) residual chlorine concentrations and amounts are not toxic to marine organisms.
Industrial Pretreatment: Develop and implement industrial pretreatment programs to manage discharges into new and existing domestic wastewater treatment systems to avert operations damage, population endangerment, sludge contamination, and environmental toxins.
Household Systems: Provide for household system construction, operation, and maintenance of sewage collection in areas without them.
Management, Operations, and Maintenance: Provide for resources, including development of training programs, development and access to operations manuals, and other technical support for management and system operators to ensure proper system operations.

2.1 Discharge of Domestic Wastewater

All discharges of domestic wastewater into the Convention Area are to be regulated. Consequently, Annex III requires that all domestic wastewater discharges impacting the Convention Area be managed. The Convention Area includes the marine environment of the WCR.

Annex III sets forth measures to: site; design and construct domestic wastewater facilities, household systems, and industrial pretreatment systems; encourage and promote pollution prevention practices and use of cleaner technologies; and develop and implement plans to meet the requirements defined in Annex III. Annex III is explicit in its requirement to develop plans. The Needs Assessment Guidance provides a tool to begin planning based on appropriate technology and key principals for managing domestic wastewater (UNEP 2000). Appropriate technology and sewage pollution control in the WCR is presented in CEP Technical Report 40 (UNEP 1998).

2.2 Effluent Limitations

Effluent (discharge) limitations are established in Annex III to regulate discharges into the Convention Area. To comply with the effluent limits, each country must establish a process to classify receiving waters as Class I or II. Application of the domestic wastewater effluent limitations are based on water quality considerations of the receiving water. Table 2.2 provides the complete definition of Class I and II waters, as stated in Annex III. Proper management at the national level will allow countries to develop and implement a domestic wastewater plan that complies with the effluent limitations in a consistent manner throughout the WCR.

Table 2.2 Definition of Class I and Class II Waters

Class I Waters
Waters in the Convention Area that, because of inherent or unique environmental characteristics or fragile biological or ecological characteristics or human use, are particularly sensitive to the impacts of domestic wastewater. Class I waters include, but are not limited to the following: • Waters containing coral reefs, seagrass beds, or mangroves • Critical breeding, nursery, or forage areas for aquatic and terrestrial life • Areas that provide habitat for species protected under the Protocol Concerning Specially Protected Areas and Wildlife to the Convention (the SPAW Protocol). • Protected areas listed in the SPAW Protocol • Waters used for recreation
Class II Waters
Waters in the Convention area, other than Class I water, that because of oceanographic, hydrologic, climatic, or other factors, are less sensitive to the impacts of domestic wastewater, and where humans and living resources that are likely to be adversely affected by the discharges are not exposed to such discharges.

Discharge requirements are to be implemented on a tiered schedule over a 20-year period, which depends on features such as:

- Whether the effluent source is a new source or an existing source
- What population size is associated with the discharge
- Whether the sewage system is for a commercial facility or the community
- Whether the sewage collection system is already in place.

Chapter 2
Overview of the Requirements for Fulfillment of Annex III

The timeframe requirements are outlined in Table 2.3.

Table 2.3 Timeframe for Meeting Effluent Limits

Category	Effective Date of Obligation (in years after entry into force) for the Contracting Party [1,2]	Domestic Wastewater Effluent Sources
1	0	All new domestic wastewater systems
2	10	Existing domestic wastewater systems other than community wastewater systems
3	10[2]	Communities with 10,000 –50,000 inhabitants
4	15	Communities with more than 50,000 inhabitants already possessing wastewater collection systems
5	20	Communities with more than 50,000 inhabitants not possessing wastewater collection systems
6	20	All other communities, except those relying exclusively on household systems

1 Any country may request an extension to meeting Categories 2, 3, 4, or 5 timeframes in accordance with specific conditions established in Part G. Extension Period of Annex III.

2 Contracting parties that decide to give higher priority to Categories 4 and 5 may extend their obligations pursuant to Category 3 to 20 years (timeframe established for Category 6).

Discharge (or effluent) limits are based on monthly averages of various domestic wastewater discharge parameters, which indicate physical, chemical and biological constituents. Details on how to quantify monthly averages are not defined in Annex III. The discharge limits for the parameters to be managed under Annex III are summarized in Table 2.4.

Table 2.4 Discharge Limits for Class I and Class II Waters Based on a Monthly Average

Parameter	Effluent Limit
Class II Waters	
Total Suspended Solids	150 mg/L*
Biochemical Oxygen Demand (BOD)	150 mg/L
Ph	5-10 pH units
Fats and Oil and Grease	50 mg/L
Floatables	Not visible
Class I Waters	
Total Suspended Solids	30 mg/L*
Biochemical Oxygen Demand (BOD)	30 mg/L
PH	5-10 pH units
Fats and Oil and Grease	15 mg/L
Fecal Coliform	Fecal Coliform: 200 mpn/100 mL: or a. E. coli: 125 organisms/100 mL (freshwater); b. enterococci: 35 organisms/100 mL (saline water).
Floatables	Not visible

* Does not include algae from treatment ponds

Nutrients, primarily nitrogen and phosphorous are not specifically addressed by Annex III, but reducing these pollutants will benefit the region's water bodies. Because treating nutrients is technically challenging and costly, development of prevention standards can be a important water quality anti-degradation practice to control these pollutants.

2.3 Industrial Pretreatment

A number of industries discharge waste to domestic wastewater systems. In view of the toxic effects of some industrial waste, Annex III establishes general requirements for pretreatment for industrial wastewater that is discharged to a domestic wastewater system. Each country should consider whether separate treatment for these wastes or a higher degree of treatment at the point of origin needs to be enforced. Regulation of domestic wastewater should provide management measures to ensure that industrial discharges do not hinder the operation of new and existing domestic wastewater systems and that toxics are not introduced into the Convention Area that could harm human health and the environment.

2.4 Household Systems

Household systems are common in small communities and communities where municipal sewerage has not been economically feasible. Household systems may also be appropriate alternatives when rock substrate or topography makes other options impractical. Annex III encourages installation of cost-effective and environmentally acceptable systems that prevent direct or indirect pollution to the Convention Area. Discharges of household systems should also be properly treated to prevent impacts to the Convention Area.

In urban areas, household systems often can be eliminated by sanitary sewer connections, but in rural areas the most economically feasible solution would be individual or combined septic tanks. However, proper maintenance must be applied to extend the life of the septic tanks; otherwise, they will eventually overflow and discharge to the nearest downgradient body of water.

2.5 Management, Operations and Maintenance

Annex III requires that domestic wastewater systems are properly maintained, operated, and managed. Management should include a diverse set of measures such as forecasting and allocating the appropriate level of funding for operation and maintenance activities; technology, equipment, and human resources; and other activities such as training for operators, system inspection to evaluate the facilities, associated infrastructure, and management program's effectiveness.

Chapter 3
Planning Framework for the Development of National Plans for Domestic Wastewater Pollution

Planning is a way of organizing the attention, resources, and energy of government agencies, resource user groups, NGOs, local stakeholders, and others on the issues about domestic wastewater pollution that need to be addressed to meet Annex III requirements. This chapter provides a discussion of the need for domestic wastewater pollution control, planning goals, a recommended planning framework, and steps to get started towards fulfilling the requirements of Annex III.

3.1 Need for Pollution Mitigation and Control

Pollution from domestic wastewater has been identified as the most significant source of pollution problem facing the coastal and marine areas in the WCR (UNEP 1994). The ecological and health problems posed by the discharge of untreated sewage in coastal waters of the WCR needs to be examined on a short- and long-term basis for its mitigation and control. Addressing water pollution calls for a holistic approach in which all issues impacting the ability to control or mitigate pollution are addressed. Annex III addresses domestic wastewater pollution control, one of several water policy sectors that are addressed. Consequently, managing domestic wastewater is expected to provide several benefits, as summarized in Table 3.1.

Table 3.1 Benefits Derived from Managing Coastal Domestic Wastewater Discharges

Public Health Protection

- Life-threatening illness associated with biological and chemical pollutants can be eliminated or greatly reduced. Chronic or non-life threatening illnesses can also be reduced.

Food Security

- Healthy corals and other coastal marine life are directly related to productivity and health of marine food sources, such as fish.

Biodiversity and Conservation

- Marine species and habitats, particularly highly sensitive ones, such as coral reefs , mangrove forests, and sea grass bed are better able to grow and withstand other environmental adversities, such as global climate change, when protected against biological and chemical pollutants.
- The Wider Caribbean Region has some of the world's richest biological diversity and sensitive environments that can benefit from improved water quality.

Recreational Value

- Water-oriented recreational uses can be optimized by managed use of water resources.

Economic Development

- Increase in the value of coastal development properties can be attained by ensuring better water quality.
- Ability to meet water quality discharge requirements can be used as a measure for seeking approval of proposed development projects.
- Protection of water quality ensures protection of resources, such as coral reefs, mangroves, and other wildlife, that provide direct and indirect economic benefits

3.2 Planning Goals

Complying with Annex III will require planning at all levels of government, from local governments to state or provincial governments and on up to national government. A key strategy in planning is to identify and engage stakeholders, that is, all those with a vested interest in mitigating and controlling pollution resulting from domestic wastewater discharges. A participatory approach should be used to identify issues to be addressed, establish goals to be achieved, map the management areas, identify management strategies, and define co-management regimes among government, NGOs, and wastewater discharger groups for implementation of the management plans.

Based on progress made in the 1990s in providing safe water and sanitations, the United Nations Secretary General (UNEP 2000) identified several practices in the development of national programs, which are summarized in Table 3.2. The considerations will vary from country to country, based mainly on practices and resources already in place. Special consideration should be given to integrate existing social, economic and environmental-oriented programs, such as those pertaining to poverty alleviation, human settlement, and integrated coastal area management.

Table 3.2 Considerations for the Development of National Programs

- Making water supply and sanitation integral parts of poverty alleviation programs
- Incorporating water supply and sanitation as integral parts of human settlement programs
- Improving service delivery, operation, maintenance, service reliability, and water quality
- Identifying adequate financial resources coupled with effective cost recovery policies
- Decentralizing and devolving responsibilities to the lowest appropriate level of management
- Integrating water supply and sanitation with hygiene education
- Focusing on the gender dimension of water supply and environmental sanitation
- Improving information management
- Integrating water supply and sanitation within a holistic approach to the development, management, and use of water resources
- Including and integrating stakeholders, from the local level to the regional and national levels, to build partnerships for management of domestic wastewater
- Harmonizing national plans with other existing plans, such as coastal zone management plans and development plans, and evaluating them along with other national priorities
- Long-term O&M, receiving water monitoring, and management assessment of selected options

Source: UNEP 2000.

3.3 The Planning Framework

An environmental planning framework should be adopted by a nation to develop a national domestic wastewater management plan. The planning framework proposed in this Needs Assessment Guidance is modeled on a general planning framework with proven success worldwide. In general, policy implementation can be carried out by following well established

planning components, which are outlined in this document. The recommended planning framework consists of five phases:

- Phase 1: Issue Identification and Baseline Assessment
- Phase 2: Development and Adoption of a National Plan
- Phase 3: Action Plan and Project Implementation
- Phase 4: Monitoring and Evaluation
- Phase 5: Information Management, Education and Outreach

The planning framework that serves as the foundation for this *Needs Assessment Guidance* is illustrated in Figure 3.1. A key feature of the planning framework is the element of local and regional participation and resource sharing, a concept defined as collaborative management (Courtney, C and A. White 1996). ***While the main focus of this Needs Assessment Guidance is to provide guidance leading to the development of a Baseline Assessment, represented as Phase I in Figure 3.1, this document also describes the other planning phases to achieve an understanding of how the information is interrelated and interdependent amongst each of the planning phases.***

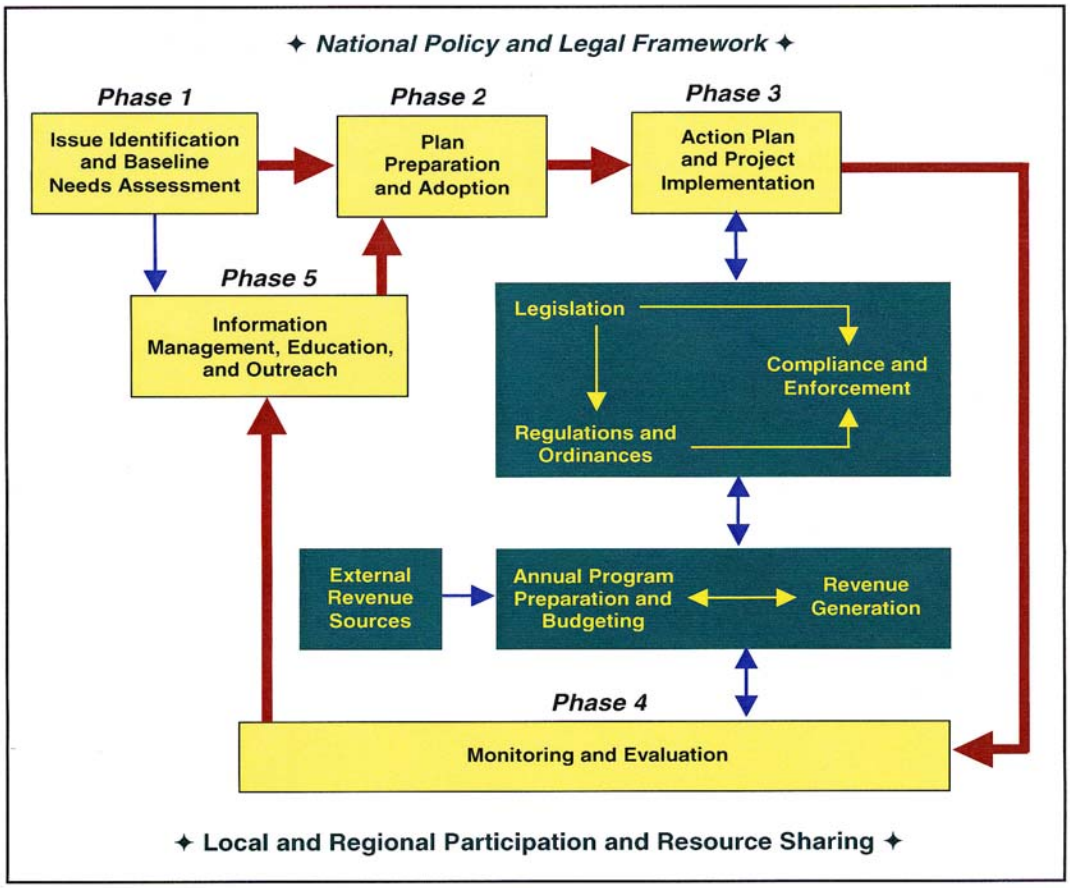


Figure 3.1 Domestic Wastewater Management Planning Framework

In order to successfully proceed with short- and long-term planning activities required to fulfill the requirements of Annex III, the planning process needs to be institutionalized. Institutionalization results from implementing steps such as those described in the following sections. Some examples to illustrate this point are provided in Table 3.3.

Table 3.3 Key National, Provincial and Municipal Government Requirements for Domestic Wastewater Management

Planning: Institutionalizing the planning, implementation, and monitoring process, such as assessing needs and developing short, medium, and long-term action plans

Legislation: Promulgating national laws, regulations or ordinances to implement recommendations established in the action plans

Regulation: Regulating the discharge into Class I and II water bodies

Enforcement: Enforcing national, provincial and municipal laws and regulations regarding discharge effluent limitations to Class I and II water bodies

Intergovernmental Coordination: Establishing co-management regimes for development and implementation of action plans

Relations with Stakeholders: Promoting early and continuous coordination with diverse stakeholders in all phases of planning and implementation

Allocating Budget and Staff: Funding staff and resources to participate in planning activities, such as collection of information, development of plans, and attendance at outreach and technical meetings

Revenue Generation: Assessing funds to finance capital infrastructure improvements recommended as part of the domestic wastewater programs plans through various financing mechanisms such as taxes, user fees, and other economic measures

Compliance time-frames and enforcement actions become a must under the application of a command and control strategy. Better results should be obtained in the WCR by using market-based mechanisms, such as: tax incentives, other types of economic incentives, subsidies, disincentives, and other control mechanisms.

3.4 Getting Started

The process of designing and implementing a successful domestic wastewater pollution control (DWPC) program includes and begins with several key activities:

- Securing funding for program development
- Securing commitment to participate in the planning process
- Recruiting staff
- Identifying planning and management boundaries
- Developing a work plan

The key activities are discussed in the sections below.

Chapter 3
Planning Framework for the Development of National Plans for Domestic Wastewater Pollution

3.4.1 Securing Funding for Program Development

Dedicated funding and staff are required for planning and implementation. Startup funds are required to initiate activities in Phase 1 until it is fully formalized and incorporated into an annual budget cycle for program development and planning. The national government entity responsible for implementation of Annex III should secure national funding and leverage potential sources of funding and technical support to assist in the program development for DWPC. Provincial governments, NGOs, academic institutions, the private sector, and foreign funding institutions are all potential sources of funds and technical assistance that should be leveraged to support program development.

3.4.2 Securing Commitment to Participate in a Planning Process

Another element in the process of program development is identifying stakeholders who benefit or otherwise have an interest in DWPC and encouraging their participation. These stakeholders include local and national government officials, wastewater dischargers, representatives of NGOs, and users of the resources being protected as a result of DWPC program implementation. Getting agreement to participate requires providing potential participants with detailed information about:

- The basic purpose of the DWPC program
- The intended outcome of such a program
- Realistic estimates of the time and resource requirements for participants
- An indication of the short-term and long-term incentives to participate, such as opportunities for additional training and new skills, opportunities to participate in an endeavor that potentially has great community importance, and economic benefits from pollution control

Commitment to participate may be informal, but in some cases, a more formal memorandum of agreement may be appropriate if significant time or resource commitments are anticipated.

3.4.3 Recruiting Staff

Recruiting program development staff is an important element in the preparation process. Ideally, most staff would be seconded from the national government agency responsible (that is, the lead agency) for compliance with Annex III, as well as other agencies committed to working on the program as a result of the identification of stakeholders. Training to ensure that staff are fully prepared for their responsibilities is necessary. Program preparation is an opportunity for staff "skill-building" that can contribute to long-term improvements in domestic wastewater pollution control.

3.4.4 Identifying Planning and Management Boundaries

Preliminary identification of relevant watershed and geopolitical boundaries should occur as part of the initial preparation and included in the work plan. Initially, a jurisdictional boundary should be identified that represents the municipal, provincial, and national jurisdictional land and water boundaries. Jurisdiction of local coastal waters needs to be assessed. Furthermore, planning must address transboundary areas, such as coastal waters shared by more than one nation. An important requirement of the Contracting Parties to the LBS Protocol, is the need for each to classify all waters of the Convention Area as either class I or class II, since all domestic wastewater discharges must be managed to meet discharge requirements based on classification of the receiving waters. Identification and classification of coastal waters should be performed through a formalized regulatory process, supported by scientific assessments, such as an environmental impact assessment (EIA) which includes opportunities for public input and decision-making.

Transboundary Areas—Coastal areas that are shared among two or more countries. The Protocol recommends that countries use their best efforts to consult and resolve issues where LBSs and activities are likely to adversely affect neighboring nations. WCR countries will all have to address international transboundary, as well as, provincial and municipal boundary issues.

The most important environmental boundary is the watershed boundary. The watershed boundary should be the common denominator for the planning and management activities. Planning and management boundaries are based on many factors such as watershed characteristics, property ownership and use, environmental pollution, ecological resources, and so forth. These factors need to be taken into consideration in the planning and management process. It is useful to identify preliminary boundaries during program preparation. A planning boundary is more inclusive than a management boundary. A management boundary addresses an area within which specific regulatory, developmental, or other management activities are designed to occur in order to reduce an adverse impact on valued coastal resources, reduce risks of hazards such as those to public health, or increase opportunities for optimal resource use such as tourism. Because multiple point and non-point source domestic wastewater discharges can impact a shared water body, management of these discharges may require defining land and water jurisdictional boundaries at the municipal, provincial, national, and international levels of government. Planning and management boundaries should be developed and validated with stakeholder participation and input during each of the planning phases, particularly in development of more detailed planning efforts such as those in Phase 3.

3.4.5 Developing a Work Plan

A work plan is the document to begin Phase I of the planning cycle. The work plan should outline a set of planning activities to be undertaken, the sequence of activities, and individuals responsible for each activity. While the work plan may be revised later, it should set forth, as precisely as possible, what planning activities will be undertaken and by whom. The work plan should also indicate budgets and schedules for each activity during the development of the Needs Assessment. Depending on funding, technical, institutional, and other factors, the first

work plan may not cover completion of the national baseline Needs Assessment. However, it could begin the process to obtain political will and funding leading to the development of a work plan that in fact does. Examples of key elements of the work plan are as follows:

- Cover page, executive summary, and table of contents
- Introduction
- Goals and objectives of the work plan
- Overview of tasks
  - ✓ Task 1: Define program goals and objectives
  - ✓ Task 2: Identify stakeholders and local "champions" to promote the project with the local community and other stakeholder groups
  - ✓ Task 3: Identify watershed and geopolitical boundaries and classify receiving water bodies
  - ✓ Task 4: Gather secondary information such as maps, location of existing treatment facilities, population census, water quality data, and other data
  - ✓ Task 5: Develop database, geographic information system, and other information management systems
  - ✓ Task 6: Identify and prioritize needs (such as funding sources, classification of receiving water bodies)
  - ✓ Task 7: Prepare baseline Needs Assessment
- Staffing needs
- Schedule of activities, including program monitoring and periodic management assessment
- Cost estimate to perform tasks identified in the work plan
- Deliverables and schedule resulting from implementation of the work plan

Chapter 4
Phase 1: Issue Identification

Phase 1 planning involves identification of issues and understanding the information needs to develop a baseline Needs Assessment. It prepares the way to proceed with Phase 2, which involves preparation and adoption of a national plan. Chapter 4 begins with a brief overview on collecting available secondary information and developing database and information management systems , followed by a discussion of the types of issues and general and specific needs to conduct a baseline Needs Assessment to meet the requirements of Annex III.

4.1 Collecting Available Secondary Information

Gathering information occurs throughout the planning process. Initially, the information gathering should encompass a broad network of potential sources of information that already exist. The important types of information include:

- Legal and jurisdictional bases for management, such as existing laws or regulations pertaining to domestic wastewater discharges limits, treatment requirements, classification of water bodies based on water quality, and so forth.
- Existing and historical maps, showing human settlements, coastal natural resources, important relevant natural features, and so forth.
- Existing data on water quality and existing dischargers.

Collecting secondary information from existing sources.

Government offices, libraries, and academic institutions are natural repositories for official documents, maps, and reports that may provide important information. However, the search for information should extend beyond the usual official sources. There are sometimes academic or other "unofficial" socioeconomic surveys, ecological surveys, previous plans, or analyses that have been undertaken by individuals or institutions in conjunction with community groups, NGOs, or user groups. There is no detailed methodology for gathering secondary information. It is mostly a matter of writing letters, making telephone calls, visiting offices and libraries, and interviewing officials, teachers, scientists, and researchers. Municipalities may request the assistance of a province in making requests to national government agencies, NGOs, academic institutions, and donor assisted programs for information and reports applicable to the province and municipalities. It is essential to keep records of the sources of secondary information and databases of digital information.

4.2 Developing Database and Information Management Systems

A key planning tool that should be used in the development of the Needs Assessment is an information management system. The information management system should be initiated early in the planning process and further developed in future planning efforts. The topic of information management is discussed further in Chapter 8.

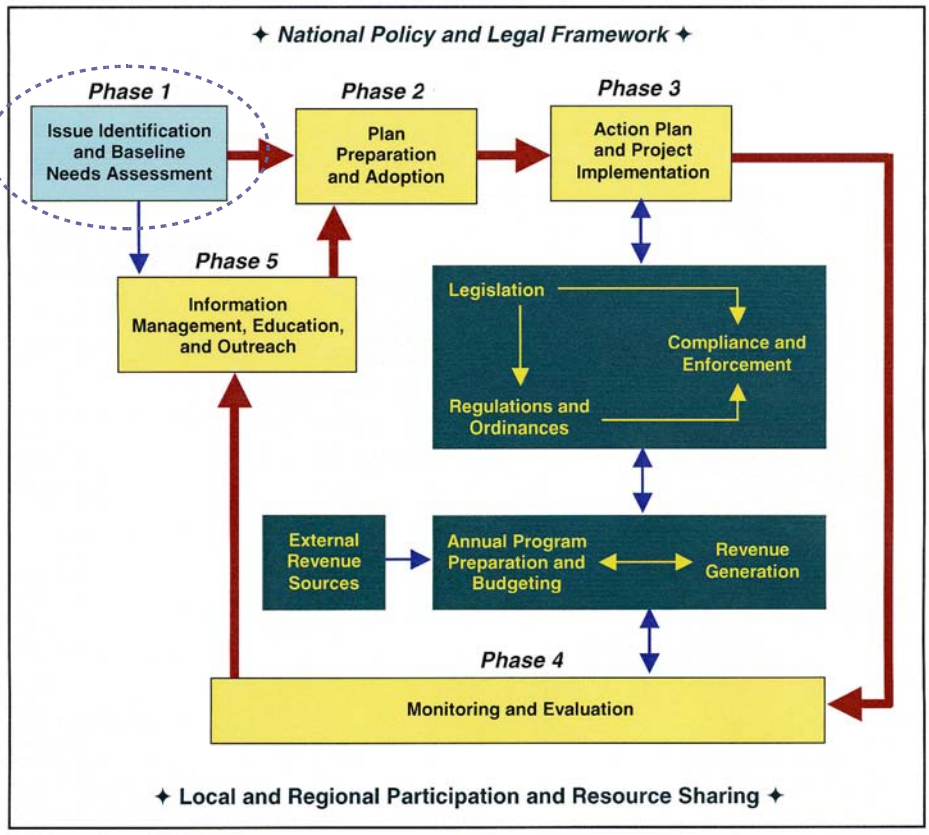


Figure 4.1 Phase 1 – Issue Identification and Baseline Needs Assessment

4.3 Identifying Issues and Needs

Identifying issues and the means to address them are performed in Phase I, as part of completing the Needs Assessment. Typical issues that could be considered during development of a domestic wastewater national plan are described below. In fact many of the issues are interrelated. For example, inadequate institutional capacity may be a result of lack of training, lack of funds, lack of human and equipment resources, poor information management, or lack of clear policy. In identifying the issues it is important to focus on specific requirements to comply with Annex III and associated general framework requirements. The issues, level of detail, and types of data needs or infrastructure for each country will vary, depending on the extent of domestic wastewater pollution control already provided. Table 4.1 provides an example of typical issues that can be expected and the types of data needed to assess the problem at the national, provincial, and municipal levels.

Table 4.1 Issues and Data Needs for the Baseline Assessment

Typical Issue	Types of Data Needed
Lack of stakeholder participation. A process to involve them is typically not available or well established. Lack of political will or support	A list of stakeholders needs to be defined. Identify types of actual or potential stakeholders and their specific interests and motivation for involvement.

Table 4.1 Issues and Data Needs for the Baseline Assessment

Insufficient capital to fund domestic wastewater pollution management program	Identify potential sources of funding, economic and financial instruments, such as taxes, loans, private investors, public-private partnerships, grants, and user fees.
Lack of ratification of protocol and contradictive and overlapping regulatory authority or political jurisdictions	Determine whether the LBS Protocol has been ratified, review existing laws and regulations, and define conflicting and overlapping authorities.
Lack of authority and coordination with other national-, provincial-, or municipal-level planning programs.	Define the existing legal government framework, government structure and functions and types of management and coordination needed.
Inadequate inventory of communities with discharge to water	Identify types of discharges to which the protocol applies, locations, and quantities of discharges, and outfalls. Provide maps and drawings showing discharges, sewered areas, existing treatment facilities, etc.
Lack of classification for sensitive or unique water bodies, watersheds, local coastal resources, sensitive species, and sensitive habitats or ecosystems	Identify location of human use areas; sensitive watersheds and coastal and marine biological areas; inventory natural resource values of water bodies.
Inadequate conveyance, collection, and treatment infrastructure	Describe existing and required sewage infrastructure needs based on population growth. Also should consider the drinking water conveyance and distribution system.
Poor or lack of industrial pretreatment which compromise integrity of domestic wastewater management systems.	Identify industrial dischargers with discharges to existing domestic wastewater management systems. Include broken system components and infiltration and inflow effects.
Lack of domestic wastewater systems, especially for small households or extremely limited sewage systems posing significant public health and environment risks	Identify and quantify urban and rural household sewage system needs
Poor or inadequate facility operation and maintenance programs	Define facility operation and maintenance needs for projected long-term needs, including operator training.
Expanding population and inadequate infrastructure	Calculate the projected population over a 25-year period to facilitate calculations of required domestic wastewater pollution control systems.
Persistent outbreaks of disease associated with unmanaged domestic wastewater discharge	Describe types of diseases and where and when populations are affected.
Inadequate access to technology	Describe types of innovative and practical technology required to meet projected infrastructure demands.
Poor or lack of monitoring to assess environmental progress	Define types of monitor program and environmental indicators to monitor progress in meeting Annex III requirements, monitoring plans, and institutions to implement monitoring and approximate costs to ensure baseline and long-term monitoring programs.

Table 4.1 Issues and Data Needs for the Baseline Assessment

Polluted water or degraded coastal habitats	Evaluate water quality monitoring data to detect problems, trends.
Lack of enforcement of existing regulations	Review records of enforcement actions and resulting penalties.

As issues and potential solutions are identified early in the planning process, the nation's priority to act upon them must be decided. The prioritization of issues needs to be an outcome of stakeholder participation and one that occurs continuously and at periodic intervals during the planning process. All issues probably cannot be addressed. However, the ability to address them is dependent on defining solutions. A Needs Assessment is a way to identify solutions to identified issues. It's a necessary first step to begin a dialogue with stakeholders leading to prioritization of the solutions. Prioritization of issues is a step performed in Phase II, as part of developing the national plan, and thus occurs after development of the Needs Assessment described in Chapter 4.

4.3.1 Institutional Framework and Capacity Building

Evaluation of existing institutional framework pertaining to domestic wastewater, its governance overlapping roles and responsibilities, and capacity to implement successful planning.

4.3.2 Applicable Policy, Laws, and Standards

Evaluation of an existing legal framework for regulation of domestic wastewater discharging into or adversely affecting the marine environment, as required by Annex III. Describe policy, laws, enforcement, regulations, and standards applicable to domestic wastewater discharges and relevance for management and pollution control.

4.3.3 Public Health Considerations

Evaluation of outbreaks of public health diseases, contaminated seafood, existing public health education, and control of areas which are impacted from current and future domestic wastewater discharges directly and indirectly to marine waters.

4.3.4 Sensitive Marine Environments

Assessment of coastal environment, loss of fisheries productivity, loss or compromised tourism potential. The needs will require a characterization of the social, economic, and environmental values of the marine environment, as well as, national and international marine protection regulatory requirements. A central need is the classification of receiving bodies using diverse criteria to differentiate between sensitive marine environments and all others. The classification will be a necessary step to determine whether the Class I or Class II effluent criteria of Annex III will be applied.

4.3.5 Domestic Wastewater Effluent (Discharge) Sources

Assessment of whether existing domestic wastewater effluents (discharge) meet Class I or Class III discharge requirements, and evaluate why or why not (e.g., lack of treatment, inadequate

treatment, industrial discharges). Describe existing systems technology, operation and maintenance, and other needs to keep facilities operating optimally.

4.3.6 Priorities for Water Pollution Mitigation and Control

Assessment of resources to finance domestic wastewater management program needs. Priorities should be established among the various water sector needs. Describe needs by location and levels of treatment, the nature and extent of sewage collection system improvements, existing structures such as the location and type of wastewater outfalls, and the management of diverse non-point source discharges. Provide information regarding public health, the environment, institutional capacity, funding, and other considerations that will help prioritize needs.

4.3.7 Pollution Prevention and Resource Conservation

Evaluate pollution prevention and resource conservation practices that can be incorporated into domestic wastewater management systems leading to benefits such as lower operating costs, reduction and reuse of resources such as a water, process chemicals, and reduction of industrial waste discharges. These practices should be implemented for households, small businesses such as restaurants and hotels, and small industries, as well as other sources, to minimize or eliminate discharges that adversely affect the marine environment. Regulatory aspects must be considered, including sewer use ordinances and pretreatment requirements for commercial and industrial wastewater that might be discharged to municipal wastewater facilities.

4.3.8 Management, Operations, and Maintenance, and Monitoring of Treatment Facilities and Ancillary Structures

Evaluate operation and maintenance practices, including availability of proper equipment, trained staff, written procedures, and audits to ensure domestic wastewater management systems comply with requirements. Describe needs, such as fiscal planning, staffing, budgets, other resources, and institutional capacity.

4.3.9 Stakeholder Identification and Participation

Identify stakeholders that should be involved in the planning process and ways that their participation can be facilitated. Stakeholders need to be involved to maximize use of resources, bring forth diverse opinions, and help develop solutions.

4.3.10 Economic Instruments and Financial Resources

Identify sources for financing and economic incentives. As potential solutions are developed and priorities established, the available financial resources should be used to address the most critical needs.

4.3.11 Integration with Other Water Sector Policies and Other National Plans

Identify other sources of water pollution and their respective management requirements. Review other water sector policy and other national plans associated with other practices such

as agriculture, tourism, industry, urban and rural development, transportation, water supply, and energy. Ensure these other practices are coordinated, compatible, and integrated with the proposed domestic wastewater management programs.

Rapid urban and industrial agricultural growth and development along coastal regions has resulted in non-point sources of pollutions being a significant threat to coastal water quality. Major sources in coastal waters include agriculture and urban runoff. Other significant sources include faulty septic systems. Annex III of the LBS Protocol principally addresses domestic wastewater point sources of pollution, originating from domestic sewage outfalls associated with treatment plants. However, many WCR countries rely on septic tank systems, which are not always effective because of factors like poor design, inadequate installation, or inadequate maintenance. Thus non-point sources of pollution from diverse sources, including septic systems should be should be evaluated and managed. Management strategies should be coordinated and compatible with any domestic wastewater management program. The United States has since about 1990 began to address diverse non point sources of pollution into coastal water and has developed many useful publications on this topic, as well as, other water sector management programs which can be found at following web page: http://www.epa.gov/ebtpages/watewaterpollution.html.

Case Study: Cruise Ship Discharges

The worldwide cruise ship fleet includes more than 223 ships that carry an estimated 9.5 million passengers every year, according to industry sources referenced in a report issued by the United States Government Accounting Office (GAO) in February 2000. While cruise lines contribute to the tourism economy, they also contribute to illegal discharges to the marine environment. Cruise discharges impairing the Convention Area need to be addressed through stricter regulations.

Between 1993 to 1998, according to the GAO report, cruise ships were involved in 87 confirmed illegal discharge cases. On March 17, 2000, EPA received a petition from the Bluewaters Network on behalf of 53 organizations suggesting that gaps in regulations pertaining to cruise-ship water pollution result in potential risk to the environment. According to the petition, cruise ships generate the following waste streams:

- Black Water (sewage): A typical cruise ship generates as much as 210,000 gallons during a 1-week voyage.
- Gray Water (shower, sink water): A typical cruise ship is estimated to generate up to one million gallons a week.
- Solid Waste (food waste, plastic, paper, glass, and such): The petition suggests that cruise ships often dump solid waste at sea.

The petition requested that U.S. Environmental Protection Agency (EPA): (1) assess the volumes and characteristics of cruise ship waste streams and their potential impact on water quality and the marine environment, (2) examine existing Federal regulations governing cruise ship waste streams, and (3) form recommendations on how to better control and regulate these waste

streams. In response to the petition, EPA is currently undergoing studies to evaluate the impact of the sewage plumes from cruise ships on the marine environment.

4.4 Understanding the Needs

Identification of issues is the initial step towards completing Phase 1 planning. The next step is to describe and quantify the needs, which include categories such as institutional capacity building, infrastructure (associated with building domestic wastewater management systems), and financial resources. For purposes of this Needs Assessment guidance, the needs are organized into general and specific needs which are specific to meeting the requirements of Annex III of the LBS Protocol. Each country can evaluate these need categories and expand or redefine them for purposes of developing their needs assessment. The needs will range from institutional capacity to infrastructure for domestic wastewater management.

Any wastewater program will have a cost. In rich countries, users usually pay for a service. In developing countries residential users usually do not have sufficient income to pay for a service charge. Thus, establishing a mechanism for financing the program becomes a major task in developing countries.

4.4.1 Summary of General and Specific Needs

While Annex III has specific requirements, the LBS Protocol also has general requirements which are typically associated with most environmental programs. Some of these general needs are listed below:

- **Stakeholder Participation:** Identify and involve the people representing government, private sector, academic, nongovernment institutions and people in the community including businesses and citizens who will have an interest and therefore should be involved in the development of a national domestic wastewater management plan.
- **Financial Resources:** Identify and secure the financial resources. This is one of the greatest limitations in ensuring that the national program's institutional and facilities components can be funded.
- **Legislative Authority:** Assess the effectiveness of existing laws, and, if necessary, adopt and implement applicable laws, regulations, and policies, because these provide the basis for developing the institutional framework and authorities.
- **Government Structure and Authority:** Ensure that government agencies (national, state, local) are available for adopting, integrating, and implementing and monitoring adherence to laws, regulations, and policies and national plans.

The specific needs are derived directly from the specific requirements of Annex III (see Table 2.1). These specific needs are listed below:

- **Discharge Identification:** addresses the need to identify discharges into localized areas of the coastal zone
- **Effluent Limitations:** addresses the need for discharges to meet effluent limitations based on classification of receiving waters
- **Domestic Wastewater Treatment:** addresses the need to identify and install collection and treatment systems
- **Industrial Pretreatment:** addresses the need to provide for industrial pretreatment or separate industrial effluents from municipal wastewater effluents
- **Household Systems:** addresses the need to provide treatment where alternatives are limited
- **Operations and Maintenance:** addresses the need to ensure long-term operability and upkeep of treatment systems

Other implicit specific needs that will also be discussed in section 4.4.3 include: (1) classification of receiving waters, (2) identification of a range of design and construction options to address sewage treatment needs and (3) long-term receiving water monitoring and management evaluation of selected options. Each issue identified through the issue identification process is likely to generate a combination of multiple general and specific management needs for its resolution.

Typical needs to be addressed in the planning process and recommended approaches to understanding those needs are discussed in Sections 4.4.2 and 4.4.3 below. Design and construction considerations are an important part of the planning process to develop actual facilities; these considerations are discussed extensively in sections 4.4.3.3 and 4.4.3.6.

4.4.2 General Needs

The general needs are discussed in this section in relation to their application of Annex III. There are other requirements of the LBS Protocol, which are not explicitly discussed in the Needs Assessment Guidance. However, the Annex III requirements should be integrated into the other broader program requirements of the LBS Protocol, which include items such as: monitoring and assessment programmes; EIA; development of information systems; transboundary pollution; and participation, education and awareness, reporting, and institutional mechanisms.

4.4.2.1 Stakeholder Participation

Article X of the LBS Protocol, identifies specific requirements to promote participation including public access to information. The needs assessment should identify and establish a list of stakeholders and a process for their involvement. It is important to develop and maintain avenues for stakeholder involvement throughout development and implementation of a national plan. A program should be established to involve identified stakeholders in the development of alternative solutions that protect the Convention Area while considering financial impacts. Consideration for promoting greater stakeholder involvement are summarized in Table 4.2. Further discussion on strategies, such as private sector involvement in promoting sanitation can be found in the document *Sanitation Promotion*. Successful

involvement typically is contingent on including a local "champion"; ideally this is someone who is a respected advocate and capable leader.

Stakeholders — Individuals or groups involved, interested in, or impacted (positively or negatively) by an existing or proposed program policy, infrastructure, or natural resource uses. Members of the community (local or other), business sector (i.e. tourism), NGOs, representatives of government, media, financial institutions, academic experts, and others. Identification of stakeholders requires an understanding of the issues relevant to individuals and institutions.

Table 4.2 Stakeholder Invo

- Identify stakeholders impacted by proposed program:
  - Political stakeholders (national and local)
  - Dischargers (including, tourism industry)
  - Public (such as communities)
  - Industries, private sector
- Include stakeholders in the development of a plan:
  - Present information in a manner understandable to stakeholders
  - Establish stakeholder committees to serve as liaisons between government and agencies
  - Provide hearings, workshops, discussion panel, community events or festivals to allow upper and lower watershed people to meet each other and understand the need to address sewage problems on a watershed-wide scale
  - Include stakeholders in data gathering
  - Maintain a record of communication
- Identify benefits and impacts on stakeholders resulting from the plan. Are there any cultural taboos to be considered?.
- Obtain commitment from stakeholders to the plan.
- Incorporate inputs from stakeholders into the plan.
- Proceed with the plan, while maintaining stakeholders involved through the stakeholders participation program. Hire and train local people and community leaders to manage the wastewater program.

By involving stakeholders, access to a much larger pool of ideas and resources are available. Mobilizing stakeholders starts with identifying potential partners, then meeting with them and presenting a convincing case of why they should become involved. Advocacy is the key tool to use to convince groups to become partners. Ideal partners are those that share common interests, have previous experience in gaining support and initiating change, and are influential in their own right. A framework for collaborative management in the context of managing coastal resources is discussed in Courtney, C and A. White 1996. Involvement of a variety of stakeholders mobilizes support from a broad cross section of society representing a wide variety of interests that will be incorporated throughout the baseline assessment and development of a national plan.

4.4.2.2 Financial Resources

Article XVI of the LBS Protocol, promotes the exploration of financial sources to fund required management programs. The needs assessment should include an analysis of financial needs and innovative funding strategies. The mechanisms used to finance existing domestic wastewater management programs need to be identified and evaluated to understand available financing resources and their applicability to finance future domestic wastewater management

efforts. A financial analysis serves as a guide when evaluating alternatives in development of domestic wastewater strategies. For example, funding may not be available to fully implement domestic wastewater systems, but the financial capability analysis would provide guidance for a phased approach to implementing the system. Types of funding analysis that should be performed are summarized in Table 4.3. Further discussion on strategies, such as household credit financing schemes can be found in the document *Sanitation Promotion* (WHO 1998).

Table 4.3 Funding Analysis

Activity	Tasks
• Determine funding related to developing and implementing a domestic wastewater management plan	Develop plan and prepare a cost benefit analysis Fund resources (such as staff) Implement design, construction, and monitoring options Implement operation and maintenance plan Monitor, evaluate, and enforce plan
• Identify existing debts	Determine funds allocated to marine waters and domestic wastewater programs Determine funds spent on existing marine environment and domestic wastewater programs Evaluate impacts of not addressing sewage needs versus a clean environment to local economy (food, tourism, businesses, local health)
• Identify socio-economic indicators	Unemployment rate Median household income
• Evaluate financing opportunities	Bonds, grants, loans, and privatization
• Evaluate cost recovery programs	Effluent charges on businesses and industries Users fee on households Fines for discharge permit violations
• Develop phased funding for implementation of programs and facilities	Determine costs required for each phase of program planning and development

The following needs should be considered when analyzing financial resources:

- What time period will financial resources be needed?
- What infrastructure needs are anticipated during the time period?
- What funding sources and amounts are planned to be utilized by local governments to fund infrastructure needs during the time period?
- What funding gap exists between infrastructure needs and funding sources available during that time period?
- What public and private financial resources are available to address infrastructure needs?
- What level of use of available financial resources is projected to address infrastructure needs during the time period?

Chapter 4
Phase 1: Issue Identification

- What funding options and policy alternatives exist for addressing the infrastructure funding gap.
- How can capital facilities plans and planning process be improved?
- What type of decision support system could be implemented to monitor and compare on an ongoing basis, infrastructure needs, resources, and the gap between them.

Funding Allocation and Accuracy of Estimates

Understanding how funding will be allocated and the amount of funding necessary, are the major components in analyzing financial resources. When attempting to forecast the needs for investment in domestic wastewater, the difficulty is compounded by a shortage of data. The assumptions and judgments required in the absence of detailed data increases the uncertainty surrounding the initial estimates. The types of financial resources to be allocated and the accuracy of estimate obtained at each step are discussed below.

- Financial resources need to be allocated to perform **preliminary studies** to determine an initial cost estimate. The preliminary cost estimates are based on little detail compared to firm estimates that are determined throughout the process. However, these preliminary estimates are extremely important for determining if further consideration should be given to a project and to ensure funding is being provided to high priority projects. Cost estimating has a probable accuracy of up to ±50 percent.
- Additional financial resources are allocated to perform **focus studies**. Data is gathered from previous focus studies, as well as from the baseline needs assessment to refine costs. Cost estimating has a probable accuracy within ±30 percent.
- Financial resources are then allocated to developing **facility plans**. The facility plan begins to refine the alternatives and gather detailed data on the project. The estimate is based on almost complete data but before completion of drawings. Cost estimating has a probable accuracy within ±20 percent.
- Financial resources are then allocated for **design** and **implementation**. At this stage, a detailed estimate is based on complete engineering drawings, specifications, and site survey data. The probable accuracy of estimate within ±10 percent.
- Lastly, financial resources are allocated to **operation and maintenance** and **monitoring** programs for the project. At this stage, sufficient data has been collected to provide a firm estimate to develop and implement these programs. The probable accuracy is usually within ±5 percent.

As additional data is collected, the distinction between preliminary costs and firm estimates decreases. The percent (%) error decreases from the preliminary studies stage to the detailed design and implementation stage. Throughout the process, estimates are compared to the funding sources available to obtain an idea of the funding gap that exists between funding for infrastructure needs and the funding sources. Therefore it is important to realize that the

funding gap will vary as the cost estimates are being refined throughout the process. Obtaining a clearer understanding of the impacts the estimates will have on the funding gap will dictate management strategies to minimize the funding gap.

Willingness to Pay

A crucial step in addressing the funding gap is to estimate the benefits of the proposed service through a willingness to pay for water analysis, i.e., for the amenity of sewage removal and running water in the house. Two commonly used approaches for determining public willingness to pay is through surveys and observation of the existing economic trends. Five percent of household income has often been estimated in developing countries as a typical willingness to pay for water and sewage. In developing countries, households may be willing to spend a percentage of their family income on water and sewage facilities. This willingness to pay is a reflection of the health benefits and the amenities and convenience associated with water and sewage services. Studies performed in Brazil illustrated a willingness to pay between 2.8-6% of household incomes for sewage services alone (Carrizosa, S. 1993). An evaluation in Nigeria also confirmed low income households were willing to spend 18 percent of family income on water. Therefore management strategies should support programs that promote self-financed solutions to wastewater problems.

Financing Low-Income Household Systems

Low income populations not served with public water and sewerage services require special consideration when planning for their needs. This segment of the population, which cannot afford to pay for conventional services even if they were offered to them, is the highest-risk population from a public health point of view. Non-conventional, low-cost technologies, primarily household systems can provide lower-quality service at an affordable cost. Because low-income communities are common in the WCR, financing strategies specifically for poor communities warrants further discussion. Some examples of successful sanitation financing exist, but these cannot be applied universally. The following are examples of two financial strategies for low-income communities.

- **Household Credit Financing**: Offering credit tied to household systems is one possible means of encouraging people to spend some of their limited income on domestic wastewater systems. Credit facilities extend the options available to households who would otherwise have had to save for the facility, if not continue to do without it. Credit mechanisms can actually lower the cost of the investment. If the client can pay for the system in a lump sum, contractors are likely to offer a lower price. In the absence of credit, households may pay more for materials if they are only able to purchase many small lots of materials until they have enough to complete the work. Appendix B-3 provides additional household credit financing schemes for sanitation, lessons learned, and useful financial principles when addressing costs to implement low-income household systems.

- **Rotating Savings and Credit Associations**: Rotating savings and credit associations (ROSCAs) are an established feature of urban and rural societies in many parts of the world. A fixed number of participants contribute a fixed sum to a pot of money on a regular basis (e.g., 12 participants monthly). Each month ownership of the pot goes to a different individual, according to some criterion (e.g., lottery) with everyone receiving the pot once. In this way, a larger sum of money is saved than could be saved by a single individual. In Thailand, household collection systems have been financed by ROSCAs, with each participant household contributing once a month to the pot, the contents of which is used (along with voluntary labour) to construct another system each month.

Homeowners are responsible for covering the installation, operation, maintenance, and repair of their systems. However, an important alternative is centralized management of individual systems. This approach would require a program to keep track and audit existing systems and ensure necessary mitigation steps are taken as necessary. Left unchecked the maintenance of these systems are lapse. In addition, funds are needed to cover costs associated with site evaluation, design, land acquisition, and associated administrative and legal costs. The initial step in acquiring funds to cover household systems is to evaluate the funding sources available. Appendix B-4 lists potential funding sources used to finance household systems in the United States and their advantages and disadvantages. Although one-time sources can help initiate special projects or develop new functions, support for operating and maintaining household systems over the long term should come from sources that can provide continuous funding. Monthly service fees, property assessments, regulator general fund allocations, and permit/licensing fees can be difficult to initiate, but provide the most assurance that household systems can be supported over the long term. Securing public acceptance of these financing mechanisms requires stakeholder involvement in their development.

4.4.2.3 Legislative Authority

The needs assessment should include a review of the policy, legislative authority associated with regulating and providing for domestic wastewater management and pollution control. The review should address provisions for pollution control of coastal waters as well as responsibility for providing domestic wastewater management infrastructure. The role of government in enacting legislation is fundamental to shaping the pace and nature of domestic wastewater management improvements. Each nation will need to begin by asking whether the Protocol, including Annex III, has been adopted, and, by reviewing what other laws, regulations and policies are in place. Each nation should additionally review inter-jurisdictional conflicts, which are commonplace because of the existing patchwork of legislation, regulations, and judicial intervention combined with ineffective mechanisms for enforcement, which leads to delays in making improvements. Development of laws should be based on policies derived from dialogue and political consensus among different levels of government, industry groups, and communities likely to benefit from the planned improvements.

Government, industry groups, and other stakeholders should be engaged in development of new legislation to address compliance and enforcement gaps; and identify strategies for meeting compliance and enforcement, including various capability building, resource sharing, and economic instruments such as cost recovery and financing.

After legislation is enacted, it may be necessary to promulgate regulations to specify in detail how the legislation should be implemented. Regulations are typically promulgated by the implementing agency or governing body. The public and stakeholders, as well as other government agencies, should be given the opportunity to comment on proposed regulations. It may also be necessary to enact ordinances at the local level in order to implement the new laws and regulations.

Types of legislative needs are summarized in Table 4.4.

Table 4.4 Types of Legislative Authority Needs

• Review existing legislation and specifically determine if the Protocol has been adopted or begin steps to adopt it.
• Identify issues and needs through stakeholder participation (adoption of Protocol, compatibility and interjurisdictional conflicts with existing laws, compliance and enforcement gaps, and domestic wastewater management funding for institutional capacity building, capital improvements, and facility O&M funding).
• Develop draft and final legislation through stakeholder participation (develop position papers on proposed legislation, circulate draft legislation to interested stakeholders, and allow for input from stakeholders, and develop final legislation).
• Submit legislation for governmental approval.
• Draft corresponding policies, regulations and standards to implement legislation and allow for public/stakeholder input.
• Draft local ordinances if necessary.
• Implement and enforce new legislation (legislation may result in the creation of new institutions, environmental management programs, and the need to administrate new funds to support compliance and enforcement programs).

4.4.2.4 Government Structure and Authority

The needs assessment should review the government structure and functional roles associated with regulating and providing for domestic wastewater management systems and pollution control. The jurisdictional boundaries for planning and management in relation to where discharges fall into coastal water will need to be defined. Additionally, there should be clarification regarding which government bodies have responsibility for regulating discharges to coastal waters vs. providing for domestic wastewater management infrastructure. Implementation of a domestic wastewater management program may require modification of existing government structures and authorities, if not the creation of totally new government entities. Changes to existing government structures would come about from new legislation recommended as part of the national plan, but initially identified as part of understanding the

needs. Domestic wastewater management should be implemented by existing government institutions where institutional knowledge and experience reside; however, in some cases, it may be more appropriate to create new government institutions. The government's structure and authority should be clearly defined by legislation and further refined by the respective authorities through capacity building activities, resulting from dialogue and coordination with other national-, provincial-, and local-level government institutions, as well as private sector, academic, and NGOs. Consideration should be given to provide enforcement authority for the regulatory pollution control agency over the entity in charge of providing the wastewater service.

Types of government structure and authority needs are summarized in Table 4.5.

Table 4.5 Types of Governance Needs

• Review existing government structures and clarify corresponding roles, responsibilities, and authorities (protocols for compliance and enforcement and financial expenditures).
• Identify capacity building needs (staff training and office and field equipment such as computers, sampling and monitoring devices).
• Implement institutional communication and resource sharing mechanisms.
• Specify enforcement needs (jurisdiction, responsibility)
• Establish governing authorities and policies to conduct environmental impact assessments (EIA), facilitate public participation, perform monitoring and other institutional related requirements of the LBS protocol.

Specific requirements are set forth in Article VII of the LBS Protocol to develop and adopt guidelines concerning EIA to review potential effects of planned land based activities in any of the countries of the WCR that may cause substantial pollution or harmful changes to the Convention Area. The EIA is a regulatory process supported by documentation to evaluate environmental impacts of proposed policies, programs, and projects. This regulatory instrument is often used to evaluate proposed government policies or projects ranging from major developments involving highways, dams, power plants, dredging harbors, rivers, or channels, as well as, industrial or domestic waste water treatment plants. Consequently, policy proposals such as the classification of water bodies as Class I or Class II should also require an EIA. The EIA process would facilitate public involvement and input to the decision makers, consistent with Article X of the LBS Protocol. Some of the immediate objectives of an EIA are to:

- Use resources appropriately and efficiently
- Identify appropriate measures for mitigating the potential impacts of the proposals, and
- Facilitate informed decision making, including setting the environmental terms and conditions for implementing the proposal.

Other long term objectives include:

- Protect public health and safety
- Avoid irreversible changes and serious damage to the environment
- Safeguard valued resources, natural areas and ecosystem components, and
- Enhance the social aspects of the proposal.

Further guidance on the EIA process is available through UNEP at http://www.unep.ch/etu/publications/EIAMan_2edition.htm (Freeman and Jenson 1998).

Case Study: Establishing a Government Structure in Uganda for Sanitation

Securing a political structure for addressing sanitation involved a long process stretching more than twenty years. However in 1997, Uganda was one of the first countries in the world to issue a well-articulated national policy on sanitation. The effort to make sanitation the center of attention and obtain a national policy was a cooperative one involving the ministries of health, gender and community development, natural resources, finance and economic planning and information, and external support agencies such as UNICEF and WHO. The first step involved putting together a committed team of experienced professionals at the Division of Environmental Health in the Ministry of Health. Those selected had to be suitably qualified and also have a high level of personal commitment to improving sanitation. The team's main purpose was to develop a strategic plan which would enable the problem of sanitation in the country to be defined clearly. The team developed a sanitation strategic plan by first identifying the major environmental problems in the country. A workshop was held later with major stakeholders from government departments and other agencies to develop strategies for tackling these problems. An assessment of the status of sanitation in Uganda was undertaken and provided important information for raising awareness and triggering discussion about sanitation among politician, donors, administrators and NGOs. Discussion was generated formally through meetings, workshops, and national events and informally at social gatherings, sports events, and by using prominent private citizens such as retired professors to initiate discussions. A national sanitation task force was then established. Membership includes representatives from government departments, NGOs, multi and bilateral organizations, support agencies, and prominent private citizens. The task force developed further strategies for resource mobilization, information, education and communication. The task force held Uganda's first ever National Sanitation Forum. All district authorities and other key stakeholders attended and together they signed a declaration of commitment. Today Uganda's national sanitation program is on firm ground and has full political backing.

Chapter 4
Phase 1: Issue Identification
4.4.3 Specific Needs

Before each of the specific needs of Annex III can be addressed, there needs to be a determination of the planning and management boundaries (see section 3.4.4) of where it applies and then a determination of management needs. Guidance to determine the specific needs are discussed in this section and assisted by Figures 4.2 through 4.7 and Tables 4.6 through 4.14. Depending on the size of the country, some of these needs may be prioritized. It may also be appropriate to consider pilot scale projects designed to gain experience in implementing the activities, before a more full scale effort is made.

4.4.3.1 Discharge Identification

Type of Discharges
- Urban Runoff
- Agricultural
- Industrial
- Domestic

A general inventory of domestic wastewater and other types of discharges into the Convention Area should be assessed first. A more complete assessment, should be a task identified as part of future planning activities. It will be important to assess what types of discharges are having the greatest impact to water quality, so that they are considered as part of the assessment of national priorities. Point and nonpoint pollution sources, such as urban runoff and agricultural runoff, and industrial discharges, along with domestic wastewater discharges, will all adversely impact water quality. For example, in many watersheds, additional domestic wastewater treatment will have essentially no impact on water quality until storm water discharges and nonpoint sources of pollution are controlled. The Annex III does not provide guidance in controlling pollutant sources other than domestic wastewater. However, it is important to recognize the role these other sources of pollutants have and ensure that they are managed as part of other water sector policies.

**Hospital discharges via a direct outfall discharge.
The hospital drains medical wastes and sewage directly into the river that is located adjacent to the local community.**

Figure 4.2 provides guidance in assessing the following:

- What type of discharges are present?
- Do discharges comply with Annex III effluent limits?

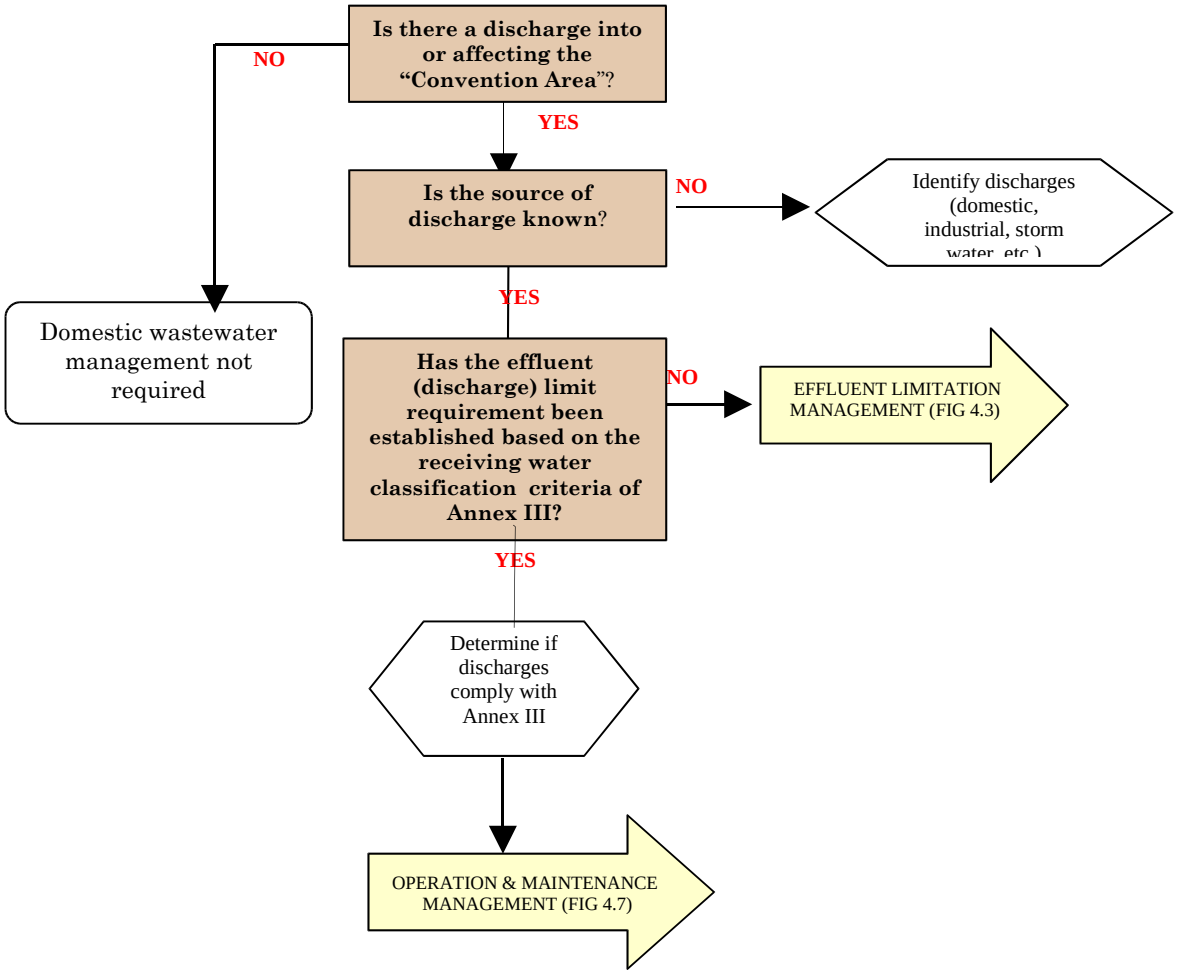
Domestic wastewater discharges can impact the Convention Area directly or indirectly. For example, domestic wastewater can seep through the subsurface and into groundwater, which then flows into the Convention Area. The needs assessment should both direct and identify indirect domestic wastewater discharges impacting the Convention Area. Table 4.6 provides examples of indirect and direct discharges into the Convention Area.

Table 4.6 Indirect and Direct Discharges

Indirect Discharges	Direct Discharges
• Discharge into the river connecting to the Convention Area • Discharge into the estuary connecting to the Convention Area • Groundwater	• Outfalls into the Convention Area • Ditches, collection systems into the Convention Area • Cruise ship discharges

A geographic information system and associated databases will assist the countries in performing tasks such as (1) locating, describing, and completing the inventory of discharge sources, (2) classification of water bodies based on Class I and Class II criteria, and (3) defining watershed and geopolitical boundaries.

Chapter 4
Phase 1: Issue Identification



OBJECTIVES:

- **Identify discharges into the Convention Area**
- **Determine if domestic wastewater management required**

Figure 4.2 Discharge Identification Decision Tree

4.4.3.2 Effluent Limitation

Each country of the WCR will need to classify its respective Convention Area coastal waters as Class I or II waters. This task will vary in the level of effort required to complete it depending on the size of each country. For the needs assessment, it may be appropriate to prioritize areas to be classified, since the classification process will likely entail a significant field effort and will require extensive public review, before final decisions can be made. Classification of receiving waters should be based on the definitions of Class I and Class II waters provided in Table 2.2. It should also be performed based on a formal EIA process that evaluates the impacts of the proposed classification and one that includes participation by stakeholders throughout the process. Considerations for establishing valuation of the natural resource will require use of economic, environmental, and social measures as illustrated in valuing fisheries in one example by Castilla (1995) and other examples provided in Programa de las Naciones Unidas para el Medio Ambiente (PNUMA) y Fundación Bariloche (FB) (1966). The approach taken to classify Class I and Class II waters will likely be different in each WCR country, but they should all achieve the goals and specific objectives of the LBS protocol.

Classification of coastal waters is required to establish effluent limits for each discharge. A discharge into a Class I water of the Convention Area, should meet the effluent limits established for Class I waters. Similarly, a discharge into Class II waters of the Convention Area, should meet the effluent limits for Class II waters. Effluent limits cannot be established for discharge waters, if the waters of the Convention Area in the country, as well as, any shared international borders have not been classified as either Class I or II waters.

Receiving Waters — The receiving water are defined as any point or area in the Convention Area waters where the domestic wastewater effluent is discharged. The discharge into the receiving waters may be from a discharge outfall, runoff, accidental spill, or any other mechanisms where it's end point is the Convention Area waters.

To determine compliance Annex II, the effluent water quality needs to be measured and compared against the effluent limits established for the receiving waters. If the effluent water quality is unknown, a monitoring program should be established.

Figure 4.3 provides guidance in managing the following:

- Have the receiving waters been classified as Class I or II?
- Is a formal process for classifying receiving water as Class I or II in place?
- Are the effluent limits known in order to determine compliance of discharges based on classification of the receiving waters?
- Is a monitoring program available to determine compliance with effluent limits?

Where classification of the receiving waters are unknown, a formal process that includes preparation of an EIA to classify waters of the Convention Area should be required. Additionally, the process should include public participation to provide input from all potential stakeholders. Table 4.7 provides recommendations for classifying receiving waters.

Table 4.7 Considerations to Classify Receiving Waters

Environmental Impact Assessment Process

- Propose an EIA process to classify receiving waters in each country and begin the classification
- Produce an EIA with proposals for Class I and II waters in each country
- Send EIA to stakeholders for review
- Hold public hearings with stakeholders to get input on proposals
- Incorporate stakeholders comments into the EIA
- Finalize the EIA
- Publish a record of decision describing classification process and list results of the classification of receiving waters of the country
- Establish permit limits to all dischargers based on whether their effluents discharge to Class I or Class II receiving waters
- Establish a compliance inspection program to ensure that discharges are in compliance with effluent limits based on requirements of Annex III

Considerations for Water Classification

- Do the waters sustain coral ecosystems, seagrass beds or mangroves (extensive, moderate, sparse)?
- Are the waters considered breeding areas for aquatic life (critical, moderate sparse)?
- Are the waters considered critical breeding areas for terrestrial life (critical, moderate sparse)?
- Do the waters provide a habitat for species protected under the SPAW Protocol?
- Are the waters considered a protected area under the SPAW Protocol?
- Would discharges into these waters adversely affect humans?
  - Would discharges result in contamination of fish and shellfish consumed by humans?
  - Are direct ingestion of waters by humans likely?
  - Are waters used to body-contact recreation (swimming, diving)?
  - Are waters used for non-body contact recreation (boating)?
- Would discharges into these waters adversely affect living resources (food chain, ecological impacts)?
- Are the waters classified with unique environmental characteristics?
  - Do the waters support endangered or threatened species?
  - Do the waters support endemic species?
  - Are the waters considered an estuary?
- Are the water boundaries defined?
- What are the legal jurisdictional boundaries?
- What are the physical boundaries?
- What are the ecological boundaries (seasonal, migratory, breeding)?

Example of a Ranking System for Water Classification [1]

A. Presence of Aquatic Life

1. **1 Point** Waters do not provide habitat for aquatic life
2. **2 Points** Waters provide habitat for aquatic life, fish
3. **3 Points** Waters contain sparse (<25% of surface water area) populations of coral reefs, seagrass beds, or mangroves

Table 4.7 Considerations to Classify Receiving Waters

4.	**4 Points**	Waters contain moderate (25% to 50% of surface water area) populations of coral reefs, seagrass beds, or mangroves
5.	**5 Points**	Waters contain substantial (>50% of surface water area) populations of coral reefs, seagrass beds, or mangroves
B.	**Breeding Area for Aquatic Life**	
1.	**1 Point**	Waters do not provide breeding area for aquatic life
2.	**2 Points**	Waters provide breeding area for non-sensitive aquatic life
3.	**3 Points**	Waters provide minimal breeding area for aquatic life
4.	**4 Points**	Waters provide moderate breeding area for aquatic life
5.	**5 Points**	Waters provide critical breeding, nursery, or forage areas for aquatic life
C.	**Waters Adversely Affecting Humans**	
1.	**1 Point**	Non-recreational water use by humans
2.	**2 Points**	Water use impacting resources ingested by humans (shellfish, direct ingestion)
3.	**3 Points**	Waters use for non-body contact human activities (boating)
4.	**4 Points**	Waters use for body-contact human activities (swimming, diving)
5.	**5 Points**	Waters used for substantial recreational and economic benefits (tourism)

1 Circle the scores for all that apply and sum the scores.

Chapter 4
Phase 1: Issue Identification

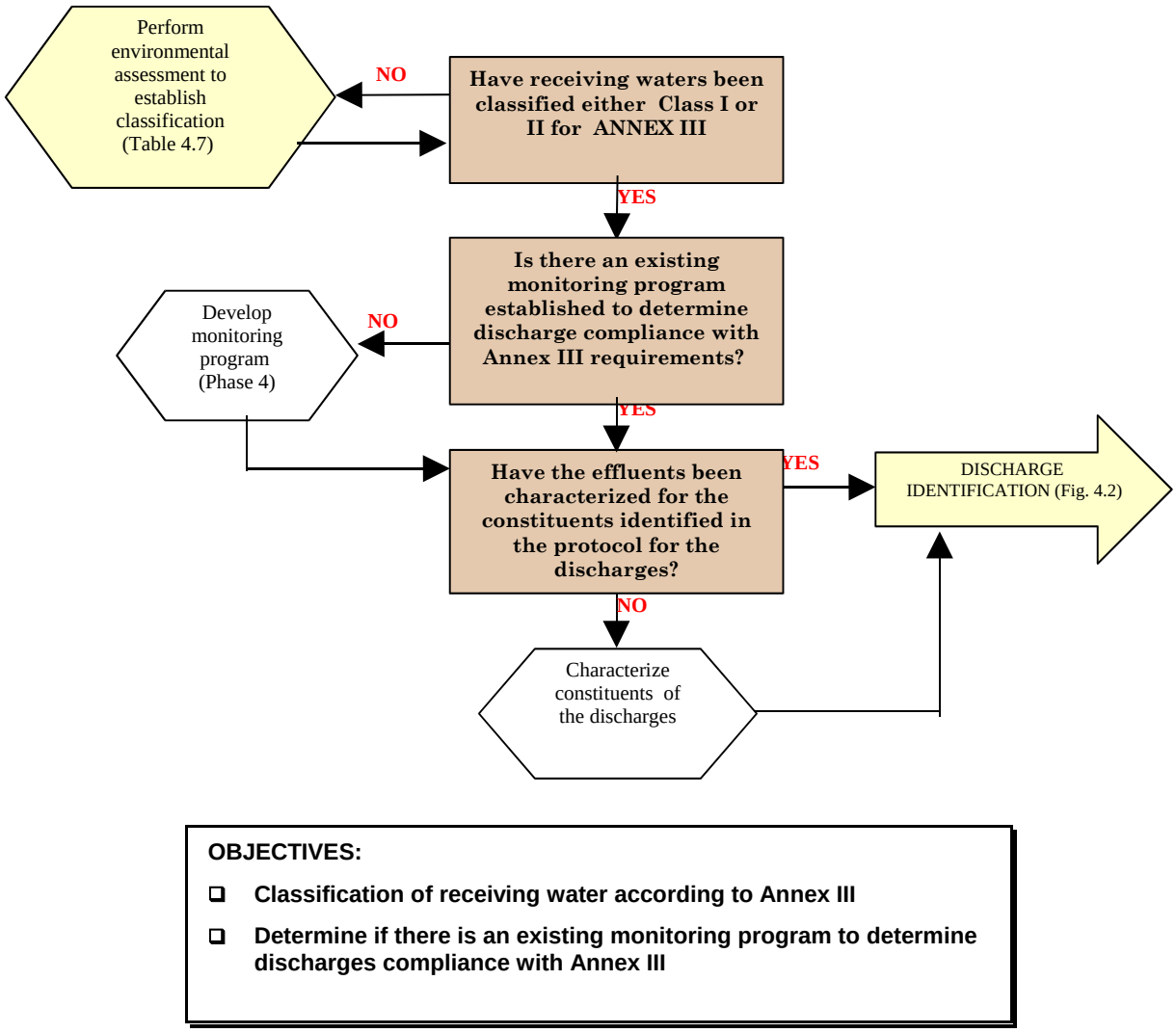


Figure 4.3 Effluent Limitation Decision Tree

4.4.3.3 Domestic Wastewater Treatment

A review of the existing domestic wastewater management systems needs to be assessed, followed by an evaluation of treatment options; these include potential for flow reduction and determination of a decentralized vs. centralized system. These three need categories are discussed below.

Existing Systems and Projects of Future Needs

A national assessment of existing and future domestic wastewater management systems needs involves several steps, only a few of which are described in this document. The population that needs to be served should be estimated based on projections of existing and future growth . The timeframes should be based on the planning period needed to meet domestic wastewater management program requirements. Communities should be described in terms of projected waste per household, population densities, current costs of domestic wastewater collection, treatment, and disposal, and percentage and types of systems in place such as (1) central sewage systems or (2) septic tanks, cesspools, or other on-site systems for excreta disposal. The level of treatment and extent of domestic wastewater management systems with any treatment should be assessed. An assessment should be made of industrial dischargers, presence, types, and quantities of dischargers into domestic wastewater treatment systems.

Some additional information needs include a summary of the socioeconomic and cultural considerations, the environmental characteristics, such as issues of water availability, siting concerns such as, flood plains, meteorology, geology, climate, and prevalence and profile of human settlements

The information should be tabulated by communities and details of existing systems mapped, so that an analysis of trends can begin to be formulated. This baseline information is then used to project future needs, based on considerations described below.

Flow Reduction

One of the first considerations in assessing domestic systems is evaluating flow reduction methods. An extensive array of techniques and devices are available to reduce wastewater flows generated by individual water-using activities. Flow reduction has an impact on the volumes of wastewater being produced as well as the characteristics of the wastewater. Strategies should be implemented to reduce the flow volume or decrease the mass of key pollutants in the influent wastewater. This in turn may impact the type of domestic wastewater system implemented. For example, a semi-rural town may be producing high volumes of wastewater. While a collection and treatment system would be feasible, if flow reduction techniques are implemented, household systems may be a least expensive and environmentally viable option.

Decentralized vs. Centralized

The second consideration in assessing domestic systems is to determine if decentralized or centralized treatment systems are feasible. If there are no existing collection and treatment systems, a cost feasibility needs to be performed to determine if a collection and treatment system is appropriate, or if a decentralized treatment system in appropriate. Since centralized

systems require collection of wastewater and treatment for an entire community at substantial cost, decentralized systems, when properly installed, operated and maintained can achieve significant cost savings while recharging local aquifers and providing water reuse opportunities.

When considering whether decentralized or centralized system is suitable, the following factors need to be considered:

- Capital costs
- O&M Costs
- Space available for treated wastewater
- Site Conditions

Cost analysis performed have indicated that decentralized systems are generally a cost-effective means of managing wastewater in rural communities due to the distance between homes and land available. The selected household system must also be environmentally acceptable. For example, a cesspit is cost-effective, but not as environmentally acceptable as other alternatives. In small communities and fringe areas of metropolitan cities, the most cost-effective solution depends on population density, distance to the sewer interceptor, and availability of land. The centralized alternative can be competitive with decentralized options in fringe areas, where the distance to the intercepting sewer is less and the receiving water body can accommodate the additional waste load. In addition, the cost of failure for centralized systems can be far greater, given that all wastewater is concentrated at a central location. Once the decision has been made to move towards either a centralized or decentralized system, the focus can be turned to managing the necessary domestic wastewater systems.

Rehabilitation in the WCR — Small islands tend to have centralized systems in urban areas, if the topography permits, which helps in the administration of the system by a single agency. Rural mountainous areas are generally inaccessible and decentralized so that individual systems are required. Combining sanitary and storm sewers in old Caribbean cities like Santo Domingo, San Juan, Cartagena, or Veracruz, may provide a cost-effective solution considering the problem of rehabilitation or improvements require excavations in old historical streets. San Juan decided to collect all the combined sewer of old San Juan and route the flow to the Regional Treatment Plant because it has enough capacity to accommodate the projected flows until the year 2020. After 2020, the two systems will have to be separated again as the Regional Treatment Plant reaches its capacity based on projected growth.

Domestic wastewater systems include collection and treatment and disposal/reuse systems. Collection systems convey wastewater used by individuals and by commercial and industrial establishments to wastewater treatment facilities. Management is needed in the areas of implementing cost-effective collection and treatment systems and evaluating and rehabilitating existing collection systems.

Figure 4.4(a) provides guidance in assessing the following:

- Is a conventional collection and treatment system the appropriate technology?
- Which collection system alternative is feasible?

In some cases, rehabilitation of existing collection systems may be all that is needed to improve system efficiency and comply with Annex III requirements. Table 4.8 identifies steps in conducting a sewer system evaluation. (Section 4.4.3.5 addresses use of household systems, which are a potential alternative where conventional systems can not be used or are impractical.)

Table 4.8 Steps in Conducting a Collection System Evaluation

Preliminary Collection System Survey

- Assemble a survey team
- Collect and review data
- Analyze available data:
  - Mapping information, previous I/I, O&M records, and inspection reports
  - Geologic and topographic hydrologic information
  - Flow records from treatment plants, lift stations, bypasses, and overflows
  - Odor complaints, odor surveys, and corrosion data
  - Investigate areas of reported sewer overflow
  - Rainfall records and groundwater monitoring
  - Identification of O&M staff and their responsibilities
- Establish system boundaries
- Prioritize subsystem problems and eliminate nonproblem areas

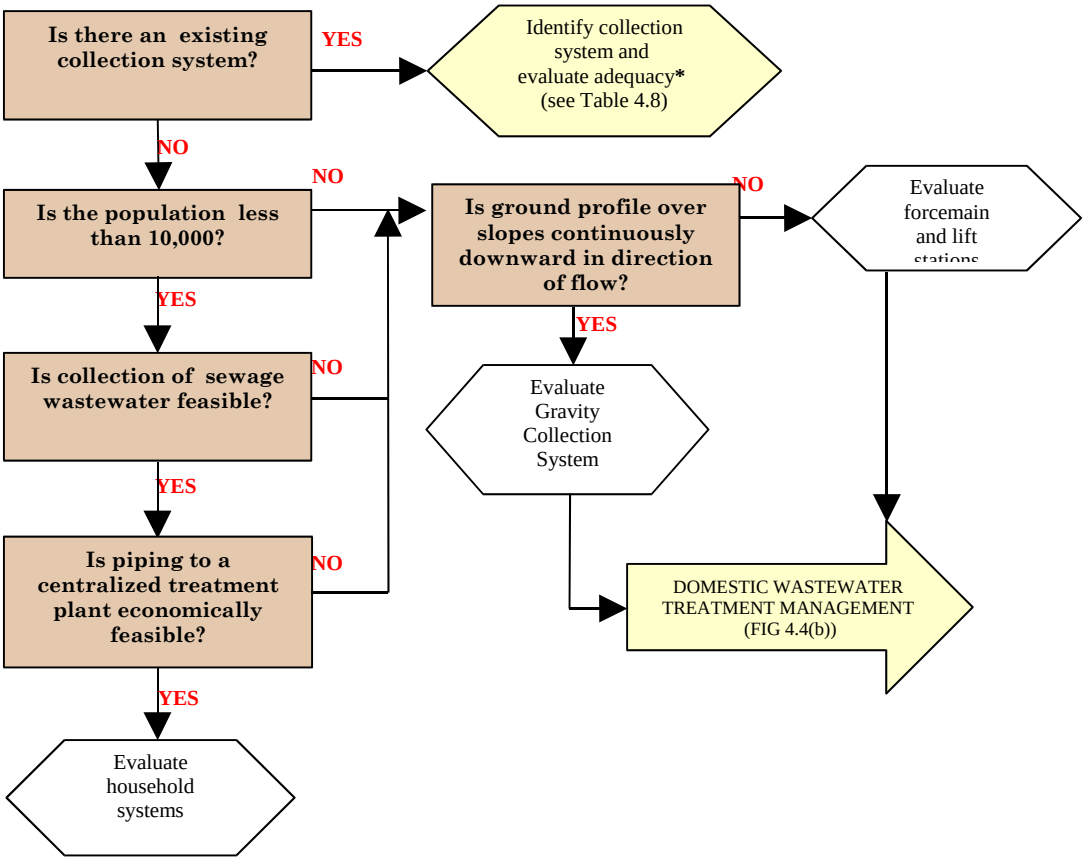
Collection System Analysis

- Conduct further Investigation of problem subareas:
  - Effects of exfiltration and migration
  - I/I analysis
  - Identify causes for overflow and alternative solutions
  - Video survey of sewer
  - Corrosion analysis
- Eliminate nonproblem segments of problem areas
- Conduct an investigation and corrosion survey
- Conduct cost-effective analysis of all problems

Rehabilitation

- Develop a final rehabilitation plan: establish planning timeframes, specific work scopes, and budgets:
  - Implement plan
  - Procure equipment and services
  - Award contracts

Chapter 4
Phase 1: Issue Identification



* Evaluate adequacy of existing collection systems using same considerations for establishing new collection systems.

OBJECTIVES:

- **Identify existing domestic wastewater systems (collection systems)**
- **Implement an appropriate collection system that complies with Annex III**

Figure 4.4(a) Domestic Wastewater System Decision Tree (Collection System)

Once existing collection systems have been rehabilitated or new collection systems have been implemented, domestic wastewater treatment systems need to be evaluated and managed. Figure 4.4(b) provides guidance in managing the following:

- Is off-site treatment of septage and industrial discharges into the plant a possible solution?
- Is water reuse a possibility?
- Which treatment system alternative is feasible?

Existing treatment systems also need to be evaluated to determine their adequacy in relation to factors such as future population projection needs, technology innovations, treatment efficiency and performance, and operational and maintenance needs.

Water Reuse

Water reuse is a viable option and provides the opportunity for pollution abatement when it replaces effluent discharge to sensitive surface waters. By eliminating effluent discharges through water reuse, the need for costly advanced wastewater treatment processes may be reduced. Consideration in developing a reuse system is that the quality of the reclaimed water be appropriate for its intended use. Higher-level uses, such as irrigation of public access lands or crops requires a higher level of wastewater treatment compared to lower-level uses, such as pasture irrigation. Table 4.9 presents a systematic approach to water reuse management.

Table 4.9 Steps in Water Reuse Management

Preliminary Investigations: to locate potential sources of effluent for reclamation and reuse and to identify institutional constraints affecting reuse:

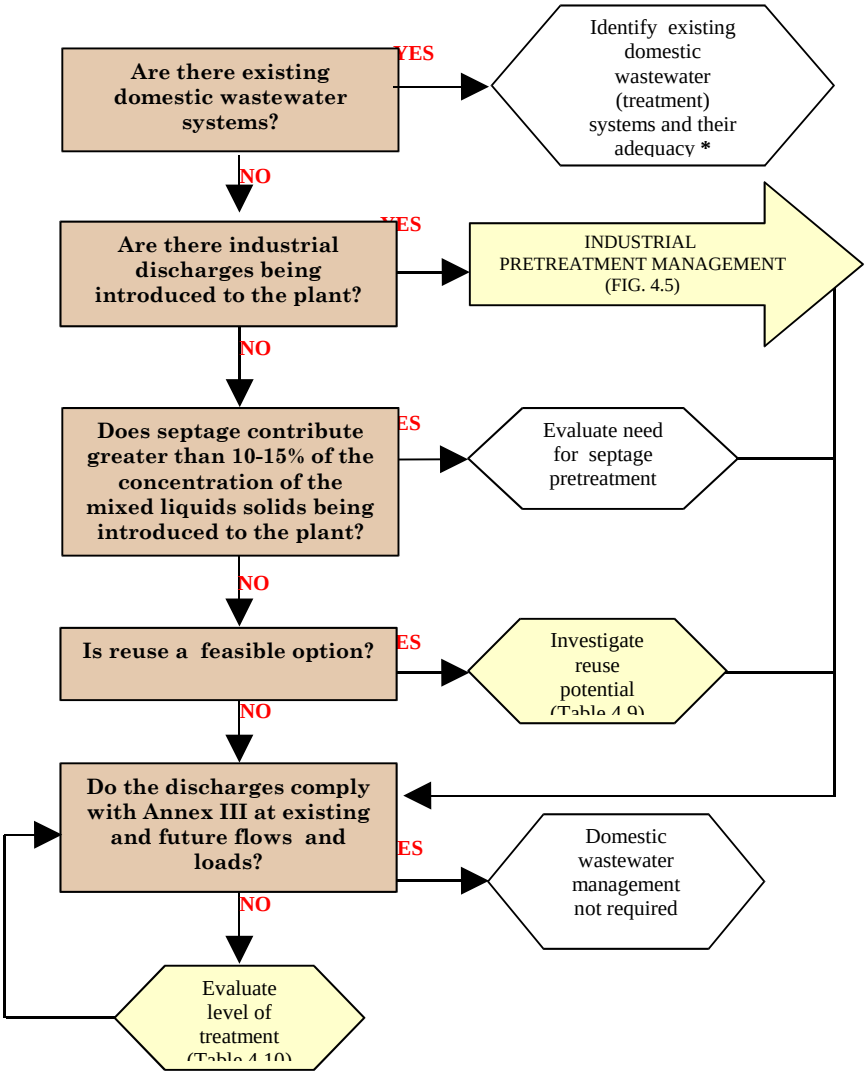
- Identify local sources of effluent that might be suitable for reuse
- Identify potential local markets for reclaimed water
- Evaluate public health risks associated with reuse and how they will be addressed
- Evaluate potential environmental impacts of water reuse
- Evaluate how water reuse will integrate with existing uses of other water resources in the area
- Identify existing or proposed laws and regulations concerning water rights and those affecting water reuse in the proposed area
- Identify national and local agencies involved in reuse program
- Evaluate funding available to support a reuse program

Screening of Potential Markets: to identify candidates that might be suitable in the area and screen alternatives to determine possible project alternatives:

- Identify quality of water to be reliably produced compared to user's requirement
- Determine the quantity of water available and the ability to meet demand
- Provide present and projected future cost of reuse program
- Evaluate water reuse program impact to stakeholders
- Determine power and chemical requirements associated with reuse system
- Evaluate reuse impact on land use

Detailed Evaluation of Selected Markets and Final Selection of Reuse program:

- Determine level of treatment needed to meet discharge limits
- Develop a cost-benefit analysis for alternatives
- Select cost-effective and environmentally acceptable technology
- Finalize and Implement Reuse Program



* Evaluate adequacy of existing treatment systems using same considerations for establishing new treatment systems.

[redacted]

Figure 4.4(b) Domestic Wastewater System Decision Tree (Treatment System)

Chapter 4
Phase 1: Issue Identification

Case Study: Reuse of Wastewater for Agriculture

Studies were conducted in the Guanajuato River Basin, Mexico, in 2000 to examine the economic benefits to farmers of wastewater irrigation and the health and environmental risks involved. The research examined the advantages and disadvantages of using urban wastewater for crop production in Mexico's water-scarce Guanajuato river basin. Wastewater irrigation is a critical component of intensive water recycling practices. The study showed that the 140-hectare site downstream of Guanajuato, which is irrigated with raw sewage, serves as a water treatment facility with significant retention of contaminants. The study found that the economic value of wastewater used for irrigation represents a significant monetary benefit to both society and water users. The findings suggested that continued application of wastewater to agricultural land in this area would be a more economical form of wastewater treatment than building a wastewater treatment plant. If a treatment plant were built, local farmers' net incomes would be reduced, because they would have to buy crop nutrients to replace those previously provided by wastewater. The stipulation is that the potential for serious negative impacts on health and the environment must be researched and monitored on an ongoing basis.

Wastewater Treatment Unit Process

If treatment discharges still are unable to comply with Annex III requirements after evaluating septage and industrial pretreatment and water reuse, treatment needs to be addressed at the wastewater treatment facility. Table 4-10 lists the various levels of treatment that must be addressed in order to meet effluent limits.

Table 4.10 Level of Treatment

Level I	–	Screening
Level II	–	Sedimentation
Level III	–	Biological Treatment
Level IV	–	Polishing
Level V	–	Sludge and Process Sidestream Handling
Level VI	–	Disinfection

Each level of treatment needs to be addressed in order to implement a cost-effective and environmentally acceptable wastewater treatment system. The treatment system required depends on the following factors:

- **Influent wastewater characteristics** and effluent quality required. The degrees of treatment needed to achieve Annex III requirements at present and in the future are the primary considerations.
- **Sludge handling and disposal** dictate, to a considerable extent, the selection of processes that are most feasible for separating contaminants from wastewater. A unit operation, although successful in extracting pollutants from water, can be unacceptable if the waste sludge produced is difficult and costly to dewater; therefore, sludge disposal always must be considered an integral part of any treatment system.
- Both **capital and operating costs** influence process selection and often dictate design decisions. Common factors include electric power consumption, application of chemicals, choice of method for sludge disposal, and separation of a combination of biological and chemical treatment.

A phased-approach strategy is essential in selection of conventional wastewater technologies. Many developing countries simply aim to adopt the effluent standards or regulatory water quality objectives established by environmental policies. These often prove to be too ambitious and do not allow for gradual implementation of a realistic mitigation program; as a result, developing countries simply renounce mitigation efforts in the marine environment. Therefore, priority sewage constituents must be identified and cost-effective, environmentally acceptable, phased-mitigation approaches must be selected. Generally, removing the first 50 percent of the pollutant load is moderately expensive, removing the next 40 percent is more expensive, and removal of the last 10 percent is often prohibitively expensive.

A treatment phased approach refers to treatment technologies that are developed as new, cheaper modifications of existing processes or complement the functions of existing processes. For example, if the existing treatment system consists of a facultative lagoon, rather than proposing a higher capital cost solution of an activated sludge system, an alternative could be to convert to an aerated lagoon with filtration and disinfection unit processes downstream. If a country is unable to meet Class I effluent limits, efforts should be aimed to implement technologies that move towards meeting Class II effluent limits and relocating the discharge. A phased treatment approach would then plan to expand existing unit processes by adding additional unit processes that merge to a treatment system capable of meeting Class I effluent limits. For example, if Annex III requires Class I discharges to be met in a timeframe of 10 years, funding resources initially could support a primary clarifier to assist in meeting marginal Class II discharges. In the following 5 years, additional funding resources could assist in expansion with aeration tanks and conversion to an activated sludge plant that would meet the Class II waters within the 10-year timeframe. The following three pictures illustrate three treatment units and are an example of a low technology treatment train in Guatemala. There is no mechanical equipment throughout the plant. The plant has been designed as a gravity flow plant.

**Low technology version of a clarifier.
Imhold tank provides primary sedimentation at the plant.**

Static feed trickling filter with inexpensive volcanic rock media. Wastewater is dispersed via inexpensive perforated PVC pipe.

Flows conveyed to the chlorine contact tank for disinfection and then discharged to the river.

Gravity Flow Treatment Train System in Guatemala

Table 4.11 illustrates possible treatment trains that can be used to meet Annex III effluent limits.

Table 4.11 Class I and II Treatment Trains

Level I	Level II	Level III	Level IV	Level V	Level VI	To Outfall
Class I Effluent Levels						
Fine Screen	Clarifiers	Activated Sludge	Filters	Sludge Thickening	UV	$$$$$
Fine Screen		Aerated Lagoon	Filters		Chlorine Contact	$$
Bar Screen		Selector + Oxidation Ditch	Clarifier		Chlorine Contact	$$$
Class II Effluent Levels						
	Septic Tank		Filter			$
Bar Rack	Primary Clarifier					$$$
Bar Rack		Lagoon				$$
Bar Rack		Trickling Filter				$$$$
Bar Rack		Wetlands				$$

$ Least expensive treatment technology

$$$$$ Most expensive treatment technology

Case Study: Cuba Treatment Plant Water and Sludge Reuse

In Varadero, Cuba, an area known for it's international beach front hotel resorts, an international joint venture (Aguas de Vardero and Aguas de Barcelona) constructed a small (5000 m3/day design flow) sewage treatment plant to service four local hotels. The plant's design includes beneficial reuse practices, which were feasible and practical.

The plant is an extended aeration plant. The plant includes a grit removal step to remove dense solids, such as sands and pebbles, followed by removal of all but the finest suspended solids by using a 2-3 mm spacing screen. The activated sludge which builds up is wasted to concrete lined beds where it eventually dries to a cake with a low moisture content. Because of the high ambient temperature and the dry climate, the sludge is significantly reduced in pathogenic organisms and putresolvable organic matter that would otherwise be attractive to vector organisms. After about a centimeter depth of solids has built up, the dried sludge is harvested by shoveling it into baskets, after which it is used as fertilizer and soil conditioner in the hotel gardens. At a supplemental charge to these same hotels, the treatment plant also provides recycle treated wastewater directly to the hotels for irrigation of the golf course and gardens.

Activated sludge being wasted to drying beds. Dried sludge on concrete drying beds.

4.4.3.4 Industrial Pretreatment

Industrial facilities discharging into domestic wastewater systems need to be properly managed to ensure that they do not contribute pollutants that will interfere with the operation of existing and new domestic wastewater systems. Assessment of industrial pretreatment needs involves identifying industrial users, confirming that their discharges qualify for industrial pretreatment, and implementing a pretreatment strategy that achieves Annex III effluent limits.

Industrial users are normally allowed to discharge into domestic wastewater systems if the following basic pretreatment criteria are met:

- Discharges are less than 25,000 gallons per day-average
- Discharge is less than 5 percent of the average dry weather hydraulic or organic capacity of the treatment plant
- Discharge does not contain toxic material (toxic organics and metals)
- Non-corrosive and will not create fire or explosive hazard
- Not containing high concentrations of solids or viscous pollutants with amounts high enough to obstruct flow or interfere with collection and treatment system operations
- If the wastewater is similar in character to domestic wastewater and that the pollutants contained in the industrial wastewater will be effectively removed by the domestic wastewater treatment plant
- Thermal heat of discharge will not damage collection system components and will not inhibit biological activity or increase treatment plan influent to above 40 °C

If discharges meet industrial pretreatment requirements, then a program should be implemented to establish a pretreatment system.

**Oxidation ditch in an industrial pre-treatment plant for treating glucose.
Foaming results from hydraulic problems in the original design.
The plant is improperly operated and maintained, resulting in sludge stability problems.**

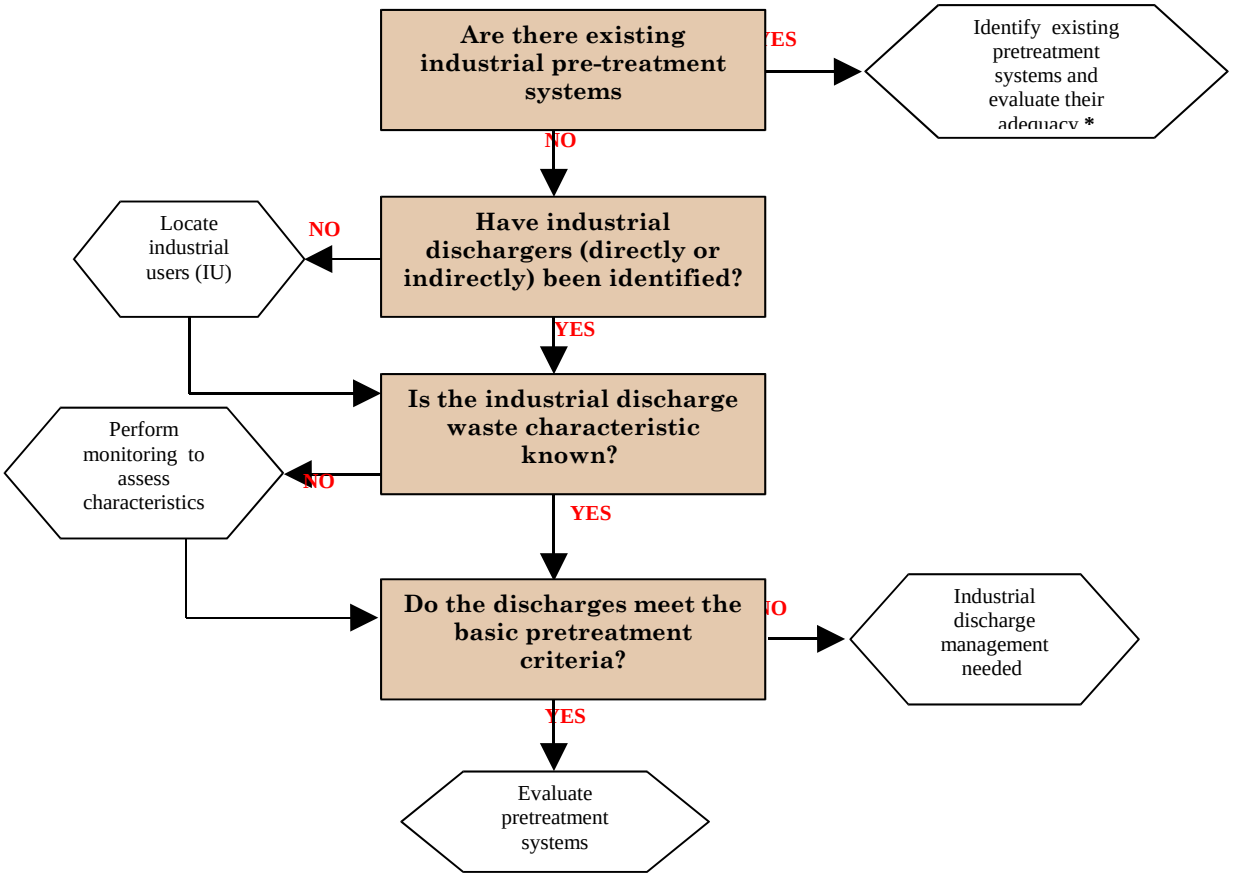
Figure 4.5 provides guidance in assessing the following:

- Have the industrial users that directly or indirectly discharge to the Convention Area been identified?
- Do industrial discharges meet the requirements that will not impair or pass through the domestic wastewater collection and treatment facilities?

4.4.3.5 Household Systems

The need for household systems instead of conventional domestic wastewater management systems should be assessed. Household systems are effective treatment alternatives where little or no piped water is available or where water consumption is low. New technologies for household systems have emerged as cost-effective wastewater management systems in rural areas which are too small and dispersed to be easily serviced by conventional systems. In communities with high costs of centralized sewage collection and treatment due to unavailable or expensive land, and where cost and energy saving technologies are crucial, household systems are viable alternatives to wastewater collection and treatment systems. Information on the planning, design, construction and management of household systems should be evaluated. Management associated with these systems relate to health and pollution hazards, including groundwater contamination, and the limits of the systems' application.

Chapter 4
Phase 1: Issue Identification



* Evaluate adequacy of existing pretreatment systems using same considerations for establishing new pretreatment systems.

OBJECTIVE:

- **Identify industrial effluents capable of being handled by domestic wastewater treatment**

Figure 4.5 Industrial Pretreatment Decision Tree

The following outlines the selection criteria to decide whether household systems are appropriate:

- Population density
- Produced wastewater volume
- The presence of shallow water wells susceptible to sewage pollution
- The presence of high groundwater table susceptible to sewage pollution
- Soil permeability
- Unit cost of sewerage
- Socioeconomic and cultural considerations
- Public awareness and education

Figure 4.6 provides guidance in assessing the following:

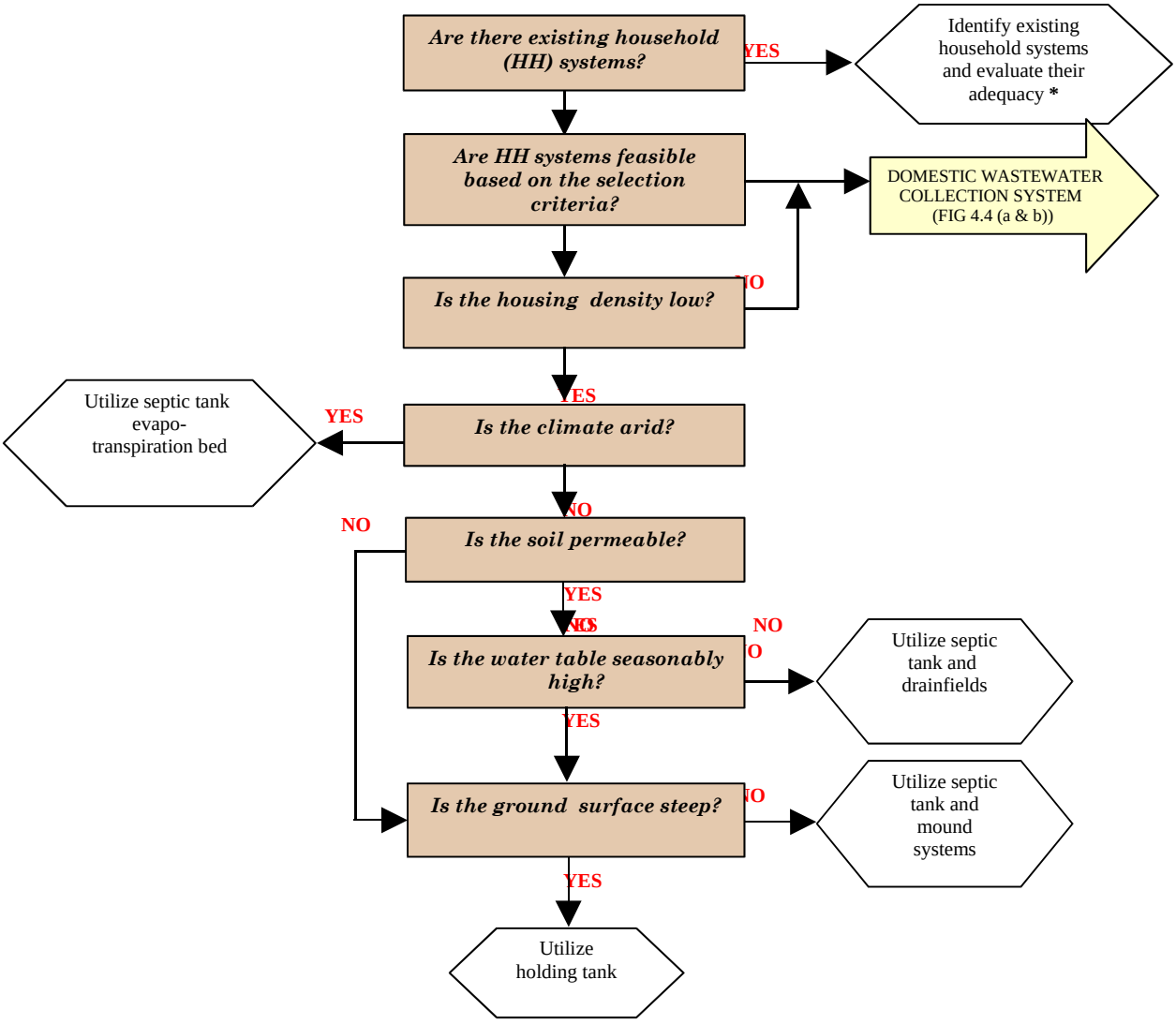
- Are household systems a feasible option?
- What is the cost-effective treatment and disposal alternative?

There are many low income, unsewered, urban and rural areas discharging along the coastline in the WCR. In these locations, septic tanks should not be used due to the proximity of the water table to the ground surface. The solution in these areas usually calls for centralized sewer systems. Also, since many of the household systems discharge directly to storm sewers, a survey of those connected to the storm sewer system must be conducted in order to identify and disconnect these structures. Coordination with government agencies, hotels, stores and residences should be encouraged to disconnect these household systems from the storm water collection and conveyance system.

Household systems require management of the treatment and disposal of the liquid effluent as well as proper removal of the raw septage from the system. Tables 4.12 and 4.13 provides options for household systems treatment and disposal method.

Climate Considerations — In temperate zones, some of these options may be less optimal or inoperable in cold weather. In tropical climates, such as in the WCR, these cold weather limitations are rarely a consideration. However, other climate considerations, such as rainfall patterns and temperature ranges, should be taken into consideration to optimize as well as address operations and maintenance requirements.

Chapter 4
Phase 1: Issue Identification



* Evaluate adequacy of existing household systems using same considerations for establishing new household systems.

OBJECTIVES:

- **Identify existing household systems**
- **Determine which household systems are applicable**

Figure 4.6 Household Systems Decision Tree

Table 4.12 Treatment/Disposal of Liquid Effluent from Household Systems

	Advantages	Disadvantages

Land Treatment		
• Irrigation	Effluent quality excellent	Large land requirement Limited by soil type, depth, topography, climate, etc. Sprinkler clogging, odors
• Rapid Infiltration	Simple operation Least land-intensive	Limited by soil type, depths, hydraulic capacity
• Overland Flow	Soil clogging not a problem Depth to groundwater not critical	Limited by soil type, crop water tolerances, climate slope Vegetation required Potential odor, vector problems
• Wetland Application	Good for small flows Low cost, simple	Large area required Potential for mosquito breeding
Discharge to Surface Water		
• Lagoons	Simple operation Low cost High reliability Long service life	Large land requirements
• Attached Growth or Suspended Growth	Process more controllable than lagooning, land treatment Performance well documented for wastewater treatment Small land requirement	Higher capital and operating costs than lagooning, land treatment
Discharge to Treatment Plant	Construction and maintenance of liquid stream facility not required	May have adverse impact on treatment plant if liquid stream high-strength.

Table 4.13 Treatment/Disposal of Septage from Household Systems

	Advantages	Disadvantages
• Spreading	Soil conditioning, fertilization Dewatering not needed Inexpensive liquid transfer	Septage should be stabilized Large area required
• Trench Fill	Suitable for unstabilized septage Low initial costs	Daily soil cover required for vector control Large land area
• Area Fill Mound	Suitable in shallow-water table areas or where excavation not possible	Stabilized septage required High manpower and equipment Leachate must be controlled
• Incineration	Stabilization not required Small land required	High Costs Air pollution control devices required Dewatering required

Case Study: Small Scale Sewage Treatment Systems in Rural Farming Communities in Costa Rica

In Costa Rica, as in many countries of WCR, rural farming is a common livelihood, with specific activities which contribute to water quality impairment. Investigators at Earth University in Costa Rica have performed pilot scale treatment system studies designed to economically treat

farm waste, in this case plant residues (e.g. banana plant) and animal manures. One of the systems under function as biodigestors, and represent a low-cost, low-technology, but effective approach to treat wastes and can be adapted to include treatment of household sewage waste in combination with farm waste. The biodigestors would be a viable option for rural communities whose economic livelihood are associated with small scale farms. The concept of the biodigestor is to maximize the use of farming waste as biodigestable material, by combining it with household sewage waste. The biodigestors pilot scale systems have already been put in practice in about 60 farms, some of which also include their household waste. The system relies on horizontal plastic bags, which provide a retention time of 50 days for treatment. The installation is relatively simple, requiring the bag to be initially filled with carbon monoxide to facilitate filling it with the organic material. The sewage waste is treated inside the plastic bag, which serves as the self contained mini-treatment plant. A pipeline from the home discharges sewage directly into the biodigestor plastic bag located several feet away from the house and buried. The biodigestor effluent is discharged from a pipeline which drains to a wetland system and eventually flows to the nearest water body. The biogas generated is used for household cooking and the solids as organic fertilizer. The residence time in the biodigestor is scaled for the specific needs of the household and requires little maintenance. The system has been demonstrated to be a relatively cost-effective solution for rural families. While the system has limitations such as inadequate treatment of the overflow from the digestor, it is a useful interim approach to reduce water pollution. (Source Dr. Carlos Hernandéz, Earth University, Costa Rica.)

Installation of biodigestor.

4.4.3.6 O&M Management

The country-wide O&M program needs should be assessed, such as availability of national guidance documents for facilities to use in developing a O&M program, certification programs for staff working in O&M of existing and future facilities, education programs for staff responsible for O&M training, and other institutional capacity building needs. The prevalence of O&M in existing facilities should also be documented to have an understanding of projected needs. Maintenance neglect has been one of the major constraints to the sustainable expansion of coverage. It results in premature deterioration of physical infrastructure, adversely affecting system performance and reliability. For the low income households, maintenance neglect is particularly devastating because it is easier for them to raise the small amounts required for routine operation and maintenance than it is to raise the large investments for periodic rehabilitation of damaged infrastructure. Besides, the rehabilitation takes up funds that could have been used for expansion of coverage. Thus maintenance neglect is a major constraint to the sustainable expansion of coverage. It is important that in planning investments in domestic wastewater systems, adequate and credible arrangements be made for routine operation and maintenance.

O&M costs are extremely important to operating agencies and particularly to small communities with limited budgets, because costs to operate and maintain facilities are funded with local funds (Brikké, F. et al. 2002). Therefore, the operability and maintenance of household and domestic wastewater systems must be evaluated. In some countries, existing systems are maintained or operated improperly. A successful O&M program provides guidance in evaluating existing systems, diagnosing existing operability problems in the system, and securing sufficient resources to fix the problems. In most cases, fixing existing maintenance problems may be all that is needed for the systems to meet existing Annex III requirements.

An O&M Program, coupled with a receiving water monitoring program, are a must because the existing sanitary sewer system in WCR lack adequate O&M programs and receiving water monitoring programs can alert plants that they need to attend to problems in effluent quality.

Example of a poorly sited unit process and the impacts of maintenance negligence. The clarifier is located along a steep rocky slope. The location provides for difficult periodic maintenance and is neglected. As a result the clarifier is inoperable and wastewater flow is bypassed and directly discharged into the river downstream.

Chapter 4
Phase 1: Issue Identification

Figure 4.7 provides guidance in assessing the following:

- Is there an existing O&M program?
- Are there existing household and domestic wastewater systems requiring maintenance?
- Will effluent comply with Annex III if existing systems are repaired and maintained?

If an existing facility-level O&M program has not been established, a plan needs to be devised to identify resources required to implement a successful program. Table 4.14 identifies key steps needed to implement an O&M program.

Table 4.14 Operation and Maintenance Program Implementation Process

• Identify existing and new systems, facilities, and components requiring maintenance.	What are the optimal operation requirements? What are the system maintenance requirements? What equipment is needed to support maintenance? How frequently will systems be inspected? What indicators will be used to monitor maintenance needs?
• Determine a budget to implement an O&M program.	O&M Budget: $ required to maintain system operating Capital Budget: $ required to upgrade system to meet future growth needs and comply with effluent limits
• Establish O&M procedure protocol (such as O&M manuals).	Provide instructions on equipment and maintenance information
• Identify O&M staff and define responsibilities.	What manpower will be required to maintain the system? Is manpower required to measure indicators?
• Develop a maintenance schedule.	Create 5-day work orders and forecast maintenance work orders.
• Establish a data collection system.	Identify quantitative and qualitative data that needs to be collected (flow measurement, effluent samples, and so on) and procedures for collecting data. Equipment Record System: collect input data such as equipment, vendor, parts, capacity, identification numbers, installation dates, cost, and so on. Track Maintenance Record: man-hours, frequency of maintenance, and inventory control of parts.
• Develop a facility system inspection program.	Develop O&M checklists for systems. Establish an Inspection Schedule: how frequent does the system need to be inspected?
• Establish a security and emergency response plan.	Emergency Operation Plan: personnel roles during emergency, coordination with other parties (such as police), security, and procedure plan during an emergency
• Establish community relations.	Communicate with public, local government, and key stakeholders regarding changes and upgrades.

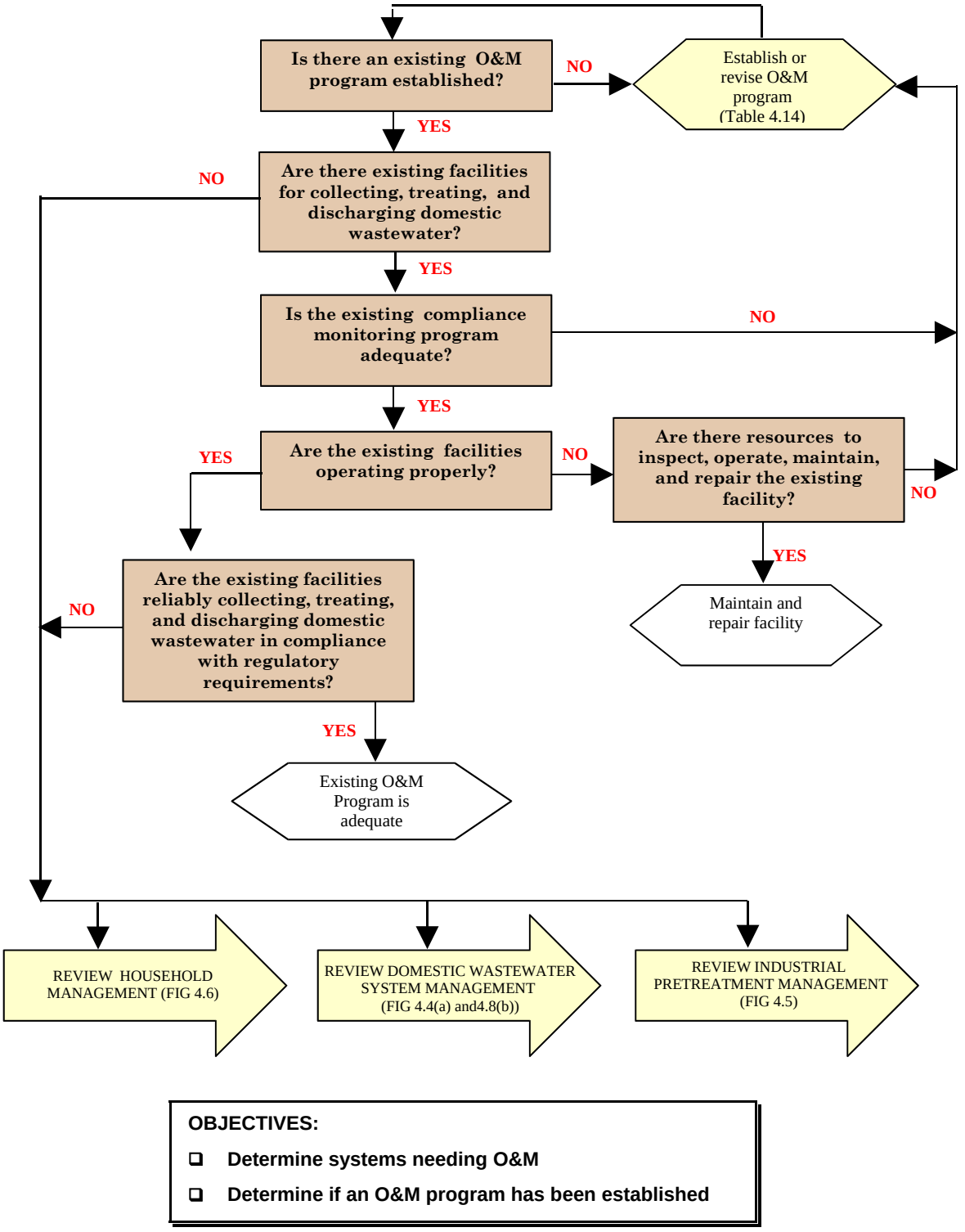


Figure 4.7 Operation and Maintenance Decision Tree

The O&M plan should include monitoring of the discharge receiving environment (water, land, etc.) and an evaluation process to assess the conditions of human health and environmental health. The assessment should feedback to the problem identification phase.

Case Study: O&M

Ghana is one of the five African nations along the northern coastline of the Gulf of Guinea. The existing collection systems were constructed employing convention design principles, but all malfunctioned to a varying degree. The system is under a very poor state of repair, mainly attributable to lack of a maintenance program. The following are examples of their problems:

- ✓ Pump stations work sporadically because of pump maintenance difficulties, and the emergency overflows become the main outlet from the pump stations.
- ✓ A third pump station, which mainly serves the industrial area, is nonoperational resulting in theft and vandalism, and the sewage flow is discharged directly into a surface stream.
- ✓ Around 95 percent of the sewers suffer from sand depositions. Approximately 40 percent of these pipes suffer a loss of cross-sectional area greater than 50 percent. Therefore, at least half of the original flow capacity has been lost in these pipes; consequently, the so-called "self-cleansing velocity" is not achieved.

Maintenance management procedures for sewerage systems and its allocation of costs have been identified as one of the factors, that has influenced unsustained use of such systems in Ghana. Dependence on central government agencies and institutions has contributed to the current state of the most sewerage systems. The country is implementing a responsive O&M management scheme. Key agencies are implementing a collection system maintenance and water tariff collection, and a private contractor has been hired to handle sewage O&M. (Source: 23rd WEDC Conference 1997)

4.5 Preparing the National Baseline Assessment Document

After identifying and gathering the information necessary to understand the needs, the next step is to compile that information into a national Baseline Assessment document.

4.5.1 National Baseline Assessment Objectives

A national Baseline Assessment should serve as a source of broad and useful information on the existing conditions and domestic wastewater management needs. It will be the foundation of information for a broad group of stakeholders to understand the general and the specific needs that should be considered in the development of a national Domestic wastewater Management Plan (DWMP). Table 4.15 summarizes the types of information that was considered in Section 4.4 and that should be presented in developing the national Baseline Assessment document. Appendix B provides an example checklist used to organize the information into the Baseline Assessment. The checklist serves as a template that can be modified for project-specific applications.

Table 4.15. Typical Information Included in a Domestic Wastewater Needs Assessment

Considerations for national planning are listed below. Most of these considerations can be reapplied at the municipal level.

Pollution Problems and Their Cost. Provide a country-level overview of the types of problems and the costs associated with not addressing them, such as poor health and disease, loss of business, resources, recreational, and other pertinent areas.

Description of the Country. This can include geography, demography, important coastal communities and their socioeconomic status as people, institutions and laws, and other relevant information for management.

Current and Future Projections of Population Growth. Population projections are needed to identify where and when population growth is anticipated and to plan for collection, conveyance, and treatment infrastructure needs.

Domestic Wastewater Systems. Existing domestic wastewater systems in the country including: (1) sewage collection, conveyance, and treatment systems, (2) O&M of existing plants and systems, and (3) the presence or absence of industrial effluents, and pretreatment programs.

Industrial Effluent Discharges. Prevalent industrial effluent discharge conditions can be discussed generally. For application at the municipal level, industrial effluent discharging into domestic wastewater facilities needs to be identified in order to address it through industrial pretreatment, as necessary.

Effluent Discharge Outfalls. Prevalent characteristics of outfalls can be generally discussed. The location of all the outfalls in the country needs to be identified, because they represent the point of compliance.

Human Use Areas. Identify the location of human use areas proximal to coastal waters.

Use Considerations of Coastal Waters. Identify resource values of coastal waters to classify based on Class I and II criteria.

Technological Approaches for a Domestic Wastewater System. Identify existing and potentially viable approaches to addressing domestic wastewater system needs and evaluate and develop recommendations based on criteria such as local conditions, effectiveness, availability, cost-effectiveness, environmental acceptability, and stakeholder acceptability.

National Capacity Building. Identify national planning issues pertaining to policy, legal and regulatory framework, government institutions, information management systems, and education.

Funding Opportunities. Identify economic instruments such as user fees, taxes, grants, loans, and private investments.

4.5.2 Documentation Considerations

There are several important considerations in preparing the national Baseline Assessment document and performing the needs assessment, which are summarized below. These considerations should be addressed before starting the needs assessment discussed in Section 4.4. They are presented in this guidance after discussing the needs in Section 4.4, since their applicability and relevance should now be more apparent.

- **Standardize Data Collection:** In order to gather comprehensive and comparable information, it is helpful to prepare a standardized approach to collecting information, which will likely come from various levels of government.
- **Standardization of Terminology:** Terms used to describe the types of treatment systems and components, management terms, and other terms should be standardized to ensure consistency in presenting information.
- **Timeframes for Planning:** The time period covered by the Baseline Needs Assessment document must be established prior to commencing the process. Typically, communities plan for their domestic wastewater needs as projected for a 20-year period. The last year of the 20-year planning period is called the design year. Facilities typically are designed to meet the requirements of the current population, plus the net population change over the next 20 years. However, depending on the immediate needs to meet Annex III discharge limits, planning may focus on a shorter period of only 5 or 10 years. Projections of needs should be based on defined timeframes relevant to specific and general planning needs.
- **Cost Estimate:** A national cost model should be established to estimate costs defining level of detail and issues, such as escalation factors to project costs over the long-term. Cost estimating begins with assessment of the need for new wastewater management facilities or improvement of existing facilities. This assessment is performed by categories of facilities, as listed in Table 4.16. Categories listed in the table represent those that should be considered at a minimum; it may be appropriate to establish additional categories. With the need for new or improved facilities in each category determined, a cost estimate for meeting the need in each category can be developed.

Table 4.16 Categories of Domestic Wastewater Management Facilities

Nonwater Carriage Toilets	Septage Pretreatment
Holding Tank	Industrial Pretreatment
Septic Tanks	Screening
Alternative Collection System	Sedimentation
Sewer Replacement/Rehabilitation	Biological Treatment
Infiltration/Inflow Correction	Polishing
Convention Collection System	Disinfection
Water Reuse	Operation and Maintenance Program

Table 4.17 provides an example of cost categories for domestic wastewater and other water sector projects. The table shows cost categories such as secondary treatment systems and combined sewer overflows.. The costs for other water sector projects should include other pollution control infrastructure needs such as non-point source controls associated with urban runoff. The national Baseline Needs Assessment should project needed funding over a broad planning period, such as a 25-year period so that future needs are considered along with more immediate needs. The costs estimates for near-term items are likely to be supported by more detailed information, compared to out bound years. Nonetheless, in the future, the cost

estimates are expected to be revised as a better understanding of the needs are established as the program planning matures.

Table 4.17 Example of National Needs Survey Project/Infrastructure Cost Categories

		Cost by Year				
NEEDS CATEGORY		**5**	**10**	**15**	**20**	**25**
Domestic Wastewater Projects*						
1.	Screening Process					
2.	Primary Treatment					
3.	Disinfection					
4.	Secondary Treatment					
5.	Advanced Treatment					
6.	Infiltration/Inflow Correction					
7.	Sewer Replacement/Rehabilitation					
8.	New Collector Sewers (includes Pump Station)					
9.	New Interceptor Sewers					
10.	Combined Sewer Overflows					
11.	Storm Water					
12.	Household Systems					
13.	Industrial Pretreatment					
14.	Septage Receiving Station					
Other Water Sector Projects**						
A	Nonpoint Source (agriculture, development)					
B	Urban Runoff					
C	Groundwater, Estuaries, Wetlands					
D	Industrial Discharge					
TOTAL NEEDS BY CATEGORY						
Treatment Categories						
Collection, Conveyance Categories						
Other Water Projects						

* Estimate cost of Projects to meet Annex III requirements

** Estimate cost of other water sector projects that may be integrated into planning for water quality control.

Chapter 5
Phase 2: Development and Adoption of a National Plan

Chapter 5 introduces the general requirements to proceed in the development and adoption of a National Plan, based on the needs identified in the Baseline Assessment. It is the Phase 2 step in the planning process described in Chapter 3 and illustrated in Figure 5.1 below. However, as discussed in Chapter 1, the goals of this document were to focus guidance on the steps needed to initiate the planning and develop a national Baseline Assessment. This chapter provides an overview of considerations in developing the national DWMP, with the objective of furthering the understanding of the application of the different planning steps and providing further recommendations designed to make further progress towards compliance with Annex III.

One of the overarching requirements of Annex III, is for each country to develop a national DWMP that serves as the basis for complying with Annex III. Meeting Annex III requirements begins with the national government, but should involve all levels of government. Some of the planning roles that these different levels of government have are summarized in Table 5.1, including the essential roles of each of these levels of government to work with stakeholders.

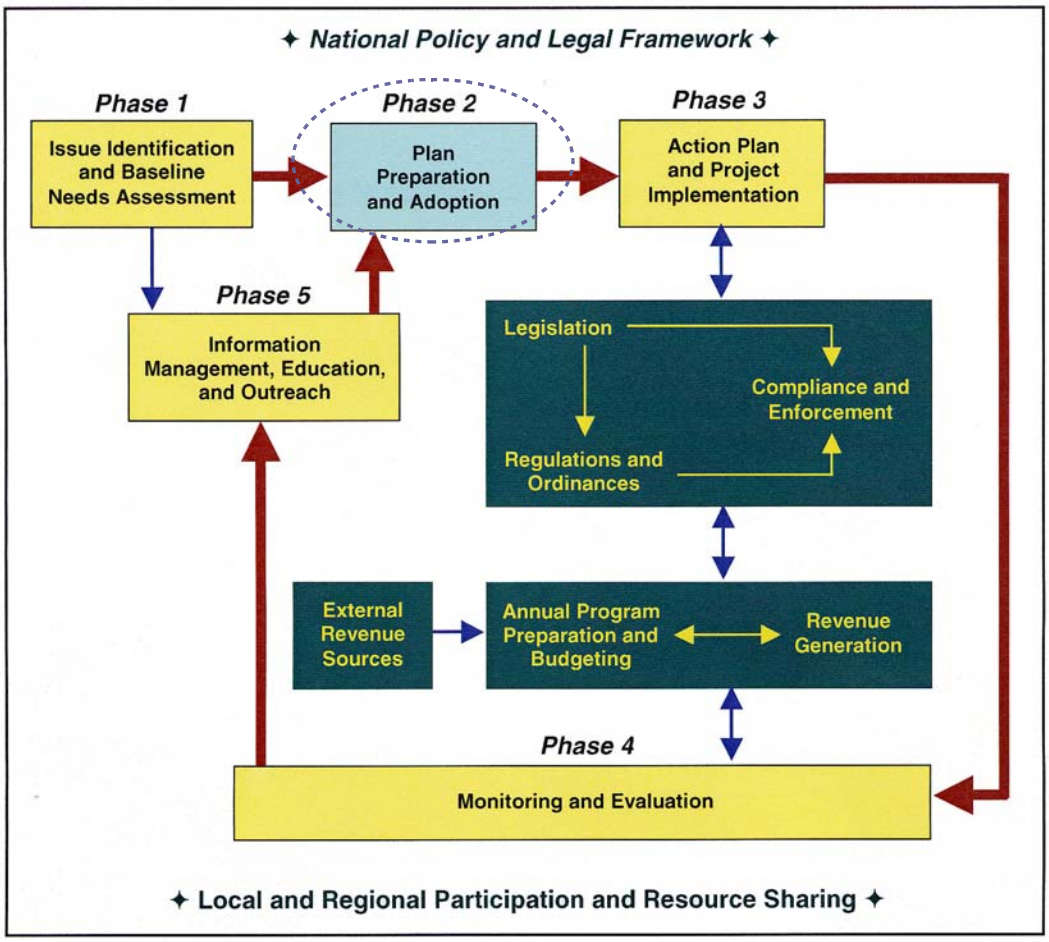


Figure 5.1 Phase 2 – Plan Preparation and Adoption

Table 5.1 Planning Roles for National, Provincial and Municipal Governments

National Government	Provincial Government	Municipal Government
Establish a Program Preparation Team and Allocate Funding. Provide funding to initiate domestic wastewater planning at the national, provincial, and local levels of government. (*Strategy* – seed money, pilot programs, and grant programs to work with provinces and municipalities.)	**Establish a Program Preparation Team and Allocate Funding.** Provide funding to initiate domestic wastewater planning at the provincial and municipal levels of government. (*Strategy* – seed money, pilot programs, and grant programs.)	**Establish a Program Preparation Team and Allocate Funding.** Provide funding to initiate the domestic wastewater planning at the municipal government level. (*Strategy* – seed money, pilot programs, and grant programs.)
Establish an Effluent Discharge Permit Program. Set up an institutional mechanism to permit domestic wastewater effluent discharges. (*Strategy* – set up a pilot program with one of the provinces; set up interim permitting to establish an inventory of the "universe" of facilities and basic characteristics and needs, develop model permit and work with provinces to obtain permit information.)	**Support Development of an Effluent Discharge Permit Program.** Set up an institutional mechanism to complete a national program and facilitate municipal governments in getting domestic wastewater effluent discharge permit applications completed. (*Strategy* – provide direct support to municipal governments to correctly complete permit.)	**Cooperate Early in Development of an Effluent Discharge Permit Program.** Work with provincial governing bodies to complete a municipal domestic wastewater effluent discharge permits application. (*Strategy* – designate a treatment facility operations team to coordinate with provincial governments to correctly complete permit.)
Establish a National Water Bodies Mapping Program. Map water bodies based on their classification as Class I or II. (*Strategy* – set up a pilot with one of the provinces; set up a interim classification scheme, using criteria and modify it as necessary, after stakeholders have voiced consensus of classification; and ensure that the process is completed early to allow planning to proceed regarding what requirements will apply to respective dischargers.)	**Cooperate Early to Classify and Map Water Bodies.** Map water bodies based on their classification as Class I or II. (*Strategy* – work directly with municipal governments to interpret classification criteria; ensure broad stakeholder participation in interpreting criteria; and provide assistance in cases with shared provincial or municipal boundaries.)	**Cooperate Early to Classify Local Water Bodies.** Support activities to map water bodies based on their classification as Class I or II. (*Strategy* – work directly with stakeholders to interpret classification criteria; recommend local water classification for approval to governing bodies; and work with provincial governments to map boundaries to determine compliance requirements early.)

Chapter 5
Phase 2: Development and Adoption of a National Plan

Table 5.1 Planning Roles for National, Provincial and Municipal Governments

Establish a Governing Body. The governing body would be responsible for leadership, government representation, coordination with other national and provincial governing bodies, identification and inclusion of stakeholders throughout the planning process, development of national needs assessment and action plans, and support for securing short and long-term funding. (***Strategy*** – establish a technical working group with the responsibility of completing needs assessment and action plans.)	**Establish a Governing Body.** The governing body would be responsible for leadership, government representation, coordination with other national and provincial bodies, identification and inclusion of stakeholders throughout the planning process, development of provincial needs assessment and action plans, and support for securing short and long-term funding. (***Strategy*** – establish a technical working group with the responsibility of completing needs assessment and action plans; and work to identify planning issues early.)	**Establish a Governing Body.** The governing body would be responsible for leadership, government representation, coordination with national and provincial bodies, identification and inclusion of stakeholders throughout the planning process, development of municipal needs assessment and action plans, and support for securing short and long-term funding. Identify inter-departmental agencies responsible for areas such as public works, public health, planning, recreational, environmental, wildlife resource, education, information management, and public communication. (***Strategy*** – establish a technical working group with the responsibility of completing needs assessment and action plans; and work to identify issues early.)
Enact Legislation and Promulgate Regulations. National action plans will require promulgation to authorize recommended action and associated funding.	**Enact Legislation and Promulgate Regulations.** Provincial action plans will require promulgation to authorize recommended action and associated funding.	**Enact Legislation and Promulgate Regulations.** Municipal plans will require local approval to authorize recommended action and associated funding.
Provide Public Outreach. Set up mechanisms to keep stakeholders informed early and throughout the planning process. (***Strategy*** – set up a web page; incorporate formal and informal education; and recruit non-profits, industry, and academic institutions for support.)	**Provide Public Outreach.** Set up mechanisms to keep stakeholders informed early and throughout the planning process. (***Strategy*** – set up a web page; incorporate formal and informal education; and recruit non-profits, industry, and academic institutions for support.)	**Provide Public Outreach.** Set up mechanisms to keep stakeholders informed early and throughout the planning process. (***Strategy*** – set up a web page; incorporate formal and informal education; and recruit non-profits, industry, and academic institutions for support.)

Table 5.1 Planning Roles for National, Provincial and Municipal Governments

Monitor Program Planning Progress. Progress should be measured at the national level through metrics established in action plans. (***Strategy*** – begin early in the program, through information provided as part of the permit process.)	**Monitor Program Planning Progress.** Progress should be measured at the provincial level through metrics established in the provincial action plans. (***Strategy*** – begin with a pilot program designed to work with the most diverse permitting issues to resolve issues early in the program.)	**Monitor Program Planning Progress.** Progress should be measured at the municipal level through metrics established in provincial action plans. (***Strategy*** – establish environmental indicators to track and monitor progress.)

5.1 Prioritizing Needs

Once all the needs have been identified, a prioritization process must be undertaken to determine short- versus long-term needs. For example, a typical priority is to address risks to human health. Initially, national considerations may focus on ranking communities in order of need. However, identifying priorities in relation to needs necessary to ensure compliance with Annex III effluent limits is a difficult task because it will be apparent that while there is agreement on needs, priorities will be challenged most due to lack of funding. However, identification of priorities also helps to identify alternatives, and should be used as an opportunity for identifying innovative approaches to provide solutions. Ultimately, addressing priorities will be an additional activity where stakeholder involvement is critical to successful development of a DMP.

There are many methodologies used as part of environmental assessment programs that are helpful in defining priorities (Canter, L. 1996). One approach for evaluating issues and needs is to construct a matrix, such as the one shown in Table 5.2 listing ranking considerations. A ranking system is then established for each criterion, defining the relative magnitude of the factor and the degree of impact each need has on that factor. The ranking systems can be descriptive (high, medium, or low) or numeric (1=low impact, 5=high impact). Using a numeric scale allows individual ratings to be added, producing an overall rating. While this is not a substitute for making final decisions, it is useful to communicate information and engage stakeholders in discussion at the national or local level.

National governments should establish a National Priority List or National Priority Statement and periodically revise it, such as every 5 years. Project funding should be based on the priority ranking on this list. The task ahead is overwhelming to the WCR countries, without sufficient assistance and long-term support from developed countries with vested interests in the WCR.

Table 5.2 Example of Ranking Considerations for Planning

Ranking 1-5	Ranking Considerations
_	How critical are existing risks to public health?
_	How important is economic return of improving or protecting water quality in relation to tourism, business development, or growth potential?

_ How essential is the need in regard to meeting other infrastructure or social needs identified in the community?

Priorities will drive national policy. For example, a national priority statement example includes the following: "Allocate planning resources and funding to provide treatment in the areas of greatest public health risk. Establish criteria to determine areas at risk based on standards of acceptable public health. Obtain stakeholder input to identify areas of greatest risk."

5.2 Elements of the National Plan

The national DWMP should address the issues and needs identified in Phase 1 and identify goals, objectives, strategies and actions to address each need. Each need identified in the Baseline Needs Assessment likely will need to be addressed in an action plan with corresponding tasks. The general elements of a DWMP are summarized in Table 5.3.

Table 5.3 Basic Elements of a National Domestic Wastewater Management Plan

A national DWMP defines the goals, objectives, policies and strategies for managing domestic wastewater pollution control for a country. The national DWMP should be integrated with provincial and other national planning activities. Basic elements to be included are as follows:

- Goals and objectives
- Management needs identified in the Baseline Needs Assessment
- Tasks and strategies identified through stakeholder participation
- Roles and responsibilities of key institutions in implementing plan
- Timeline, budget, and assumptions to meet the plan
- Environmental and program indicators to monitoring and evaluation progress

Annual funding should be anticipated to support the development of action plans associated with each of the tasks identified in the national DWMP. For some waters, such as bays and gulfs, several provinces or municipalities and even other nations may join resources to develop the action plans that will need to be prepared after development of the national DWMP.

Each of the general and specific needs listed in Section 4.4 should be addressed as separate elements. The national DWMP (Phase 2) should define general policies and actions to meet those actions, as well as, priorities in meeting Annex III requirements. An example using stakeholder participation, is given below.

- Policy statement: "Encourage and support early and continuous" stakeholder participation.
- Action plan goal: Develop a stakeholder participation plan which provides for early and continuous stakeholder participation.

Consequently, the major topics that may be addressed in a national plan include:

General:

- Stakeholder Participation
- Financing Resources
- Legislative Authority
- Government structure and authority

Specific:

- Discharge Identification
- Domestic Wastewater Treatment
- Effluent Limitation
- Industrial Pretreatment
- Household Systems
- Operations, and Maintenance Management

The national DWMP needs to consider the timeline for planning and program implementation, taking into consideration when compliance with Annex III would be required, based on the year that the country signed into the Convention. Table 5.4 defines typical time horizons in the planning process, which complements the 20-year horizon to meet the requirements of Annex III. However, compliance likely will be constrained by the financial resources available to each respective nation. Consequently, the planning horizon may likely be longer to really achieve the goals and specific requirements of Annex III.

Table 5.4 Time Horizons for Planning

Time Horizon	Planning Objective
Long-term (1-20 years)	Visions, goals, and objectives for fully meeting Annex III
Medium-term (5 years)	Priority issues and concerns addressed in specific strategies and actions at the municipal, provincial, or national level
Short-term (1 year)	Annual operations and funding programmed in support of the municipal, provincial, or national level activities.

5.3 Strategies for Managing Wastewater

There are potentially multiple solutions to managing domestic wastewater pollution. Table 5.5 identifies types and examples of domestic wastewater management strategies.

Table 5.5 Types of Domestic Wastewater Discharge Management Strategies

Strategies	Examples
Spatial and Temporal Planning Manage based on where and when the needs are greatest.	❑ Delineate and map Class I and II waters and include seasonal considerations associated with discharges.
Legislation and Regulation Manage by enacting legislation and promulgating regulations to define institutional authority, roles, and responsibilities associated with environmental policies.	❑ Legislate designation of the responsible lead agency and classification of water bodies. ❑ Establish an interim permit system designed to identify the universe of dischargers with a gradual approach to bring them into compliance

Institutional **Manage by a clearly defined compliance and enforcement institutional framework with capacity building to meet the resource and technical expertise needed to meet Annex III program goals.**	❑ Certify treatment plant operators. ❑ Provide training and access necessary resources (staff, equipment, and funding). ❑ Develop a national permitting program associated with achieving compliance for municipal treatment facilities, with gradual delegation of the program to provincial levels. ❑ Perform compliance monitoring to report progress and make adjustments. ❑ Establish a grants program to fund pilot-scale implementation efforts.
Technology Transfer **Manage by leveraging technical knowledge from government, private, academic, and nongovernment institutions.**	❑ Develop capabilities of existing private and government laboratories to develop testing capabilities for monitoring compliance. ❑ Develop certification programs for compliance testing through academic groups. ❑ Coordinate with industrial groups to participate in identification of needed technology. ❑ Establish a clearinghouse for information on various technology, regulatory, and institutional needs.
Financial Instruments **Manage by sound decision-making to encourage or discourage activities or behaviors through financial incentives or disincentives to promote compliance.**	❑ Provide tax credits for implementing home domestic improvements and industrial pollution prevention practices. ❑ Provide grants to conduct needs assessments at the provincial and municipal levels. ❑ Institute penalties for noncompliance. ❑ Consider opportunities associated with privatization concessions.
Information Management **Manage by systematically inputting and archiving information and data collected through the planning process**	❑ Establish simple to complex relational databases for use in tracking compliance (permits). ❑ Create geographic information system to assist in planning tasks. ❑ Develop web-based access of information to facilitate data access.
Stakeholder Participation **Manage by promoting and enhancing opportunities for stakeholder participation early and throughout the planning process.**	❑ Use a diversity of outreach tools to collect information, identify issues, set priorities, and implement solutions. ❑ Involve the community, they can serve and provide a resource of ideas and support

5.4 Integration With Other Water Policy Sectors

Domestic wastewater pollution control planning activities must be integrated with other national planning programs. Table 5.6 provides examples of other types of water sector planning activities that need to be integrated with the domestic wastewater planning activities.

Table 5.6 Integration of Domestic Wastewater Discharge Management with Other Water Sector Management Activities

Activity	Issue
Industrial Discharges	Industrial discharges need to be managed to prevent impact to domestic wastewater facilities.

Storm Water Runoff	Runoff from urban and suburban residential areas contributes sediment and oil and grease from roads, particularly from large parking areas.
Agricultural Runoff	Runoff from agricultural practices results in organic matter, contributing to pollutants such as high biological oxygen demand.
Erosion	Erosion resulting from uncontrolled construction practices, poorly maintained transportation corridors, and other sources contribute to increased sedimentation rates into water bodies.
Protection of Special Status Species and Habitats	Wildlife, fisheries, and habitat resources require coordinated management intervention to ensure their protection.
Development	Coastal development can contribute to a diversity of adverse impacts, including generation of new industrial and domestic wastewater discharges, erosion during and after construction, and stress on sensitive marine wildlife and habitats.
Recreation	Water-oriented activities, such as diving, fishing, and boating, can contribute to pollutants, such as oil and grease, and cause stress to sensitive marine wildlife and habitats.

5.5 Process for Adoption of the National DWMP

Adoption of the national DWMP should be a natural outcome, if it was developed through an effective stakeholder participation process. That is, stakeholders were (1) identified early in Phase 1, (2) were involved in identification of issues and needs leading to the development of the Baseline Needs Assessment, and (3) involved with the prioritization of issues that lead to development of the national DWMP.

In any case, the national DWMP may require formal adoption by the legislature in order to secure the nation's commitment, at least in principle, to ensure funding a program that will be implemented over a 20- to 30-year period. In fact, development of action plans will be the guide with regard to what specific activities need to be implemented and what specific funding will need to be allocated on a yearly or bi-yearly calendar, depending on the fiscal planning framework of each nation.

Chapter 6
Phase 3: Development of Action Plan and Project Implementation

Chapter 6 provides a general overview of Phase 3 in the planning framework. As illustrated in Figure 6.1, this phase involves Action Plan and Project Implementation. The goals, policies and proposed actions detailed in the national DWMP, are defined in more detailed action plans, leading to project implementation activities.

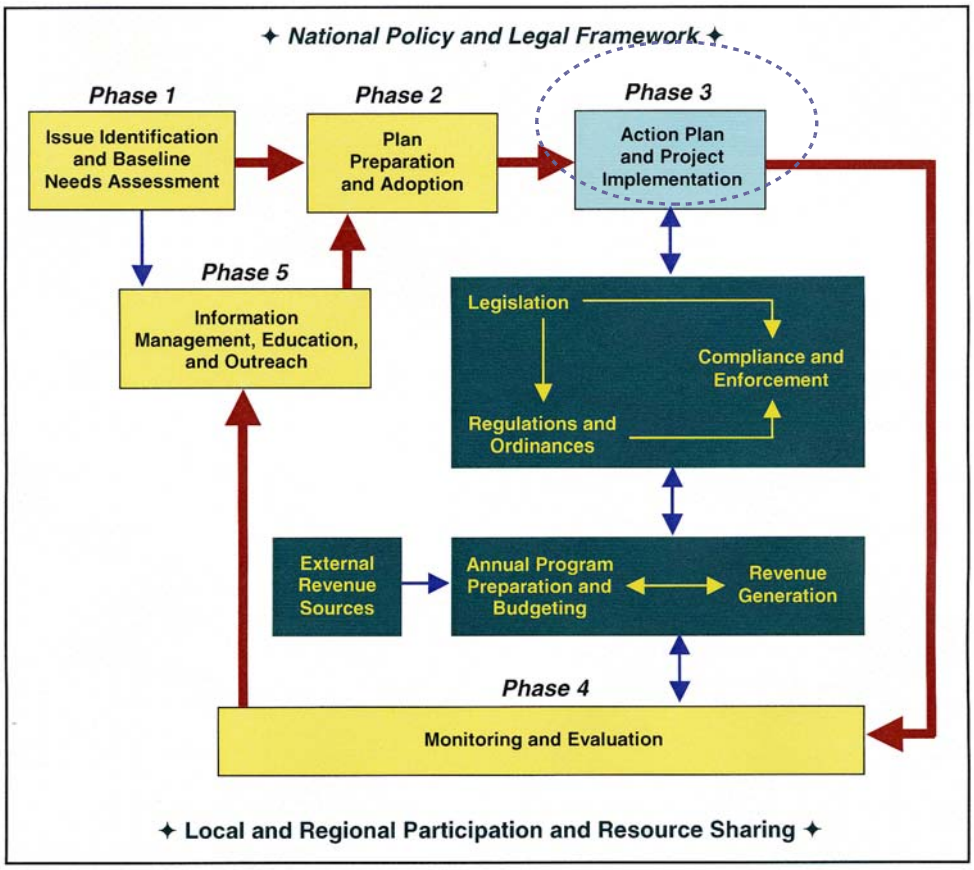


Figure 6.1 Phase 3 – Action Plan and Project Implementation

6.1 What is an Action Plan?

Action plans, are equivalent to the work plans described in Section 3.4.5 of Chapter 3. They are documents developed to implement specific goals and objectives (actions) identified in the national DWMP through development of tasks (work). The tasks in the action plan establish in detail how activities will be conducted, by whom, when, and within what timeframe and funding authority. Action plans are accompanied by a specific budget and are designed to include, assumptions about getting the work completed and program indicators to measure how well the action plan has accomplished its goals.

6.2 Specific Tasks Developed in the Action Plan

Specific action plans should be developed to address the needs identified in the Baseline Needs Assessment. The needs identified under the Baseline Needs Assessment will differ for each country, as discussed in earlier chapters, but in general action plans should be considered for the following activities.

General Actions:

- Stakeholder Participation
- Financing Resources
- Legislative Authority
- Government structure and authority

Specific Domestic Wastewater Actions:

- Discharge Identification
- Domestic Wastewater Treatment
- Effluent Limitation
- Industrial Pretreatment
- Household Systems
- Operations, and Maintenance Management

Using the example of a stakeholder action plan, the action plan should outline a set of planning activities to be undertaken, the sequence of activities, and individual responsibility for each activity. While the action plan may be revised later, it should set forth, as precisely as possible, what planning activities will be undertaken and by whom. The action plan should also indicate budgets and schedules for each activity. The key elements of the action plan using the example for stakeholders is as follows:

- **Title: Stakeholder Participation**
- Introduction
- **Objectives:** Encourage stakeholder participation early and continuously in the development of domestic wastewater actions in the country.
- Overview of tasks
  - ✓ Task 1: Prepare program for stakeholder identification and inclusion in the planning
  - ✓ Task 2: Identify stakeholders (government, academic, industry, citizens groups)
  - ✓ Task 3: Develop stakeholder outreach programs
  - ✓ Task 4: Set up information networks for access and retrieval, such as web pages
  - ✓ Task 6: Establish priorities for stakeholders on domestic wastewater needs
  - ✓ (Include additional tasks, as needed)

Chapter 6
Phase 3: Development of Action Plan and Project Implementation

- Staffing needs
- Schedule of activities
- Cost estimate
- Deliverables

6.3 Other Consideration in the Development of Action Plans

While the needs driving each action will dictate the planning timeframe that makes the most sense, a typical action plan would identify tasks to be implemented over a 5-year period or less. Because political, economic, technical, and a myriad of other factors will impact the ability to implement a plan as it was originally conceived, the development of action plans designed for implementation over a greater-than-5-year period are not practical.

Chapter 7
Phase 4: Monitoring and Evaluation

Chapter 7 provides an overview of monitoring and evaluation, which is Phase 4 of the planning framework illustrated in Figure 7.1. Monitoring and evaluation is addressed in the context of achieving successful planning and should be considered an integral part of any planning program. The objectives of monitoring are to track administrative, policy, institutional, financial, social, environmental, and other changes leading toward development and implementation of the domestic wastewater pollution control program. All activities described in the planning framework should have specific goals and each of these goals should be measured to monitor and evaluate accomplishments in attaining program goals.

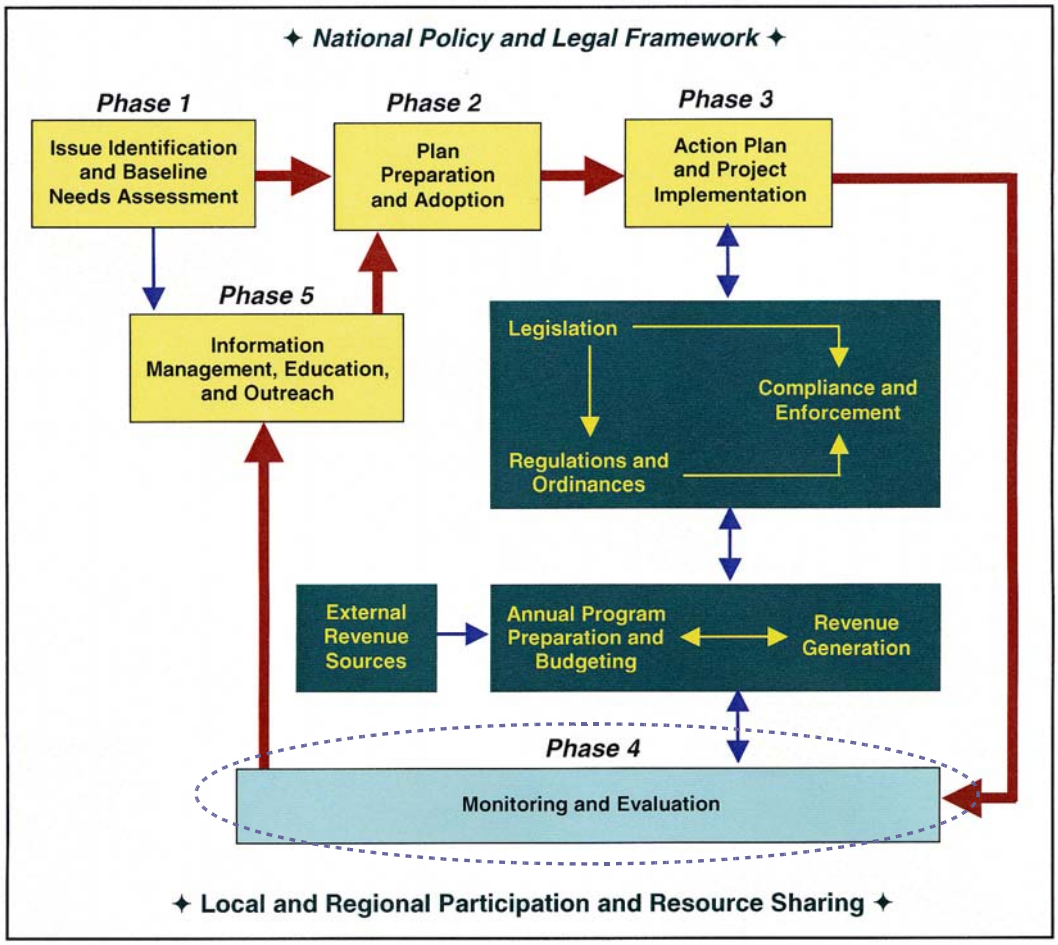


Figure 7.1 Phase 4 – Monitoring and Evaluation

7.1 Monitoring to Assess Progress

Monitoring can be applied to a broad range of activities. In this section, monitoring is discussed in the context of assessing planning achievements and measuring specific Annex III water quality achievements.

7.1.1 Monitoring to Assess Planning Progress

A monitoring program should be established to assess the effectiveness of actions taken towards meeting the requirements of Annex III under any of the planning phases. Monitoring before, during planning and after program implementation allows evaluation of improvements through comparison of baseline conditions. The following steps should be considered:

- Identify baseline conditions that will be monitored before, during and after implementation of planning actions.
- Develop a monitoring plan with program implementation indicators.
- Monitor during implementation and after the implementation phase.
- Determine if the program effectively assisted in meeting Annex III effluent water quality standards in the Convention Area.

There are several types of indicators, some examples related to monitoring planning results are provided in Table 7.1. Monitoring should be performed as a function of measuring performance. It should be performed to provide results based on milestones, such as annual fiscal planning and budget allocation cycles, or other relevant planning activities, such as monthly municipal planning meetings, when considering goals such as scheduling public meetings.

Table 7.1 Example of Monitoring Indicators for Planning

Measure	Indicators to Measure Attainment of Goals
Yes or No	Completion of the national Baseline Assessment
Yes or No; How many	Completion of the national public meetings to solicit comments on national DWMP. (Define goal in terms of number of public meetings.)
Yes or No	Ratification of national DWMP through legislative process.
Actual Budget	Allocation of 5-year budget to develop general and specific action plans. (Define goal in terms of expected budget)
Yes or No; How many	Completion of municipal planning meetings to identify needs and funding priorities. (Define goal in terms of number of municipal meetings to be held)
How many; Percent permitted	Identification and interim permit status of municipal dischargers. (Define goal in terms of number of municipal dischargers)
How many; Percentage attainment	Attainment of effluent discharge limits by permitted municipal dischargers. (Define goal in terms of number of fully permitted municipal dischargers with approved monitoring program)

In each of the planning phases, it is important to develop indicators as a means to measure accomplishments of program goals. The measures proposed should be readily quantifiable and understandable, so that measuring them is easily performed and results can be easily communicated to stakeholders. When the monitoring results are available, then the results can be evaluated. One specific measures of program success, would be to assess the number of new facilities constructed and put into operation. The evaluation component is important in order to engage discussion on what was successful and what was not and why, with provisions made to incorporate adaptations to management of programs, a concept known as adaptive

management. The tasks and strategies identified in the planning documents should be addressed in the context of the monitoring results and recommendations should be made to ensure that the goals are accomplished in the next review period.

7.1.2 Monitoring to Measure Water Quality Achievements

Monitoring to measure compliance with effluent limits is an explicit requirement of Annex III. It represents a more direct and tangible indicator of the success of planning and program implementation efforts towards complying with Annex III requirements. Initially monitoring will be required to determine effluent quality and water quality of the receiving waters. These monitoring results will serve as a baseline upon to assess what kinds of administrative, process, or technology actions are needed to comply. A well-developed monitoring program functions concurrently with all planning elements described in Figure 7.1.

The topic of monitoring and evaluation is extensive. For the purposes of this Needs Assessment guidance, only a few concepts were discussed and illustrated to provide context and further guidance. An example of some of the elements that should be addressed when developing a plan as part of a monitoring program are summarized below:

- Objectives
  - ✓ What is the purpose of the monitoring?
  - ✓ What is to be accomplished with the monitoring results?
- Tasks
  - ✓ What tasks are to be conducted?
  - ✓ What information must be collected?
  - ✓ Who will be receiving the information?
  - ✓ What specific indicators will measure effects of program activities or changes in environmental conditions?

✓ Where should monitoring be conducted to measure water quality impacts?

- Procedures
  - ✓ What procedures are to be used?
  - ✓ Will monitoring require special procedures?
- Resources
  - ✓ What personnel will be required?
  - ✓ What equipment will be required?
  - ✓ What records will be reviewed?
  - ✓ Who will finance the monitoring program?
- Schedule
  - ✓ What will be the time requirements of monitoring activities?
  - ✓ What will be the milestones?

- ✓ What will be the frequency of monitoring?

- Coordination

✓ What coordination with laboratories or other regulatory agencies is required?

✓ How will monitoring results be conveyed to project beneficiaries and the public?

- Record database
  - ✓ How will monitoring data be collected, stored and analyzed?

The LBS Protocol (Article VI) has specific requirements for monitoring and reporting. One of the goals of developing a DWM program is to consider existing reporting systems, such as the UNEP Global Environmental Monitoring System/Water (GEM/WATER) which has an existing database (http://www.cciw.ca/gem s/gem.s-e.html).

Case Study: Water Quality of Transboundary Surface Waters

Since 1987, the U. S. Environmental Protection Agency (EPA) and the Mexican National Institute of Ecology (INE) have been conducting water quality monitoring activities along the United States and Mexican border. They established a monitoring program to monitor the state of environment and changing conditions that affect human and ecological health along the border. Two parameters, turbidity and fecal coliform have contributed to defining water quality trends for principal water bodies.

7.2 EVALUATION

The evaluation of monitoring results is an opportunity express "lessons-learned", that is to learn what worked and what didn't work, or didn't work as well. Based on what is learned from the monitoring results, stakeholders involved with planning and implementation of a domestic wastewater pollution control program, can make whatever modifications to the program that may be deemed necessary.

As was discussed in Section 7.1, monitoring is a means to measure accomplishments with planning goals or specific water quality attainment. While monitoring will have diverse objectives, evaluation can be summarized as either meeting, not meeting, or being inconclusive relative to the monitoring objectives. A monitoring program should define in advance what steps will be taken depending on any of these three outcomes. Even when the results are what were expected, there may be opportunities to enhance the future planning activities, based of monitoring results. When the monitoring results indicate that results were less than expected, it's important to try to understand what less to these results, in order to correct for them in future activities, as appropriate.

Table 7.2 Evaluation of Monitoring Results

Evaluation of Results	Considerations
Were the monitoring indicators adequate to measure results?	Indicators were readily measurable, representative of results.

Was the description of the approach, assumptions, staffing, schedule, and budgets presented in the action plan adequate?	Assumptions are well documented regarding available resources, data that will be available, all monitoring measures were described in sufficient detail to implement.
Was resource allocation adequate to implement proposed actions?	Laboratories were optimal, adequate quality control procedures documented and implemented. Staffing resources were optimal, staff knowledgeable, skill level adequate.
Were institutional frameworks adequate to facilitate implementation.	Governance available to provide support and comment on results. Resources provided as promised.
Was stakeholder participation adequate and optimized for success?	Stakeholders identified. Stakeholders involved and their support was well organized.

The evaluation of a program's success is an opportunity to implement adaptive management, that is, reconsider assumptions or other issues that may have lead to success or less than optimal results. It is an integral part of planning, since it provides an opportunity to communicate "lessons-learned" to all stakeholders and provides for discussion to make changes building upon experience from the program.

7.3 Adaptive Management

Adaptive management is an opportunity to take the monitoring and evaluation feedback and incorporate lessons learned into the next phases of program development and implementation. Decisions are often made without having all the necessary information or resources available, therefore, the outcome may not always be what was expected. Consequently, it's important to have a program that is flexible to incorporate lesson-learned into future planning efforts and practices.

Chapter 8
Phase 5: Information Management and Outreach

Chapter 8 provides a discussion about information, outreach, and education, which is Phase 5 of the planning framework illustrated in Figure 8.1. Similar to monitoring and evaluation, Phase 5 is integral to the planning process and is performed in parallel with all planning elements. This section will describe information management, education and outreach, which are tools used in planning and implementation, but are in themselves technical disciplines with far reaching application.

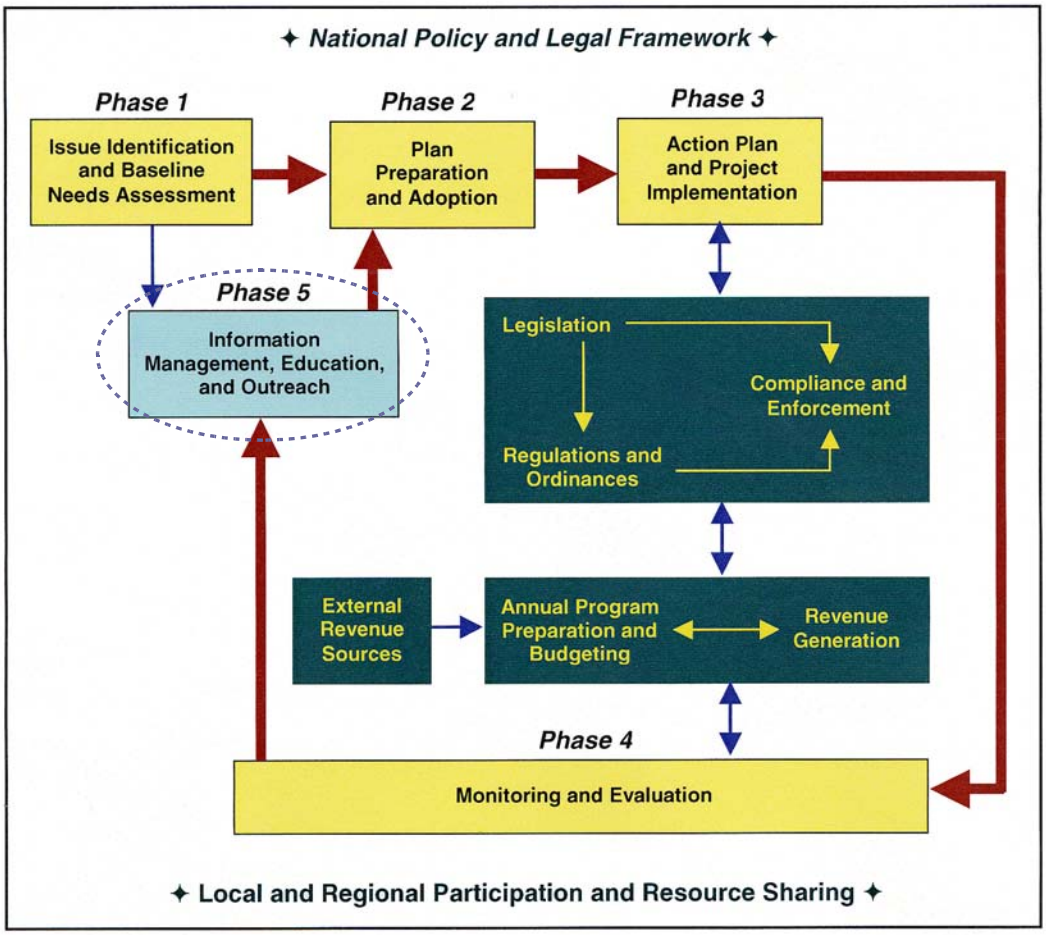


Figure 8.1 Phase 5 – Information Management, Education, and Outreach

8.1 Information Management

Information management encompasses diverse tools and applications which will support planning and implementation activities. An example of some of these tools and applications is provided in Table 8.1 below.

Table 8.1 Information Management Tools and Applications

Tools	Applications

Websites	Shared access of information useable by diverse stakeholders Source of education and outreach information for stakeholders On-line support for DWM facilities to facilitate access to requirements and forms that may be use to document and track program needs
Databases	Systems used to store and access diverse information, ranging from simple databases to complex relational databases Simple to complex data analysis, statistical analysis, and graphics
GIS	Mapping location of communities, wastewater plants, water boundaries, natural resources, sensitive habitats, planning vs. management boundaries Display of alternative locations to site facilities, model impacts of discharges into receiving waters

It is essential to begin establishing a database of information early in the planning process. In the development of the Baseline Needs Assessment as part of Phase 1 planning, there will be various sources of information, not all of which is available in electronic format. However, to the extent practical and possible, it is recommended that planning include development of web pages to share information among planners and others involved and include development of a relational database, as well as interface with a GIS. When GIS tools are available, base maps and other spatial data should be inputted to a GIS program to serve as an important starting point for planning and management. Developing these systems early will ensure a framework to continue to build information, resulting in the ability and the capacity to plan and manage. The availability and application of these systems vary, depending on local budgets, staff and skill level, and needs, such as simple databases to serve small communities or early in the planning process to more complex systems supporting larger municipalities or provinces.

8.2 OUTREACH

Outreach is a process designed to engage the community in the planning. The objectives of Annex III, described in Chapter 2 are to prevent, reduce, and control pollution from domestic wastewater into coastal marine waters of the WCR". It is important to engage the communities of the WCR and empower them as decision makers and partners in program development and in integrated coastal management. To do so requires government (especially local governments) and communities to share responsibility for program development and to work together. By creating an process for the community to become involved in the planning, there is potentially a greater opportunity to successfully meet the planning objectives. Some considerations to facilitate this process are discussed below.

- Identify the stakeholders and build partnerships between governance, NGOs, private sector, and citizen communities
- Facilitate community organization
- Involving the community in the planning, implementation, monitoring and evaluation process

Involving the community requires identifying the stakeholders, creating a process for participation, and developing opportunities to involve the community directly into achieving

Chapter 8
Phase 5: Information Management and Outreach

the program objectives. One of the objectives in involving the community is to identify fundamental social, cultural, and environmental values relative to the program objective, so that they are taken into consideration early and throughout the planning process.

Workshops in formal settings are one of many forms of "outreach."

8.2.1 Who is the Community and Why is Their Input Important?

It is not always clear what defines the community of stakeholders. Some suggestions for defining the community with interests in domestic wastewater are provided in *Sanitation Promotion* (Brikké et al. 1998); these include: government officials; external support agencies such as UNEP, WHO, etc.; international and national, as well as, local NGOs; private sector, the media, medical community, and the general public. Some reasons that these groups will have an interest and thus be considered stakeholders include:

- Improved sanitation services, for families and communities.
- Improved water quality, for tourist industry, recreation users, fishers.
- Added costs for improved services, for families, communities, and industries
- Sources of business from providing services or products, for design and construction contractors, technology vendors, laboratories, and education centers

8.2.2 What is the Community Organization Process

Community organization is a way to effectively seek input from the community. The process to solicit and respond to community input should be a formalized process, and in some cases formally institutionalized, so that the community understands how they can participate. For example, Section 4.4.3.2 discussed the need to characterize coastal waters as Class I and II, using a process described in Table 4.7. However, there will be several activities that will require community input. These communities should be identified and organized based on common interest.

In most cases, local communities will have the greatest need to organize since they will have the most tangible needs. They are sometimes in a better position to understand local needs, provide ideas and resources, and input on issues related to priorities, and willingness to pay (e.g., by who, for what, how much, and when). Recent findings indicate that understanding the cultural and social practices are important to ensuring greater success in community-based management approaches (Olsen and Christie 2000).

8.2.3 What Approaches to Involve the Community

There are several ways to involve and motivate communities in the planning process. It will take homework to build partnerships, as well as, careful planning, time and patience. It will

also take leadership from all sectors of society. Some innovative approaches to build effective community level leaders have been developed and practiced as part of the Philippines coastal management programs (Courtney and White 2000). These practices are also relevant to developing leaders for domestic wastewater management. The foundation of these programs is to build leaders within the communities by providing them the tools for redefining the roles and responsibilities of national government and thus facilitating greater community organization and decision-making at the local level. Other considerations to involve the community include:

- Sharing and making information more easily available
- Providing training in leadership and other skills to assist in program planning and implementation
- Establishing forums for communication, such as town meetings
- Providing funding to ensure support to execute public participation programs is available

In some cases, it may be appropriate to involve communities directly in gathering "field" information. Some types of information can be collected by motivating and providing basic training to local communities, so that they can assist in data collection. There are techniques that can be used to motivate communities to assist in gathering information on resource use activities, demographics, socioeconomic and cultural conditions, and resource conditions. Data gathering techniques include: interviews with individuals and groups, household surveys, and with more focused training mapping of resources and habitats.

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APPENDIX A

ANNEX III OF THE LBS PROTOCOL

PROTOCOL CONCERNING POLLUTION FROM LAND-BASED SOURCES AND ACTIVITIES TO THE CONVENTION FOR THE PROTECTION AND DEVELOPMENT OF THE MARINE ENVIRONMENT OF THE WIDER CARIBBEAN REGION

Adopted at Aruba on 6 October 1999 **Spanish | French | Word Format**

The Final Act of the Conference of Plenipotentiaries to adopt the Protocol Concerning Pollution from Land-Based Sources and Activities in the Wider Caribbean Region

The Contracting Parties to this Protocol,

Being Parties to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, done at Cartagena de Indias on 24 March 1983,

Resolved, therefore, to implement the Convention and specifically Article 7,

Taking note of Article 4, paragraph 4 of the Convention,

Considering the principles of the Rio Declaration and Chapter 17 of Agenda 21 adopted by the United Nations Conference on the Environment and Development (Rio de Janeiro, 1992), and the Programme of Action for the Small Islands Developing States (Barbados, 1994), as well as the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (Washington, 1995), including the illustrative list of funding sources set forth in its Annex,

Recalling the relevant rules of international law as reflected in the 1982 United Nations Convention on the Law of the Sea and in particular its Part XII,

Conscious of the serious threat to the marine and coastal resources and to human health in the Wider Caribbean Region posed by pollution from land-based sources and activities,

Aware of the ecological, economic, aesthetic, scientific, recreational and cultural value of the marine and coastal ecosystems of the Wider Caribbean Region,

Recognising the inequalities in economic and social development among the countries of the Wider Caribbean Region and their needs for the achievement of sustainable development,

Determined to cooperate closely in taking the appropriate measures to protect the marine environment of the Wider Caribbean Region against pollution from land-based sources and activities,

Further recognising the need to encourage national, sub-regional and regional action through a national political commitment at the highest level, and international cooperation to deal with the problems posed by pollutants entering the Convention area from land-based sources and activities,

Have agreed as follows:

Article I Definitions

For the purposes of this Protocol:

a."Convention" means the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena de Indias, Colombia, March 1983);

b."Organisation" means the United Nations Environment Programme as referred to in Article 2(2) of the Convention;

c."Pollution of the Convention area" means the introduction by humans, directly or indirectly, of substances or energy into the Convention area, which results or is likely to result in such deleterious effects as harm to living resources and marine ecosystems, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities;

d."Land-based sources and activities" means those sources and activities causing pollution of the Convention area from coastal disposal or from discharges that emanate from rivers, estuaries, coastal establishments, outfall structures, or other sources on the territory of a Contracting Party, including atmospheric deposition originating from sources located on its territory;

e."Most Appropriate Technology" means the best of currently available techniques, practices, or methods of operation to prevent, reduce or control pollution of the Convention area that are appropriate to the social, economic, technological, institutional, financial, cultural and environmental conditions of a Contracting Party or Parties; and

f."Monitoring" means the periodic measurement of environmental quality indicators.

Article II General Provisions

1. Except as otherwise provided in this Protocol, the provisions of the Convention relating to its protocols shall apply to this Protocol.

2. In taking measures to implement this Protocol, the Contracting Parties shall fully respect the sovereignty, sovereign rights and jurisdiction of other States, in accordance with international law.

Article III General Obligations

1. Each Contracting Party shall, in accordance with its laws, the provisions of this Protocol, and international law, takeappropriate measures to prevent, reduce and control pollution of the Convention area from land-based sources and activities, using for this purpose the best practicable means at its disposal and in accordance with its capabilities.

2. Each Contracting Party shall develop and implement appropriate plans, programmes and measures. In such plans, programmes and measures, each Contracting Party shall adopt effective means of preventing, reducing or controlling pollution of the Convention area from land-based sources and activities on its territory, including the use of most appropriate technology and management approaches such as integrated coastal area management.

3. Contracting Parties shall, as appropriate, and having due regard to their laws and their individual social, economic and environmental characteristics and the characteristics of a specific area or subregion, jointly develop subregional and regional plans, programmes and measures to prevent, reduce and control pollution of the Convention area from land-based sources and activities.

Article IV Annexes

1. The Contracting Parties shall address the source categories, activities and associated pollutants of concern listed in Annex I to this Protocol through the progressive development and implementation of additional annexes for those source categories, activities, and associated pollutants of concern that are determined by the Contracting Parties as appropriate for regional or sub-regional action. Such annexes shall, as appropriate, include *inter alia*:

    1. effluent and emission limitations and/or management practices based on the factors identified in Annex II to this Protocol; and

    2. timetables for achieving the limits, management practices and measures agreed by the Contracting Parties.

b.In accordance with the provisions of the annexes to which it is party, each Contracting Party shall take measures to prevent, reduce and control pollution of the Convention area from the source categories, activities and pollutants addressed in annexes other than Annexes I and II to this Protocol.

c.The Contracting Parties may also develop such additional annexes as they may deem appropriate, including an annex to address water quality criteria for selected priority pollutants identified in Annex I to this Protocol.

Article V Cooperation and Assistance

1. Contracting Parties shall cooperate, bilaterally or, where appropriate, on a sub-regional, regional or global basis or through competent organisations in the prevention, reduction and control of pollution of the Convention area from land-based sources and activities.

2. In carrying out the obligations provided for in paragraph 1 above, Contracting Parties shall promote cooperation in the following areas:

    a. monitoring activities undertaken in accordance with Article VI;

    b. research on the chemistry, fate, transport and effects of pollutants;

    c. exchange of scientific and technical information;

    d. identification and use of most appropriate technologies applicable to the specific source categories, activities and pollutants identified in Annex I to this Protocol; and

    e. research and development of technologies and practices for the implementation of this Protocol.

2. Contracting Parties shall promote co-operation, directly or through competent sub-regional, regional and global organisations, with those Contracting Parties which request it in obtaining assistance for the implementation of this Protocol particularly to:

    a. develop scientific, technical, educational and public awareness programmes to prevent, reduce and control pollution of the Convention area from land-based sources and activities in accordance with this Protocol;

    b. train scientific, technical and administrative personnel;

c. provide technical advice, information and other assistance necessary to address the source categories, activities and pollutants identified in Annex I to this Protocol; and

d. identify and approach potential sources of financing for projects necessary to implement this Protocol.

Article VI Monitoring and Assessment Programmes

1. Each Contracting Party shall formulate and implement monitoring programmes, as appropriate, in accordance with the provisions of this Protocol and relevant national legislation. Such programmes may, *inter alia*:

   a. systematically identify and assess patterns and trends in the environmental quality of the Convention area; and

   b. assess the effectiveness of measures taken to implement the Protocol.

2. Monitoring information shall be made available to the Scientific, Technical and Advisory Committee to facilitate the work of the Committee, as provided in Article XIV.

3. These programmes should avoid duplication of other programmes, particularly of similar regional programmes carried out by competent international organisations.

Article VII Environmental Impact Assessment

1. The Contracting Parties shall develop and adopt guidelines concerning environmental impact assessments, and review and update those guidelines as appropriate.

2. When a Contracting Party has reasonable grounds to believe that a planned land-based activity on its territory, or a planned modification to such an activity, which is subject to its regulatory control in accordance with its laws, is likely to cause substantial pollution of, or significant and harmful changes to, the Convention area, that Contracting Party shall, as far as practicable, review the potential effects of such activity on the Convention area, through means such as an environmental impact assessment.

3. Decisions by the competent government authorities with respect to land-based activities, referred to in paragraph 2 above, should take into account any such review.

4. Each Contracting Party shall, subject to its domestic law and regulations, seek the participation of affected persons in any review process conducted pursuant to paragraph 2 above, and, where practicable, publish or make available relevant information obtained in this review.

Article VIII Development of Information Systems

The Contracting Parties shall cooperate directly or through relevant sub-regional, regional and, where appropriate, global organisations to develop information systems and networks for the exchange of information to facilitate the implementation of this Protocol.

Article IX Transboundary Pollution

Where pollution from land-based sources and activities originating from any Contracting Party is likely to affect adversely the coastal or marine environment of one or more of the other Contracting Parties, the Contracting Parties concerned shall use their best efforts to consult at the request of any affected Contracting Party, with a view to resolving the issue.

Article X Participation

Each Contracting Party shall, in accordance with its national laws and regulations, promote public access to relevant information and documentation concerning pollution of the Convention area from land-based sources and activities and the opportunity for public participation in decision-making processes concerning the implementation of this Protocol.

Article XI Education and Awareness

The Contracting Parties shall develop and implement individually and collectively programmes on environmental education and awareness for the public related to the need to prevent, reduce and control pollution of the Convention area from land-based sources and activities, and shall promote the training of individuals involved in such prevention, reduction and control.

Article XII Reporting

1. The Contracting Parties shall submit reports to the Organisation containing information on measures adopted, results obtained and any difficulties experienced in the implementation of this Protocol. These reports should include, whenever possible, information on the state of the Convention area. The Meeting of the Contracting Parties shall determine the nature of the information to be included, and the collection, presentation and timing of these reports, which will be made available to the public with the exception of information submitted in accordance with paragraph 3 below.

2. The Scientific, Technical and Advisory Committee shall use the data and information contained in these national reports to prepare regional reports on the implementation of this Protocol, including the state of the Convention area. The regional reports shall be submitted to the Contracting Parties in accordance with Article XIV.

3. Information provided pursuant to paragraphs 1 and 2 above, that is designated by a Contracting Party as confidential, shall be used for the purposes referred to in paragraph 2 above in such a manner that assures its confidentiality.

4. Nothing in this Protocol shall require a Contracting Party to supply information the disclosure of which is contrary to the essential interests of its security.

Article XIII Institutional Mechanisms

1. Each Contracting Party shall designate a focal point to serve as liaison with the Organisation on the technical aspects of the implementation of this Protocol.

2. The Contracting Parties designate the Organisation to carry out the following Secretariat functions:

    a. convene and service the meetings of the Contracting Parties;

    b. assist in raising funds as provided for in Article XVI;

c. provide such assistance that the Scientific, Technical and Advisory Committee may require to carry out its functions as referred to in Article XIV;

d. provide the appropriate assistance as may be identified by the Contracting Parties to facilitate:

i. the development and implementation of the plans, programmes and measures necessary to achieve the objectives of this Protocol;

ii. the development of incentive programmes to implement this Protocol;

iii. the development of information systems and networks for the exchange of information for the purposes of facilitating the implementation of this Protocol, as referred to in Article VIII; and

iv. the development and implementation of environmental education, training and public awareness programmes, as referred to in Article XI;

e. communicate and work with the Caribbean Environment Programme on activities relevant to the implementation of this Protocol;

f. prepare common formats as directed by the Contracting Parties to be used as the basis for notifications and reports to the Organisation, as provided in Article XII;

g. establish and update databases on national, sub-regional and regional measures adopted for the implementation of this Protocol, including any other pertinent information, in keeping with the provisions of Articles III and XII;

h. compile and make available to the Contracting Parties reports and studies which may be required for the implementation of this Protocol or as requested by them;

i. cooperate with relevant international organisations;

j. provide to the Contracting Parties a report which shall include a draft budget for the coming year and an audited revenue and expenditure statement of the preceding year; and

k. carry out any other functions assigned to it by the Contracting Parties.

Article XIV Scientific, Technical and Advisory Committee

1. A Scientific, Technical and Advisory Committee is hereby established.

2. Each Contracting Party shall designate as its representative to the Committee an expert in the fields covered by this Protocol, who may be accompanied at its meetings by other experts and advisors also designated by the Contracting Party. The Committee may request scientific and technical advice from competent experts and organisations.

3. The Committee shall be responsible for reporting to and advising the Contracting Parties regarding the implementation of this Protocol. To carry out this function the Committee shall:

a. review on a regular basis the annexes to this Protocol as well as the state of pollution of the Convention area from land-based sources and activities and, where necessary, recommend amendments or additional annexes for consideration by the Contracting Parties;

b. examine, assess and analyze the information submitted by the Contracting Parties in accordance with Articles VI and XII and other relevant information to determine the effectiveness of the measures adopted to implement this Protocol, and submit regional reports to the Contracting Parties on the state of the Convention area. The regional reports shall set forth an assessment of the effectiveness and the socio-economic impact of measures adopted to implement the Protocol, and may propose any other appropriate measures;

c. provide advice to the Contracting Parties for the preparation and updating of information, including national inventories on marine pollution from land-based sources and activities;

d. provide guidance to the Contracting Parties:

   i. on measures and methodologies to assess pollution loads in the Convention area, and to ensure regional compatibility in data; and

   ii. on the development of plans, programmes and measures for the implementation of this Protocol;

e. advise on the formulation of common criteria, guidelines and standards for the prevention, reduction and control of pollution of the Convention area from land-based sources and activities;

f. propose priority measures for scientific and technical research and management of pollution from land-based sources and activities as well as for control, management practices and monitoring programmes, bearing in mind regional trends and conditions and any information available;

g. provide scientific and technical advice to the Meeting of the Contracting Parties regarding proposals for technical assistance;

h. formulate programmes on environmental education and awareness related to this Protocol;

i. develop a draft budget for the operation of the Scientific, Technical and Advisory Committee and submit it to the Contracting Parties for approval; and

j. carry out any other function related to the implementation of this Protocol which is assigned to it by the Contracting Parties.

4. The Committee shall adopt Rules of Procedure.

Article XV Meetings of the Contracting Parties

1. The ordinary meetings of the Contracting Parties to this Protocol shall generally be held in conjunction with the ordinary meetings of the Contracting Parties to the Convention held pursuant to Article 16 of the Convention. The Contracting Parties may also hold extraordinary meetings as deemed necessary, upon the request of the Organisation or at the request of any Contracting Party, provided that such requests are supported by the majority of the Contracting Parties. The meetings shall be governed by the Rules of Procedure adopted pursuant to Article 20 of the Convention.

2. It shall be the function of the meetings of the Contracting Parties to this Protocol to:

    a. keep under review the implementation of this Protocol and the effectiveness of actions taken pursuant to it;

    b. consider proposed amendments to this Protocol, including additional annexes, with a view to their subsequent adoption in accordance with the procedures established in the Convention and this Protocol;

    c. approve the expenditure of funds identified in Article XVI that are not otherwise designated for a specific project by the donors;

    d. review and adopt, as appropriate, regional reports developed by the Scientific, Technical and Advisory Committee in accordance with Articles XII and XIV as well as other information that a Contracting Party may transmit to the Meeting of the Contracting Parties;

    e. take appropriate action with regard to the recommendations of the Scientific, Technical and Advisory Committee;

    f. promote and facilitate, directly or through the Organisation, the exchange of information, experience and expertise and any other type of exchange between the Contracting Parties in accordance with Article V; and

    g. conduct such other business as appropriate.

Article XVI Funding

1. In addition to the financial participation by the Contracting Parties in accordance with Article 20, paragraph 2 of the Convention, the Organisation may, in response to requests from Contracting Parties, seek additional funds or other forms of assistance for activities related to this Protocol. These funds may include voluntary contributions for the achievement of specific objectives of this Protocol made by the Contracting Parties, other governments and government agencies, international organisations, non-governmental organisations, the private sector and individuals.

2. The Contracting Parties, taking into account their capabilities, shall endeavour as far as possible to ensure that adequate financial resources are available for the formulation and implementation of projects and programmes necessary to implement this Protocol. To this end, the Contracting Parties shall:

    a. promote the mobilisation of substantial financial resources, including grants and concessional loans, from national, bilateral and multilateral funding sources and mechanisms, including multilateral financial institutions; and

    b. explore innovative methods and incentives for mobilising and channeling resources, including those of foundations, non-governmental organisations and other private sector entities

3. In keeping with its development priorities, policies and strategies, each Contracting Party undertakes to mobilise financial resources to implement its plans, programmes and measures pursuant to this Protocol.

Article XVII Adoption and Entry into Force of New Annexes and Amendments to Annexes

1. Except as provided in paragraphs 2 and 3 below, the adoption and entry into force of new annexes and amendments to annexes to this Protocol shall take place in accordance with paragraphs 2 and 3 of Article 19 of the Convention.

2. The Contracting Parties may, at the time of adoption of any amendment to an annex, decide by a three-fourths majority vote of the Contracting Parties present and voting, that such amendment is of such importance that it shall enter into force in accordance with paragraphs 5 and 6 of Article 18 of the Convention.

3. With respect to any Contracting Party that has made a declaration with respect to new annexes in accordance with Article XVIII, such annex shall enter into force on the thirtieth day after the date of deposit with the Depositary of its instrument of ratification, acceptance, approval or accession with respect to such annexes.

Article XVIII Ratification, Acceptance, Approval and Accession

1. This Protocol, including Annexes I to IV, shall be subject to ratification, acceptance, approval or accession as provided by Articles 26 and 27 of the Convention.

2. In its instrument of ratification, acceptance, approval or accession, any State or regional economic integration organisation may declare that any new annex shall enter into force for it only upon the deposit of its instrument of ratification, acceptance, approval or accession thereto.

3. Following entry into force of this Protocol, any new Contracting Party to this Protocol may, at the time of acceding, declare that such accession does not apply to any annex, other than Annexes I to IV.

Article XIX Signature

This Protocol shall be open for signature at Oranjestad, Aruba on 6 October 1999, and at Santa Fe de Bogotá, Republic of Colombia, from 7 October 1999 to 6 October 2000, by any Party to the Convention.

IN WITNESS WHEREOF the undersigned, being duly authorized by their respective governments, have signed this Protocol.

DONE AT Oranjestad, Aruba, this 6 October 1999, in a single copy in the English, French and Spanish languages, the three texts being equally authentic.

ANNEXES

ANNEX I Source Categories, Activities and Associated Pollutants of Concern

A. Definitions

For the purposes of subsequent Annexes:

1. "Point Sources" means sources where the discharges and releases are introduced into the environment from any discernable, confined and discrete conveyance, including but not limited to pipes, channels, ditches, tunnels, conduits or wells from which pollutants are or may be discharged; and

2. "Non-Point Sources" means sources, other than point sources, from which substances enter the environment as a result of land run-off, precipitation, atmospheric deposition, drainage, seepage or by hydrologic modification.

B. Priority Source Categories and Activities Affecting the Convention Area

The Contracting Parties shall take into account the following priority source categories and activities when formulating regional and, as appropriate, sub-regional plans, programmes and measures for the prevention, reduction and control of pollution of the Convention area:

Domestic Sewage
Agricultural Non-Point Sources
Chemical Industries
Extractive Industries and Mining
Food Processing Operations
Manufacture of Liquor and Soft Drinks
Oil Refineries
Pulp and Paper Factories
Sugar Factories and Distilleries
Intensive Animal Rearing Operations

C. Associated Pollutants of Concern

1. Primary Pollutants of Concern

The Contracting Parties shall consider, taking into account the recommendations and other work of relevant international organisations, the following list of pollutants of concern, which were identified on the basis of their hazardous or otherwise harmful characteristics, when formulating effluent and emission limitations and management practices for the sources and activities in this Annex:

a. Organohalogen compounds and substances which could result in the formation of these compounds in the marine environment;

b. Organophosphorus compounds and substances which could result in the formation of these compounds in the marine environment;

c. Organotin compounds and substances which could result in the formation of these compounds in the marine environment;

d. Heavy metals and their compounds;

e. Crude petroleum and hydrocarbons;

f. Used lubricating oils;

g. Polycyclic aromatic hydrocarbons;

h. Biocides and their derivatives;

i. Pathogenic micro-organisms;

j. Cyanides and fluorides;

k. Detergents and other non-biodegradable surface tension substances;

l. Nitrogen and phosphorus compounds;

m. Persistent synthetic and other materials, including garbage, that float, flow or remain in suspension or settle to the bottom and affect marine life and hamper the uses of the sea;

n. Compounds with hormone-like effects;

o. Radioactive substances;

p. Sediments; and

q. Any other substance or group of substances with one or more of the characteristics outlined in paragraph 2 below.

2. Characteristics and Other Factors To Be Considered in Evaluating Additional Pollutants of Concern

The Contracting Parties should, taking into account the recommendations and other work of relevant international organisations, consider the following characteristics and factors, where relevant, in evaluating potential pollutants of concern other than those listed in paragraph 1 above:

a. Persistency;

b. Toxicity or other harmful properties (for example, carcinogenic, mutagenic and teratogenic properties);

c. Bio-accumulation;

d. Radioactivity;

e. Potential for causing eutrophication;

f. Impact on, and risks to, health;

g. Potential for migration;

h. Effects at the transboundary level;

i. Risk of undesirable changes in the marine ecosystem, irreversibility or durability of effects;

j. Negative impacts on marine life and the sustainable development of living resources or on other legitimate uses of the seas; and

k. Effects on the taste or smell of marine products intended for human consumption or effects on the smell, colour, transparency or other characteristics of the water in the marine environment.

ANNEX II Factors To Be Used in Determining Effluent and Emission Source Controls and Management Factors

A. The Contracting Parties, when developing sub-regional and regional source-specific effluent and emission limitations and management practices pursuant to Article IV of this Protocol, shall evaluate and consider the following factors:

1. Characteristics and Composition of the Waste

    a. Type and size of waste source (for example, industrial process);

    b. Type and form of waste (origin, physical, chemical and biological properties, average composition);

    c. Physical state of waste (solid, liquid, sludge, slurry);

    d. Total quantity (units discharged, for example, per year or per day);

    e. Discharge frequency (continuous, intermittent, seasonally variable, etc.);

    f. Concentration with respect to major constituents contained in the wastes emanating from the source or activity; and

    g. Interaction with the receiving environment.

2. Characteristics of the Activity or Source Category

    a. Performance of existing technologies and management practices, including indigenous technologies and management practices;

    b. Age of facilities, as appropriate; and

    c. Existing economic, social and cultural characteristics.

3. Alternative Production, Waste Treatment Technologies or Management Practices

    a. Recycling, recovery and reuse opportunities;

    b. Less hazardous or non-hazardous raw material substitution;

c. Substitution of cleaner alternative activities or products;

d. Economic, social and cultural impacts of alternatives, activities or products;

e. Low-waste or totally clean technologies or processes; and

f. Alternative disposal activities (for example, land application).

B. Pursuant to Article IV of this Protocol, each Contracting Party shall, at a minimum, apply the effluent and emission source controls and management practices set out in subsequent annexes. A Contracting Party may impose more stringent source controls or management practices. To determine if more stringent limitations are appropriate, a Contracting Party should also take into account characteristics of the discharge site and receiving marine environment, including:

1. Hydrographic, meteorological, geographical and topographical characteristics of the coastal areas;

2. Location and type of the discharge (outfall, canal outlet, gullies, etc.) and its relation to sensitive areas (such as swimming areas, reef systems, sea grass beds, spawning, nursery and fishing areas, shellfish grounds and other areas that are particularly sensitive) and other discharges;

3. Initial dilution achieved at the point of discharge into the receiving marine environment;

4. Dispersion characteristics (due to currents, tides and wind) that may affect the horizontal transport and vertical mixing of the affected waters;

5. Receiving water characteristics with respect to the physical, chemical, biological and ecological conditions in the discharge area; and

6. Capacity of the receiving marine environment to assimilate waste discharges.

C. The Contracting Parties shall keep the source controls and management practices set out in subsequent annexes under review. They shall consider that:

1. If the reduction of inputs resulting from the use of the effluent and emission limitations and management practices established in accordance with this Annex do not lead to environmentally acceptable results, the effluent and emission limitations or management practices may need to be revised; and

2. The appropriate effluent and emission limitations and management practices for a particular source or activity may change with time in light of technological advances, economic and social factors, as well as changes in scientific knowledge and understanding.

ANNEX III Domestic Wastewater

A. Definitions

For the purposes of this Annex:

1. "Domestic wastewater" means all discharges from households, commercial facilities, hotels, septage and any other entity whose discharge includes the following:

a. Toilet flushing (black water);

b. Discharges from showers, wash basins, kitchens and laundries (grey water); or

c. Discharges from small industries, provided their composition and quantity are compatible with treatment in a domestic wastewater system.

Small quantities of industrial waste or processed wastewater may also be found in domestic wastewater. (See Part D - Industrial Pretreatment.

2. "Class I waters" means waters in the Convention area that, due to inherent or unique environmental characteristics or fragile biological or ecological characteristics or human use, are particularly sensitive to the impacts of domestic wastewater. Class I waters include, but are not limited to:

a. waters containing coral reefs, seagrass beds, or mangroves;

b. critical breeding, nursery or forage areas for aquatic and terrestrial life;

c. areas that provide habitat for species protected under the Protocol Concerning Specially Protected Areas and Wildlife to the Convention (the SPAW Protocol);

d. protected areas listed in the SPAW Protocol; and

e. waters used for recreation.

3. "Class II waters" means waters in the Convention area, other than Class I waters, that due to oceanographic, hydrologic, climatic or other factors are less sensitive to the impacts of domestic wastewater and where humans or living resources that are likely to be adversely affected by the discharges are not exposed to such discharges.

4. "Existing domestic wastewater systems" means, with respect to a particular Contracting Party, publicly or privately owned domestic wastewater collection systems, or collection and treatment systems, that were constructed prior to entry into force of this Annex for such Contracting Party.

5. "New domestic wastewater systems" means, with respect to a particular Contracting Party, publicly or privately owned domestic wastewater collection systems, or collection and treatment systems, that were constructed subsequent to entry into force of this Annex for such Contracting Party, and includes existing domestic wastewater systems which have been subject to substantial modifications after such entry into force.

6. "Household systems" means on-site domestic wastewater disposal systems for homes and small commercial businesses in areas of low population density, or where centralised collection and treatment systems of domestic wastewater are not economically or technologically feasible. Household systems include, but are not limited to, septic tanks and drain fields or mounds, holding tanks, latrines and bio-digesting toilets.

7. "Wastewater collection systems" means any collection or conveyance system designed to collect or channel domestic wastewater from multiple sources.

B. Discharge of Domestic Wastewater

1. Each Contracting Party shall :

   a. Consistent with the provisions of this Annex, provide for the regulation of domestic wastewater discharging into, or adversely affecting, the Convention area;

   b. To the extent practicable, locate, design and construct domestic wastewater treatment facilities and outfalls such that any adverse effects on, or discharges into, Class I waters, are minimised;

   c. Encourage and promote domestic wastewater reuse that minimises or eliminates discharges into, or discharges that adversely affect, the Convention area;

   d. Promote the use of cleaner technologies to reduce discharges to a minimum, or to avoid adverse effects within the Convention area; and

   e. Develop plans to implement the obligations in this Annex, including, where appropriate, plans for obtaining financial assistance.

2. Each Contracting Party shall be entitled to use whatever technology or approach that it deems appropriate to meet the obligations specified in Part C of this Annex.

C. Effluent Limitations

Each Contracting Party shall ensure that domestic wastewater that discharges into, or adversely affects, the Convention area, is treated by a new or existing domestic wastewater system whose effluent achieves the effluent limitations specified below in paragraphs 1, 2 and 3 of this Part, in accordance with the following timetable:

Category	Effective Date of Obligation (in years after entry into force for the Contracting Party	Effluent Sources
1	0	All new domestic wastewater systems
2	10	Existing domestic wastewater systems other than community wastewater systems
3	10*	Communities with 10,000 – 50,000 inhabitants
4	15	Communities with more than 50,000 inhabitants already possessing wastewater collection systems
5	20	Communities with more than 50,000 inhabitants not possessing wastewater collection systems
6	20	All other communities except those relying exclusively on household systems
* Contracting Parties which decide to give higher priority to categories 4 and 5 may extend their obligations pursuant to category 3 to twenty (20) years (time frame established in category 6).		

1. Discharges into Class II Waters

Each Contracting Party shall ensure that domestic wastewater that discharges into, or adversely affects, Class II waters is treated by a new or existing domestic wastewater system whose effluent achieves the following effluent limitations based on a monthly average:

Parameter	Effluent Limit
Total Suspended Solids	150 mg/l*
Biochemical Oxygen Demand (BOD_5)	150 mg/l
pH	5-10 pH units
Fats, Oil and Grease	50 mg/l
Floatables	not visible
* Does not include algae from treatment ponds	

2. Discharges into Class I Waters

Each Contracting Party shall ensure that domestic wastewater that discharges into, or adversely affects, Class I waters is treated by a new or existing domestic wastewater system whose effluent achieves the following effluent limitations based on a monthly average:

Parameter	Effluent Limit
Total Suspended Solids	30 mg/l*
Biochemical Oxygen Demand (BOD_5)	30 mg/l
pH	5-10 pH units
Fats, Oil and Grease	15 mg/l
Faecal Coliform (Parties may meet effluent limitations either for faecal coliform or for *E. coli* (freshwater) and enterococci (saline water).)	Faecal Coliform: 200 mpn/100 ml; or a. *E. coli*: 126 organisms/100ml; b. enterococci: 35 organisms/100 ml
Floatables	not visible
* Does not include algae from treatment ponds	

3. All Discharges

a. Each Contracting Party shall take into account the impact that total nitrogen and phosphorus and their compounds may have on the degradation of the Convention area and, to the extent practicable, take appropriate measures to control or reduce the amount of total nitrogen and phosphorus that is discharged into, or may adversely affect, the Convention area.

b. Each Party shall ensure that residual chlorine from domestic wastewater treatment systems is not discharged in concentrations or amounts that would be toxic to marine organisms that reside in or migrate to the Convention area.

D. Industrial Pretreatment

Each Contracting Party shall endeavour, in keeping with its economic capabilities, to develop and implement industrial pretreatment programmes to ensure that industrial discharges into new and existing domestic wastewater treatment systems:

a. do not interfere with, damage or otherwise prevent domestic wastewater collection and treatment systems from meeting the effluent limitations specified in this Annex;

b. do not endanger operations of, or populations in proximity to, collection and treatment systems through exposure to toxic and hazardous substances;

c. do not contaminate sludges or other reusable products from wastewater treatment; and

d. do not contain toxic pollutants in amounts toxic to human health and/or aquatic life.

Each Contracting Party shall endeavour to ensure that industrial pretreatment programmes include spill containment and contingency plans.

Each Contracting Party, within the scope of its capabilities, shall promote appropriate industrial wastewater management, such as the use of recirculation and closed loop systems, to eliminate or minimise wastewater discharges to domestic wastewater systems.

E. Household Systems

Each Contracting Party shall strive to, as expeditiously, economically and technologically feasible, in areas without sewage collection, ensure that household systems are constructed, operated and maintained to avoid contamination of surface or ground waters that are likely to adversely affect the Convention area.

For those household systems requiring septage pump out, each Contracting Party shall strive to ensure that the septage is treated through a domestic wastewater system or appropriate land application.

F. Management, Operations and Maintenance

Each Contracting Party shall ensure that new and existing domestic wastewater systems are properly managed and that system managers develop and implement training programmes for wastewater collection and treatment system operators. Managers and operators shall have access to operators' manuals and technical support necessary for proper system operation.

Each Contracting Party shall provide for an evaluation of domestic wastewater systems by competent national authorities to assess compliance with national regulations.

G. Extension Period

1. Any Contracting Party may, at least two years before the effective date of an obligation in categories 2, 3, 4 or 5 of the timetable in Part C above, submit to the Organisation a declaration that, with respect to such category, it is unable to achieve the effluent limitations set forth in paragraphs 1 and 2 of Part C above in accordance with that timetable, provided that such Contracting Party:

    a. has developed action plans pursuant to Part B, paragraph 1(e);

    b. has achieved the effluent limitations for a subset of the discharges associated with those categories, or a reduction of at least 5 percent of total loading of pollutants associated with those categories; and

    c. has taken actions to achieve those effluent limitations, but has been unable to achieve those limitations due to a lack of financial or other capacity.

2. With respect to a Contracting Party that has submitted a declaration pursuant to paragraph 1 above, the effective date of an obligation in the timetable in Part C for categories 2, 3, 4 or 5 of that timetable shall be extended for a period of five years. The five-year period shall be extended for a maximum of one additional five-year period if the Contracting Party submits a new declaration prior to the expiration of the first period, and if it continues to meet the requirements set out in paragraph 1 above.

3. The Contracting Parties recognise that the complete fulfilment* of the obligations contained in this Annex will require the availability and accessibility of financial resources.

ANNEX IV Agricultural Non-Point Sources of Pollution

A. Definitions

For purposes of this Annex**:**

1. "Agricultural non-point sources of pollution" means non-point sources of pollution originating from the cultivation of crops and rearing of domesticated animals, excluding intensive animal rearing operations that would otherwise be defined as point sources; and

2. "Best management practices" means economical and achievable structural or non-structural measures designed to prevent, reduce or control the run-off of pollutants into the Convention area.

B. Plans for the Prevention, Reduction and Control of Agricultural Non-Point Sources of Pollution

Each Contracting Party shall, no later than five years after this Annex enters into force for it, formulate policies, plans and legal mechanisms for the prevention, reduction and control of pollution of the Convention area from agricultural non-point sources of pollution that may adversely affect the Convention area. Programmes shall be identified in such policies, plans and legal mechanisms to mitigate pollution of the Convention area from agricultural non-point sources of pollution, in particular, if these sources contain nutrients (nitrogen and phosphorus), pesticides, sediments, pathogens, solid waste or other such pollutants that may adversely affect the Convention area. Plans shall include *inter alia* the following elements:

1. An evaluation and assessment of agricultural non-point sources of pollution that may adversely affect the Convention area, which may include:

    a. an estimation of loadings that may adversely affect the Convention area;

    b. an identification of associated environmental impacts and potential risks to human health;

    c. the evaluation of the existing administrative framework to manage agricultural non-point sources of pollution;

    d. an evaluation of existing best management practices and their effectiveness; and

    e. the establishment of monitoring programmes.

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* In this context, the Spanish word "cumplimiento" that appears in the Spanish text shall have the meaning of the English word "fulfilment" and not "compliance".

2. Education, training and awareness programmes, which may include:

    a. the establishment and implementation of programmes for the agricultural sector and the general public to raise awareness of agricultural non-point sources of pollution and their impacts on the marine environment, public health and the economy;

    b. the establishment and implementation of programmes at all levels of education on the importance of the marine environment and the impact of pollution from agricultural activities;

    c. the establishment and implementation of training programmes for government agencies and the agricultural sector on the implementation of best management practices, including the development of guidance materials for agricultural workers on structural and non-structural best management practices, to prevent, reduce and control agricultural non-point sources of pollution; and

    d. the establishment of programmes to facilitate effective technology transfer and information exchange.

3. The development and promotion of economic and non-economic incentive programmes to increase the use of best management practices to prevent, reduce and control pollution of the Convention area from agricultural non-point sources.

4. An assessment and evaluation of legislative and policy measures, including a review of the adequacy of plans, policies and legal mechanisms directed toward the management of agricultural non-point sources and the development of a plan to implement such modifications as may be necessary to achieve best management practices.

C. Reporting

Each Contracting Party shall report on its plans for prevention, reduction and control of pollution of the Convention area from agricultural non-point sources in accordance with Article XII of this Protocol.

Return to the CEP Home Page.
Return to the Environmental Law Page.

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APPENDIX B

NEEDS ASSESSMENT CHECKLIST

Appendix B
Needs Assessment Checklist

This document is a checklist to assist in preparation of a Needs Assessment to support development of a domestic wastewater management (DWM) program oriented towards preventing, reducing, and controlling pollution of the marine environment from land-based sources and activities. The checklist is a companion to the Needs Assessment Guidance document and is intended to provide an overview of the needs that should be addressed when developing a national domestic wastewater management plan (DWMP).

A. GETTING STARTED			
Item			**Section**
1.	Have startup funds been secured to get the program development underway?	Limited funding should be allocated by the federal government with the specific objective of getting program development underway. One of the first task in program development is preparation of a work plan that defines future planning activities and budget requirements.	3.4
2.	Have impacts to the communities associated with a developing DWM program been identified?	Identifying the communities potentially impacted by development of a DWM program is essential to begin to define potential issues. Some communities will clearly see the benefits, but others will have issues such as increased financial burdens. However, it is important to define all issues to begin to identify solutions for the common good.	3.4.2, 4.4.2.1, and 8.2
3.	Have communities and associated stakeholders been identified?	Identifying stakeholders will be an iterative process. As new issues are identified, new stakeholders also may be identified.	3.4.2, 4.4.2.1, and 8.2
4.	Have dedicated staff been recruited to work on program development?	A dedicated team of professionals, ideally recruited from existing government institutions, should provide staff familiar with institutional, technical, and stakeholder issues. An important consideration is the ability to build political consensus to move most effectively into program development.	3.4
5.	Are the planning and management boundaries known?	Jurisdictional management boundaries already may be established. However, because Annex III requires classification of receiving waters, these boundaries likely will be undefined.	2.2, 3.4.4, 4.4.3.2

A. GETTING STARTED			
6.	Has a work plan been prepared for program development?	A work plan (action plan) should be prepared to launch program development. Developing the work plan is a tool to define activities and assumptions such as use of staff resources, schedules, and budgets.	3.4.5 and 6.0
7.	Is there an existing information system for storage and retrieval of program development information, technical data, and other information-based resources used in planning.	Use of existing information systems should be located to maximize use of existing resources. A multidisciplinary team, which includes an information system specialist, should be consulted to ensure that decisions regarding use of existing systems versus development of new systems is evaluated, based on short- and long-term program development goals.	4.1, 4.2 and 8.1

B. GENERAL PLANNING NEEDS			
Item			**Section**
1.	Have strategies involving stakeholders been developed?	Involvement of stakeholders should be encouraged, because it provides an opportunity for a larger pool of ideas and resources. Strategies for involvement include: participation in public meeting organization, collection of community information, development of planning documents, and profiling of social, environmental, or economic conditions.	3.4.2, 4.1, 4.2, 4.4.2.1, and 8.2
2.	Is there an adequate mechanism to monitor and evaluate program development progress?	Stakeholders should be kept abreast of program development progress by ensuring that all planning activities have established goals that are measurable and can be used to evaluate the effectiveness of program development measures. Stakeholders should be involved in all planning cycles and have an opportunity to participate in making program changes that may be needed to correct deficiencies or build upon successes.	3.4, 7.0

B.	GENERAL PLANNING NEEDS		
3.	Are the financial resource requirements known?	Ensure that all financial resources needed to successfully implement program development are identified, including: (1) general planning needs such as institutional capacity building; (2) alternative analysis, focus feasibility, and facility plans; (3) design and construction, including preliminary design studies, construction, and O&M; and (4) other costs such as monitoring and evaluation, information management, outreach, and education.	4.4.2.2 and 4.5.2
4.	What strategies have been developed to secure program funding?	Securing financial resources requires an understanding of issues such as willingness to pay, which can then be used to develop the most appropriate approach to financing programs.	4.4.2.2
5.	Has Annex III been adopted as a legal requirement?	Each Wider Caribbean Region country should formally adopt Annex III. However, if Annex III has not been formally adopted, planning may still be modeled using this planning framework.	1.1 and 4.4..2.3
6.	Have policies to comply with Annex III been drafted?	Policies should be drafted based on dialogue and political consensus of all stakeholders.	4.4.2.3 and 8.2
7.	Have other water sector needs (e.g. non-point sources) been identified ?	Ensure that other water sector planning (agriculture, tourisms, industry, urban and rural development, etc.) is compatible and integrated with wastewater management (particularly consider urban runoff control).	4.3.11

C.	SPECIFIC PLANNING NEEDS		
Item			**Section**
1.	Do discharges into the Convention Area occur?	Annex III requires management of domestic wastewater effluents discharging into the Convention Area; therefore, discharges into the Convention Area need to be characterized.	4.4.3.1
2.	Have discharge sources been adequately characterized?	Point and nonpoint source discharges need to be assessed to determine which ones have a domestic wastewater component that should be managed as part of a DWM program.	4.4.3.1

C.	**SPECIFIC PLANNING NEEDS**		
3.	What types of discharges are present?	Identification of other types of discharges, such as agricultural and urban runoff, industrial, and others, are not managed under Annex III. However the [spell out] (LBS) Protocol recommends that these be considered as part of other technology and management measures, such as an integrated coastal zone management.	4.4.3.1
4.	Do discharges comply with Annex III effluent limitations?	Management of effluents is based on water quality requirements of the receiving waters. Therefore, receiving waters need to be classified.	4.4.3.2
5.	Have receiving waters been classified?	All waters of the Convention Area should be classified as Class I or II waters. Classification of receiving waters should be based on social, economic, and environmental criteria, as well as specific requirements stated in Annex III, such as meeting the Protocol Concerning Specially Protected Areas and Wildlife to the Convention.	4.4.3.2
6.	Is there an existing EA framework for classifying waters of the Convention Area?	Classification of waters of the Convention Area should be based on a formal EA process, with opportunity for input from all potential stakeholders.	4.4.3.2 and 82
7.	What are existing DWM practices?	"Management" here is defined as collection or treatment systems. "DWM", as defined under Annex III, also includes industrial pretreatment and management using household systems.	4.4.3.3, 4.4.3.4, 4.4.3.5, and 4.4.3.6
8.	Is there an existing centralized or decentralized domestic wastewater collection system?	Collection systems alternatives analysis should be performed to assess and develop the most appropriate systems, based on cost-effective solutions, that consider rehabilitation needs of existing systems, move towards either centralized versus decentralized systems, or use of household systems.	4.4.3.3
9.	What are the existing DWM treatment systems in place?	Diverse levels of treatment options presented as treatment trains should be evaluated and selected based on factors such as technology and cost considerations, but ultimately, treatment needs should be based on meeting effluent limits.	4.4.3.3

C.	SPECIFIC PLANNING NEEDS		
10.	Are pollution prevention practices in place?	Pollution prevention practices should be adopted as policies and formalized into practices supported by institutional capacity building, including outreach and education programs. Practices, such as waste reduction and water reuse, are applicable at the source (residential, commercial, and industrial facilities), as well as specific practices at the DWM treatment facility.	4.4.3.3
11.	Are industrial facilities discharging into DWM systems?	Annex III requires that industrial wastes not hinder domestic wastewater systems and that toxic substances not be introduced into the Convention Area.	2.1 and 4.4.3.4
12.	Are industrial discharges characterized?	Industrial pretreatment may be necessary, depending on discharge characteristics such as quantity of flow (gallons per day-average) and quality (toxicity and dry weather discharge considerations). Therefore, a DWM program should identify and characterize the effluents associated with industrial dischargers.	4.4.3.4
13.	Are household systems a better alternative than conventional DWM systems?	Household systems may be more practical solutions than conventional DWM systems, particularly in rural communities that are too small and dispersed to potentially benefit from economies of scale by a conventional, urban infrastructure system.	2.1.4 and 4.4.3.5
14.	What provisions have been made for O&M practices?	O&M should be integrated into the overall management of a DWM system. O&M practices should be identified for existing and new systems, facilities, and components; practices should be documented for procedures such as emergency operations, staff training, equipment maintenance, and community outreach (for example, communication on changes and upgrades).	2.1.5, 4.4.3.6, and 8.2
15.	Have DWM program needs been documented into a BA?	After all needs have been defined, they should be documented in a national BA, which is the foundation of information for developing a national DWMP to address DWM needs.	4.5

C.	SPECIFIC PLANNING NEEDS		
16.	Have production considerations been addressed prior to preparing the draft national BA?	In advance of producing the draft national BA document, considerations should be given to standardizing data collection, such as: (1) use of cost models, forms, and questionnaires for inventories; (2) defining DWM terminology and planning periods; and (3) using or expanding upon existing reporting procedures, because these may serve to build upon existing knowledge for future decision-making.	4.5
17.	Has the national BA been circulated for feedback by stakeholders?	The national BA is a public document; it serves as the foundation for information used in development of a national DWMP.	4.4.2.1, 4.5 and 8.0

D.	OTHER PLANNING PHASES		
Item			**Section**
1.	Have provisions been made to begin developing the national DWMP?	Although the national government has the responsibility to develop the national DWMP, all levels of government have a role and responsibility to participate. Some examples of the roles are unique to a specific level of government, while other roles are shared. For example, municipal governments will be responsible for establishing a DWM system that meets local needs, as well as Annex III requirements; whereas, national and provincial governments should provide the framework for reporting and complying with Annex III requirements, as well as any other national standards. Therefore, all levels of government should work in partnership to accomplish shared goals.	4.4.2.3, 4.4.2.4, and 5.0
2.	Have priorities been discussed and established?	One of the most challenging elements of planning is identifying priorities. Funding will be the greatest limitation in meeting all needs. Consequently, it is important to ensure broad stakeholder participation to identify priorities as part of the planning process.	4.3, 4.4.2.1, 5.1, and 8.2
3.	Are all elements of planning addressed?	The planning document should have policies, planning goals, and specific actions that will be taken to address each of the needs identified in the BA.	5.2

D.	OTHER PLANNING PHASES		
4.	What types of strategies are being considered?	Several types of strategies can assist in developing actions, ranging from financial resources, technology needs, and institutional capacity building, to meet DWM needs. For example, define the role of government and institutional training to ensure efficient implementation.	4.4.2 and 5.3
5.	Have detailed action plans been prepared for each proposed action in the national DWMP?	Specific actions should be broken down to easily understood tasks, with defined schedules and budgets that comprise an action plan (also known as a work plan).	6.2
6.	What provisions have been made to measure planning achievements?	Planning and program implementation achievements should be measured using quantifiable indicators, which can be communicated national, as well as used to comply with Article VI (Monitoring and Assessment Programmes) of the LBS Protocol.	7.1
7.	What provisions have been made to measure water quality achievements?	Measuring effluent limits can be used to demonstrate that Annex III requirements are being met may be used to demonstrate that water quality is being improved or controlled. If water quality monitoring of receiving waters is performed based on standardized methods used by all countries of the WCR, then program implementation achievements can be communicated internationally. This would provide an effective way to comply with Article VI (Monitoring and Assessment Programmes) of the LBS Protocol.	7.2
8.	What provisions have been made for using information management systems in the planning process?	Use existing systems is appropriate, because building upon existing resources can be cost-effective. Ensure that an information system specialist is included as part of a multidisciplinary planning team.	8.1

D.	**OTHER PLANNING PHASES**		
9.	What provisions have been made for outreach and education in the planning process?	Outreach and education are integral parts of planning, which should be used throughout the planning cycle. Outreach is a way to ensure that all stakeholders have role and participate in the process. Education is a formal process that should be integrated in governmental, nongovernmental, private, and academic institutions. It is a way to ensure education on issues such as pollution prevention and practices that can be integrated into primary and secondary education systems to change social behavior. These practices can be incorporated into higher centers of learning to ensure that practitioners and educators are prepared and available for participating in the work force.	8.2