PAPER NO. 037

INTERNATIONAL WATERS SERIES

Monitoring and Evaluation Guidelines for World Bank-GEF International Waters Projects

October 1996

Acronyms

CZE	Coastal Zone Ecosystems
EPI	Environmental Performance Indicators
GEF	Global Environment Facility
IEPS	Initial Executive Project Summary
IW	International Waters
LME	Large Marine Ecosystems
M&E	Monitoring and Evaluation
NGO	Non-governmental Organization
OECD	Organization for Economic Cooperation and Development
PDF	Project Development and Preparation Facility
PMT	Project Management Team
PMU	Project Management Units
PPI	Project Performance Indicators
SAP	Strategic Action Programs
SEI	Socio-economic Performance Indicators
SIDS	Small Island Developing States
UNDP	United Nations Development Program
UNEP	United Nations Environment Program

Contents

1 Introduction

Organization and Use of the Guidelines

These guidelines are intended to assist World Bank task managers, staff and consultants engaged in the design and implementation of monitoring and evaluation (M&E) components of international waters (IW) projects funded by the Global Environment Facility (GEF). As part of their preparation, the guidelines were reviewed by the other GEF implementing agencies to gain broader experience with the design and implementation of GEF project M&E. It is anticipated that the guidelines will serve as a useful reference for client government agencies, non-governmental organizations and others involved or interested in the design, implementation or evaluation of IW projects.

The technical aspects of M&E plans and strategies are addressed in Section 2. Focus is on performance indicators, including environmental and socioeconomic indicators. Examples of environmental indicators of the major international waters ecosystems addressed by GEF-funded projects are included as illustrative annexes. The annexes review coastal zone and large marine ecosystems (Annex A), freshwater basin ecosystems (Annex B) and transboundary groundwater ecosystems (Annex C). Each annex contains (i) a general description of the ecosystem type and its associated environmental issues; (ii) elements of an initial assessment; and (iii) examples of key environmental indicators.

Section 3 surveys the organizational and institutional aspects of M&E plans and strategies, emphasizing the need for coordinated national and regional institutional mechanisms. The concluding chapter provides specific guidance to task managers on the development of M&E plans and strategies at key stages of the project cycle.

Background to Bank-GEF Monitoring and Evaluation

It is the policy of the World Bank that all Bank-funded projects shall include plans for M&E, recognizing that the relative emphasis, scope and organization of such plans will vary, depending on the project and particular responsibilities for execution. The Bank, acting as one of the three implementing agencies of the GEF, channels resources to client countries for preserving biodiversity, reducing greenhouse gas emissions, controlling ozone-depleting substances, and protecting international waters. The effective use of these resources needs to be monitored and results need to be evaluated against project objectives. Such efforts are guided by the Bank's operational guidelines for monitoring and evaluation, but they must also respond to GEF standards for monitoring and evaluation and reflect GEF's operational strategies.

These M&E guidelines for IW projects are founded on the Bank's Operational Directive on Project Monitoring and Evaluation.[2] They are designed to recognize the particular characteristics and complexities that IW projects bring to the design of M&E strategies[3] and to respond to the particular consequences for M&E that flow from the global environmental nature of GEF

Box 1.1 Key Elements of an IW Project M&E Plan

- *Formulate clearly defined project objectives*
- *Select relevant M&E indicators at appropriate spatial and temporal scales according to objectives*
- *Design or build linkages with longer-term, ecosystem-wide M&E strategy*
- *Design of a management information system*
- *Institutional responsibilities and organizational arrangements*
- *Costs and funding*
- *Implementation schedule*

operations.[4] They follow the publication of similar guidelines for greenhouse gas abatement, biodiversity conservation, and ozone layer protection projects.[5]

Project Monitoring and Evaluation

Project *monitoring* is the collection of data prior to and during the project. These data, when analyzed, pinpoint progress or constraints as early as possible, allowing project managers to adjust project activities as needed. Monitoring also provides the basis for *evaluation,* which involves two questions: Has the project met its objectives? and What accounts for its level of performance? Monitoring is a continuous assessment throughout the implementation period, whereas evaluation is periodic, including interim evaluation during implementation, terminal evaluation at the end of the project and impact evaluation some time after the completion of the project.

Each project must have a *monitoring and evaluation plan* (*M&E plan*) based on a suitable management information system. As environmental considerations are increasingly being mainstreamed in Bank operations, it is essential that projects which address environmental degradation include *environmental performance indicators* (EPIs) and *socioeconomic performance indicators* (SEIs) in their M&E plans. Performance indicators (EPIs and SEIs) complement an M&E plan's conventional elements, notably *process indicators* which monitor progress in securing project inputs and delivering project outputs against set targets. These guidelines focus on EPIs that assess how project activities affect the direction of change in environmental performance and how to best measure that change. The SEIs measure that same change in terms of impacts on people. The *pressure-state-response framework* developed by the OECD[6] — increasingly used as a unifying typology for EPIs — has been adopted for these guidelines (Section 2).

Bank projects addressing environmental problems typically are comprised of a subset of activities that is targeted to improve the state of a specific environmental resource or ecosystem. But these activities may not address other severe threats to ecosystem integrity. For example, a project designed to reduce industrial pollution in a freshwater basin may help to improve the health of the ecosystem, but other activities (such as land use and fishing effort) may have an equal or greater impact on the state of the ecosystem. In such cases, the individual project cannot be held responsible if, despite successful control of industrial pollution, the overall health of the ecosystem does not improve.

The responsibility for the implementation of the M&E plan rests with the *project management team* (*PMT*) in the client country or, in complex projects, with one agency assuming overall coordination of monitoring. The PMT uses the M&E plan to help develop, implement and report on project activities, including their required inputs and outputs as well as their impacts. The management information system for the project is used to maintain the necessary data on on-going activities.

Ecosystem-wide Monitoring and Evaluation

When establishing environmental policies and management programs three issues must first be assessed: The state of environmental resources or ecosystems, the sources and severity of identified threats, and the geographic and temporal parameters of those threats. Such assessments must be based on an *ecosystem-wide* monitoring and evaluation system since the achievement of environmental policies and management programs is inherently tied to pressures and conditions of the broader ecosystem in which they operate. In most project situations, M&E systems are non-existent or of limited scale or capacity. Thus it is critical for the objectives of international waters projects to include measures that specifically monitor the pressures and the conditions of the natural resource environment or ecosystem in which the specific activities of the project take place.

To that end, these guidelines recognize that most IW projects are required to develop, test and build capacity for implementing *ecosystem-based monitoring and evaluation strategies (M&E strategies)*. IW projects typically are limited either in geographic area, in scope of activity and in project lifetime. In order to be relevant to the broader ecosystem in which they operate, as has been noted, M&E plans need to help establish or reinforce M&E strategies which ensure broader spacial and temporal measurements of ecosystem health and needed policy responses.

In some cases, the initial design of the strategy may form part of project preparation, along with testing, design modifications, and the required human resource development activities. In other cases, strategy design may be part of project implementation. In any case, the objective is for such strategies to be designed and backed up by institutional arrangements and trained human resources so that they are sustainable beyond the life of the project. In addition, for projects to have wide, longer-term impact, it is important that they be viewed in a broader framework. For example, projects that are part of national plans or strategies are more likely to have a sustained effect and thus be more cost-effective.

International Waters Projects and M&E

Environmental management of international waterbodies and their related ecosystems is complicated by the nature of the natural resources (including the multitude of water systems) and their pattern of use.

- First, international waterbodies and their associated ecosystems have diverse morphological characteristics. They include oceans, large marine ecosystems, enclosed or semi-enclosed seas and estuaries, rivers, lakes, groundwater systems and wetlands with transboundary drainage basins or common borders. Moreover, watersheds, airsheds, estuaries and coastal and marine waters are commonly linked through transport of water, pollutants, sediments and living resources.
- Second, these waterbodies and related ecosystems are subject to a variety of demands by beneficiary groups, which generate a multitude of environmental concerns (illustrated in Box 1.2). The diversity of user groups accounts in part for the variety of sectorial activities impacting the ecosystem.

- Third, the international waters area includes numerous international conventions, treaties and agreements. The structure of marine agreements is especially complex, and a large number of bilateral and multilateral agreements exist for transboundary freshwater basins.
- Fourth, the transboundary nature of international waterbodies and their related ecosystems requires that governments of riparian ecosystems find common objectives and institute compatible policies and programs.

The nature of IW, as described above, complicates project-specific M&E plans and waterbody or ecosystem-based M&E strategies. Criteria for choosing appropriate indicators for monitoring vary according to the type of waterbody, ecosystem and project. Monitoring coverage often needs to be extensive both in terms of space and user activities. The diverse sectors that impact transboundary ecosystems demand that M&E assess in a coordinated fashion the various user activities and their interactions with the environment. Also, institutional arrangements for M&E need to include intergovernmental or regional coordination to address transboundary management problems.

M&E and the Global Environmental Agenda

As part of the global environmental agenda, the GEF supports innovative and pioneering initiatives in environmental management of the global commons. The Bank's IW projects funded by the GEF address some of the priorities under the global environmental agenda. Progress in moving these priorities forward needs to be carefully monitored. Lessons learned must be communicated to allow on-going modification of project design and implementation arrangements, and outcomes must be evaluated for their impact or potential impact on the global environment. As a GEF implementing agency, this is essential to the Bank for at least four reasons.

Box 1.2 Global Environmental Concerns Relating to International Waters

As defined by the GEF Operational Strategy for international waters adopted by the GEF Council in October 1995, the main environmental concerns for GEF international waters projects include:

Degradation of the quality of transboundary water resources caused mainly by pollution from land-based activities (toxic chemicals, nutrients, pathogens, oxygen-demanding wastes, sediment, and debris).

Physical habitat degradation of coastal and near-shore marine areas, lakes, and watercourses (for example, wetlands, mangroves, estuaries, coral reefs) as a result of unmanaged use (for example, land conversion, dredging, coastal construction, irrigation).

Introductions of nonindigenous species that disrupt aquatic ecosystems and causes toxic and human health effects (for example, introduction of toxic dinoflagellates through untreated ballast water discharges from ships).

Excessive exploitation of living and nonliving resources due to inadequate management and control measures (for example, overfishing, excessive water withdrawal).

(Source: Global Environment Facility, *Operational Strategy* (Washington, D.C., February 1996) p.47.)

- With help from the GEF, the international community has provided resources for national resource managers to take local action to advance global conservation and sustainable development objectives. Project-specific M&E plans and ecosystem-based M&E strategies help ensure that resources are spent effectively.

- Wider application of viable approaches is essential for achieving the most out of scarce conservation funds. Effective M&E is the way lessons are learned, the first step in identifying best practices and enabling replication elsewhere.

- The use of GEF resources raises special requirements for public information, transparency and stakeholder consultation, as well as the dissemination of lessons for replication.

- Strong M&E plans and programs help GEF projects influence changes in attitude about the global environment — whether in legislation, policies or practices.

[1] M&E indicators are organized on an ecosystem basis because the GEF operational strategy for international waters emphasizes "*ecosystem-based* approaches to managing international waters" (emphasis added). Although each annex surveys a specific IW ecosystem, it should be noted that projects often address several different ecosystems or portions thereof. For example, projects aimed at the comprehensive management of the international waters of small island developing states will likely include elements of coastal zone and large marine ecosystems and freshwater basin ecosystems. The GEF Operational Strategy for international waters (Global Environment Facility, *Operational Strategy* (Washington, D.C., February 1996) chap. 4) should be consulted for programmatic priorities and selection criteria established by the GEF for specific IW projects.

[2] *See* World Bank Operational Directive 10.70 ("Project Monitoring and Evaluation"). *See also* World Bank Operational Directive 13.05 ("Project Supervision"). *See generally* World Bank, "An Overview of Monitoring and Evaluation in the World Bank," OED Report No. 13247 (Washington, D.C., 1994).

[3] Global Environment Facility, *Operational Strategy* (Washington, D.C., February 1996).

[4] Global Environment Facility, "General Requirements for a Coordinated GEF-Wide Monitoring and Evaluation System," Document GEF/C.4/6 (document presented at GEF Council meeting, Washington, D.C., May 3-5, 1995).

[5] *See* World Bank, "Greenhouse Gas Abatement Investment Project Monitoring and Evaluation," Environment Department Paper No. 8 (Washington, D.C., June 1994); World Bank, "Guidelines for Monitoring and Evaluation of GEF Biodiversity Projects," Environment Department Paper No. 29 (Washington, D.C., December 1992); and World Bank, "Monitoring and Evaluation Guidelines for ODS Phaseout Projects," Environment Department Paper (Washington, D.C., October 1995) (forthcoming).

[6] Organization for Economic Cooperation and Development (OECD), *Environmental Indicators*. Paris: OECD, 1994.

2 Performance and Process Indicators

This section of the guidelines addresses the technical aspects of selecting performance and process indicators for project-specific M&E plans or ecosystem-based M&E strategies. A framework and typology for environmental performance indicators, defined in the broader context of performance and process indicators, is given along with criteria for selection. Guidelines for socio-economic impact indicators, which must also be included, are briefly reviewed in their IW context as a supplement to their more extensive treatment in other Bank directives and best practice guidelines. Selection of process indicators relevant to IW projects is covered, and the section concludes with examples of some typical performance indicator configurations for IW projects.

Definitions

Initial Assessment.[7] During project identification/preparation, an *initial assessment* (see Section IV) is undertaken to compile an inventory of existing information upon which baseline[8] conditions are determined and against which future changes — and project impacts — will be evaluated. The inventory of existing information includes (i) the environmental and socio-economic conditions in the project area and geographic equivalent of the defining ecosystem, (ii) the legal, policy, and regulatory framework governing the management of water and related resources, (iii) institutional responsibilities, organizational arrangements and existing resources available for environmental management, and (iv) gaps in the information base and institutional arrangements.

Performance Indicators. A project's M&E plan incorporates indicators based on project objectives, since the achievement of objectives is the measure of performance. In these guidelines, such indicators are referred to as *project performance indicators* (PPIs). The objectives of projects targeted at the environment aim to either curtail environmental degradation or improve environmental quality. Thus, *environmental performance indicators* (EPIs) measure the project's specific contribution to the solution of specific environmental problems. EPIs are also used at higher levels of aggregation in broader ecosystem-wide monitoring strategies. To facilitate aggregation among different projects, the selection of EPIs at the project level should conform to definitions used at the broader ecosystem level.

An additional objective of GEF-funded projects is to make stakeholders and beneficiaries of environmental resources better off. Socio-economic impact assessments of the project require another set of indicators, *socio-economic indicators* (SEIs). Again, these indicators may be aggregated over groups of projects or activities to provide measures of change in social and economic impacts at the level of the ecosystem. In all projects, the SEIs should be as integral to M&E plans or ecosystem-based M&E strategies as EPIs.

Process Indicators. In addition to monitoring performance vis-à-vis project objectives, M&E plans also involve monitoring progress in project activities designed to accomplish the stated project objectives. The progress of activities involving procurement and production (inputs and outputs) of goods, physical structures and services (as described in the Bank's Operational Directive on Project Monitoring and Evaluation[9]) are measured by *process indicators*. Capacity building, human resource development, and stakeholder involvement are increasingly recognized as important to achieving sustainable project outcomes. Thus these activities also require their own process indicators.

All of these activities are managed according to adopted implementation schedules and targets, and indicators need to be developed to help measure progress toward targets. These guidelines limit themselves to highlighting processing steps and process indicators that are of particular relevance to the M&E plan for GEF international waters projects.

Selecting Environmental Performance Indicators[10]

Environmental problems are diverse, the variability of their settings considerable, and the possible solutions to the problems many. Hence, there can be no standard list of EPIs. In formulating an IW project's M&E plan or ecosystem-based M&E strategy, the selection of EPIs is determined largely by the objectives for environmental management, the nature of the proposed interventions or activities, the feasibility and cost of collecting various types of information and data, and the institutional capability for incorporating them into analysis and decision making. Most importantly, indicators must be practical and realistic, given the many constraints that face those who implement and monitor projects or those who monitor environmental performance at the ecosystem, sectoral, or national levels.

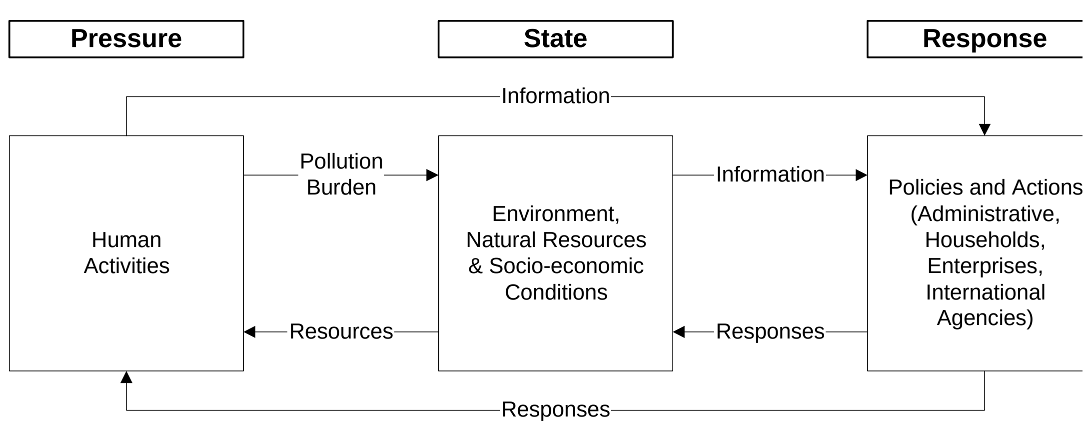
Indicators that measure project impacts quantitatively — as opposed to indicators that simply identify direction of change in environmental performance — are particularly useful. Since quantitative results are often more specific than qualitative ones, they can be more persuasive in establishing the benefits achieved against costs.

The selection of EPIs is always project-specific, but the pressure-state-response framework developed by OECD is helpful as a unifying typology for EPIs (see figure 2.1). This framework is structured by three main questions: What is happening to the state of the environment or natural resources? Why is it happening? What are we doing about it? The first question is answered by indicators that measure the area's ecological state (*state indicators*). Indicators of stresses or pressures from human activities that cause environmental change (*pressure indicators*) answer the question why, and measures of policies and actions adopted in response to environmental problems (*response indicators*) answer the question of what we are doing.

Pressure Indicators

Pressure indicators measure the underlying forces driving environmental degradation. In the case of international waters, these forces may include pollution discharge, fishing effort, sedimentation, pumping rate of groundwater, or rate of extraction of surface water. These

Figure 2.1: Pressure-State-Response Conceptual Framework for Indicators[11]



(Source: Adapted from Adriaanse, op cit.)

pressures may indicate an existing problem or be the result of a new activity such as loss of mangrove forest from port development or toxic waste effluents from a new manufacturing plant.

From a project-specific viewpoint, monitoring of pressure indicators measures reductions in pressure achieved by the project. In an ecosystem-based M&E strategy context, monitoring of pressure indicators measures changes in pressures stemming from all activities generating stress on the ecosystem, including those emanating from individual projects. In some cases, considerable time lags may occur between reduction in pressure and environmental improvements. For example, reduced fishing effort will eventually allow fish stocks to recover, but the pace of change is also determined by population dynamics of the stocks. In some cases, improvement in the state can be long after the pressure was reduced, even beyond the life of the project.

After the specific pressures have been discovered during an initial assessment and the specific activities have been identified, the most effective measurements of pressure reduction (pressure indicators) are chosen. The pressure indicators should measure changes in pressure from baseline values towards target values. Baseline values are established in the initial assessment and the target values are part of the process of setting objectives for the individual project or the ecosystem-wide M&E strategy. See examples of pressure indicators (and state and response indicators) used in IW projects in Figure 2.2 and in the annexes.

State Indicators

State indicators measure the quality or "state" of the environment of the targeted ecosystem, particularly as it is affected by human activities. For example, ambient pollution levels of air and water are state variables commonly used in analyzing pollution (such as measuring water pollution by testing biological oxygen demand loads). Levels and composition of fish stocks (stock assessment) are frequently used as indicators of the biological health of fishery resources within a water ecosystem. The state of other natural resources that form part of the ecosystem concerned may involve forest cover, soil depth and fertility.

Figure 2.2: Examples of Environmental Performance Indicators Relevant to IW Projects[12]

Issue	Pressure	State	Response
Eutrophication	(N, P water, soil) emissions	(N, P, BOD) concentrations	Treatment connection; investments/costs
Toxic Contamination	(POC, heavy metals) emissions	(POC, heavy metals) concentrations	Recovery of hazardous waste; invests./costs
Freshwater Resources	Demand/use intensity (resid./indus./agricult.)	Demand/supply ration; quality	Expenditures; water pri savings policy
Forest Resources	Use intensity	Area of degraded forest; use/sustain grow ratio	Protected area forest, sustainable logging
Fish Resources	Fish effort	Sustainable stocks	Quotas
Oceans/Coastal Zones	Emissions; oil spills; depositions	Water quality	Coastal zone mgmt; oce protection

(Source: Hammond, et al., op cit., p.13)

State indicators help to determine the need for action to reduce pressure as well as how to measure the effectiveness of that action. When a project aims to reduce discharges of pollutants, a state indicator, such as ambient water pollution levels, would measure the success of the project in improving water quality. In most cases, individual projects control only some of the pressures on water quality and can therefore not be held solely responsible for the improvement in water quality. Thus it is important to adopt pressure indicators that demonstrate specific pressure reductions resulting directly from the project.

IW projects often focus on managing transboundary waters and their related terrestrial resources. Inter-governmental or regional collaboration is required to effectively address these management problems, and this collaboration depends on a common understanding of the environment or ecosystem's state and pressures. This collaboration often develops over time while state indicators are in development. Regional strategies for monitoring water quality or fisheries management take time to establish, test and be accepted by all parties as a joint management tool. For this reason, most IW projects include the development of regional monitoring strategies as part of project activities.

Finally, state indicators must be "calibrated" to the appropriate level of measurement. The rationale for alleviating environmental degradation is to increase environmental and economic benefits and reduce costs. The closer the indicators are to the point at which these benefits and costs are generated, the easier it is to quantify ecological and economic returns to the project. For example, with overharvesting of fishery resources, state indicators of sustainable levels of yield from a fishery are more pertinent to evaluating economic gains and ecological sustainability than the size of the total fish biomass.

Response Indicators

Response indicators measure efforts taken to improve a specific environment or mitigate its degradation. At the macro or sector level, they measure the success of implemented policies and actions. For example, they track the progress of treaty agreements (including regional cooperation agreements), budget commitments, research, regulatory compliance, changes in the incentive framework or voluntary modifications in resource use or management practices (including investments by stakeholders).

Bank projects typically involve one or more of these responses, so projects can affect the state of an environment either directly — for example, by influencing fisherfolk to increase the minimum mesh size of nets — or indirectly by removing the pressure another way — by providing alternative income sources for fisherfolk who otherwise would overharvest fishery resources. IW projects also improve the potential response to an environmental problem by increasing the capacity of local, regional, or national entities to enforce environmental laws or to manage environmental information systems, including M&E and ecosystem modeling systems. Monitoring of project outputs in terms of physical structures, services, institutional capacity building, and human resources development through the project's output indicators is therefore tantamount to monitoring the delivery of the project's response (i.e., the project's process indicators constitute its response indicators).

Socio-economic Indicators

M&E plans and strategies need to reflect the fact that humans interact with the physical environment. These interactions can be quite complex. On the one hand, people affect the state of the environment through the ways in which they use environmental resources as sources or sinks. The essential elements of such human activities should be captured through environmental pressure indicators, with the impacts being expressed through changes in the environmental state variables, as discussed above. On the other hand, changes in the state of the environment affect people's behavior by translating changes in the physical environment into impacts on human health, safety and welfare, the subsistence base of local communities and indigenous peoples, economic well-being, educational opportunities, social values and self esteem.

Box 2.1: Bank Operational Policies and Guidance Documents Relevant to Socio-economic Project Performance

The following Bank operational policies, procedures and guidance address issues relevant to social assessment of GEF international waters projects. These sources should be consulted when selecting socio-economic indicators for project monitoring and evaluation.

Bank Operational Policies and Procedures[13]

- *Environmental Assessment* (OD 4.01, to be issued as OP/BP/GP 4.01)
- *Environmental Action Plans* (OP/BP/GP 4.02)
- *Natural Habitats* (OP/BP/GP 4.04)
- *Environmental Policy for Dam and Reservoir Projects* (OD 4.00 Annexes B-B4, to be issued as OP/BP/GP 4.05)
- *Water Resources Management* (OP 4.07)
- *Indigenous Peoples* (OD 4.20, to be issued as OP/BP/GP 4.10)
- *Involuntary Resettlement* (OD 4.30, to be issued as OP/BP/GP 4.12)
- *Poverty Reduction* (OD 4.15, to be issued as OP/BP/GP 4.15)
- *Forestry* (OP/GP 4.36)
- *Projects on International Waterways* (OP/BP/GP 7.50)
- *Procedures for Investment Operations under the Global Environment Facility* (OD 9.01, to be issued as OP/BP 10.20)
- *Management of Cultural Heritage in Bank-financed Projects* (Operational Policy Note 11.03, to be issued as OP/BP/GP 4.11 under the title *Cultural Property*)
- *Involving Nongovernmental Organizations in Bank-supported Activities* (OD 14.70, to be issued as OP/BP/GP 14.70)

Operational Guidance

- *Using Social Assessment to Support Public Involvement in World Bank-GEF Projects* (Global Environment Division Working Paper, July 1996)
- *Methods and Tools for Social Assessment and Participation* (Environment Department Paper, forthcoming)
- *Social Assessment* (Environment Department Dissemination Note, September 1995)
- *World Bank Participation Handbook* (Environment Department Paper, June 1995)

Traditionally, impact assessments have focused on societal impacts on the environment and have tended to ignore environmental conditions which impact people. In Bank operations, this imbalance has been redressed through Bank policy initiatives, new operational directives, and development of "best practice" guidelines (see Box 2.1). Task managers are advised to consult these sources when developing M&E plans for IW projects or formulating ecosystem-wide M&E strategies.

IW Projects and Process Indicators

While performance indicators are concerned with project impact, process indicators monitor the progress of project “outputs” — one measure of whether project objectives are on schedule. Key project processing steps and process indicators are developed for individual project components. For IW projects there are three main components:

- *Direct enhancement or abatement* components address environmental degradation *directly*. Examples include construction of waste treatment facilities or reforestation of a watershed.
- *Environmental management capacity building* components *indirectly* limit degradation or rehabilitate degraded assets by enhancing local or national environmental management capacity. Examples include promot-

ing community involvement in management of water resources or such related assets as wetlands or fisheries, establishing environmental information systems at local and national levels (including the development and implementation of an M&E strategy), and strengthening the legal and regulatory frameworks for environmental management. Stakeholder participation in project design and implementation is a major tool for building sustainable environmental management capacity.

- *Project management* is the component designed to oversee, coordinate and monitor (through an M&E plan) the implementation of all project activities.

In IW projects that address transboundary resources (as in GEF-funded IW projects), all components, particularly project management, have a national and a regional dimension, since governments need to jointly manage such resources.

Task managers can identify key processing steps and indicators for activities in the main project components following practices common to most Bank projects. This is particularly true in direct remediation, where monitoring the procurement of inputs and the subsequent processing steps are well documented in Bank directives and are well known to task managers.

Three areas of IW project design and implementation merit special attention when identifying key processing steps and process indicators: Environmental management capacity building, project management at the national level (including project monitoring and evaluation), and institutional arrangements for regional coordination. Critical processing steps and examples of process indicators in these areas are summarized in Box 2.2. Sections 3 and 4, which discuss institutional arrangements for M&E and their relationship to the project cycle, provide additional guidance.

Box 2.2: Key Processing Steps/Process Indicators for International Waters Projects

Environmental Management Capacity Building and Human Resource Development

- Ensure national level compliance with appropriate agreements, conventions and/or regulatory bodies.
- Develop human resource/capacity building strategy.
- Formulate and implement a stakeholder participation strategy, involving local, national, regional and international stakeholders.
- Develop a regional M&E strategy for the waterbody and its associated natural resources, including selection of environmental and socio-economic performance indicators:
    - Establish a high-level regional interministerial steering committee
    - Assess existing environmental, social, and economic conditions to establish baseline conditions, then select performance indicators (merging national assessments into regional M&E strategy)
    - Ensure that national M&E plans reflect regional objectives and monitor progress, then revise regional strategy as appropriate
    - By project completion, formulate an M&E strategy for sustained activities at national and regional levels.
- Secure agreement/protocol/convention on joint management and sustainable financing for project institutions.

Project Management

- Establish national project management units and train PMU staff.
- Create a high-level regional coordinating body (regional steering committee with small technical secretariat).
- Adopt and implement national M&E plans that respond to regional objectives.

IW Ecosystems and Choice of Indicators

Some indicators and M&E approaches cut across most IW projects, but each IW project needs project-specific M&E indicators for the particular ecosystems being addressed. Three groupings of IW project ecosystems are briefly outlined below,[15] with examples of key environmental indicators — comprising pressure, state and response indicators. Technical annexes are provided to further assist task managers in selecting performance indicators for different ecosystems addressed by IW projects.

Coastal Zone and Large Marine Ecosystems

Coastal zone ecosystems (CZEs) typically require efforts to improve the long-term viability of estuaries and to protect valuable coastal resources from the increasing pressures of development. Projects need comprehensive approaches to habitat protection, pollution abatement and reduction of fishing pressure. For small island developing states (SIDS), the integration of freshwater basin management with coastal zone management is critical.

Examples of environmental indicators:

- *Pressure*: Levels of non-point sources of pollution
- *State*: Leveling or reduction in impervious surface area; reduction in flash flooding from stormwater events; reduced sedimentation and water turbidity in near-shore waters
- *Response*: Establishing integrated land-use plan for soil stabilization

Large marine ecosystems (LMEs) are extensive areas of near-coastal oceans characterized by distinct currents, underwater topography and biological communities. Managing these LMEs typically involves reducing fishing pressure and abating pollution discharges.

Examples of environmental indicators:

- *Pressure*: Levels of nutrient loading in coastal waters of the LME as measured by satellite or coastal water sampling
- *State*: Population and diversity levels of identified fish stocks
- *Response*: Implementation of heightened standards of municipal wastewater treatment

Freshwater Basin Ecosystems

Freshwater basin ecosystems typically require joint management of shared drainage basins for conservation, sustainable use, and development. Common issues are abating pollution, providing sufficient instream flows to support habitat and species, and ensuring equitable sharing of water for sectoral uses. Lake and reservoir basins are particularly vulnerable to unsound sectoral development policies and projects and so demand priority attention. Interventions may include delineating point and non-point sources of nutrients and developing a nutrient budget to determine the magnitude of the various sources. Strategic interventions may include "end of the pipe" treatment for controlling point sources or "best management practices" for reducing contamination from non-point sources.

Examples of environmental indicators:

- *Pressure*: Industrial pollution inputs, such as levels of metals, organic contaminants, nutrients, thermal waste
- *State*: Improvement in trophic status of lake
- *Response*: Percentage change in industries with in-plant pretreatment prior to discharge to municipal systems

Transboundary Groundwater Ecosystems

Transboundary groundwater ecosystems typically require efforts to protect the quality and sustainable use of valuable underground water resources that are transboundary in nature. Promoting shared management of the resources among bordering states is essential.

Protecting recharge areas from toxic pollution and limiting withdrawals to sustainable yields are top priorities. Other issues include preventing saltwater intrusion and limiting subsidence.

Examples of environmental indicators:

- *Pressure*: Industrial and agricultural inputs to aquifer system
- *State*: Aquifer water quantity trends
- *Response*: Enforcement of land-use and water-use zoning specifications

[7] The "initial assessment" is undertaken at project identification, as discussed in Section IV, to assess baseline conditions of the targeted ecosystem, including environmental and socio-economic dimensions. The initial assessment should not necessarily be equated with the Bank's requirements for a formal project *environmental assessment* (see World Bank Operational Directive 4.01 ("Environmental Assessment"), which may or may not be conducted as part of the initial baseline assessment.

[8] The term "baseline" as used here should not be confused with its use under GEF incremental cost calculation where its refers to the environmental commitments that countries involved in IW projects should make from their own national interests (and be funded domestically or through conventional development assistance), and what activities are additional for solving transboundary priority problems and qualifying for GEF funding.

[9] World Bank Operational Directive 10.70 ("Project Monitoring and Evaluation").

[10] The typology of environmental indicators used in this paper is based on work developed in John Dixon, Arundhati Kunte and Stefano Pagiola, "Environmental Performance Indicators," World Bank Environment Department (Washington, D.C., February 1996). *See also* OECD, *Environmental Indicators*, Paris: OECD, 1994.

[11] Adapted from Adriaanse, A., *Environmental Policy Performance Indicators*. The Hague: Ministry of Housing, Physical Planning and the Environment, 1993, *cited in* John Dixon, Arundhati Kunte and Stefano Pagiola, "Environmental Performance Indicators," World Bank Environment Department (Washington, D.C., February 1996).

[12] Hammond, Allen, *et al*. *Environmental Indicators: A Systematic Approach to Measuring and Reporting on Environmental Policy Performance in the Context of Sustainable Development* (Washington, D.C.: World Resources Institute, May 1995) p. 13.

[13] Beginning in fiscal 1993, existing Bank Operational Directives (ODs) began to be converted into a new system of operational policies and Bank procedures. The new system consists of three categories: Operational Policies (OPs), Bank Procedures (BPs) and Good Practices (GPs). Where the policies listed have already been converted and reissued, the new citations are given. Where conversions are under way, the new citations are annotated as "to be issued."

[14] World Bank, "Using Social Assessment to Support Public Involvement in World Bank-GEF Projects," Global Environment Division (Washington, D.C., July 1996).

[15] The GEF Operational Strategy for international waters (Global Environment Facility, *Operational Strategy* (Washington, D.C., February 1996) Chap. 4, Annex 4.1) identifies three different types of operational programs eligible for GEF financing — Waterbody-based Operational Program, Integrated Land and Water Multiple Focal Area Operational Program and Contaminant-based Operational Program — each reflecting particular ecosystem management characteristics.

3 Institutional Arrangements for Monitoring and Evaluation

The major objective of GEF international waters programs is to catalyze implementation of comprehensive, *ecosystem* approaches to managing international waters. To that end, the identification of process and performance indicators and the development of effective, long-term monitoring and evaluation of project objectives require a coordinated institutional framework. Effective management of transboundary water systems rests on coordinated national and regional institutional arrangements for M&E .

Such arrangements include assigning responsibilities for M&E activities to appropriate agencies and ensuring that the skills exist to monitor and evaluate projects according to adopted blueprints. While Bank task managers are well suited to address these issues through the approach of traditional project development, it is important to recognize that the diversity of resource use and stakeholder interests in GEF IW projects (as discussed in Section 1) complicate the task of developing effective M&E arrangements. A key consideration is the need to reach agreement among a wide range of public entities and stakeholders — local, national, and international — as to the terms by which project objectives are to be measured and progress judged.

In GEF-supported IW projects, where governments collaborate in implementing activities that address transboundary management problems, the assignment of institutional responsibilities and the development of M&E skills have both a national and a regional dimension. The governing principle is that M&E arrangements should follow the general structure of project management. In most cases, this means a regional project management entity or executing agency coordinates national M&E efforts just as it would coordinate other project activities across participating countries. In all cases, creating new regional M&E institutions should be avoided; rather, whenever feasible, regional targets and objectives should be built within existing national programs.

The following section summarizes the main guidance on institutional design of project M&E that is provided by the Bank's Operational Directive on M&E[16] and presents generally accepted design criteria. It discusses the challenges for M&E that flow from the particular characteristics of IW projects and their implications for coordination at the national and regional levels.

General Guidance from the Bank's Operational Directive

The main principles for assigning institutional responsibilities for project M&E, as set out in the Bank's Operational Directive on Project Monitoring and Evaluation, are as follows:

- Project monitoring is the responsibility of the country project management team (PMT). In complex projects several agencies may be involved, with one assuming overall coordination.
- The need for a separate M&E unit within the PMT is greatest when project implementing agencies have a weak history, or when the objectives (especially social and institutional) are complex, particularly in projects with multiple components. Such M&E units should be integrated into the

management structure of the implementing agency to best serve the information needs of the agency.

- Institutional responsibilities for evaluations of project performance differ depending on the nature of the evaluation. For example,
  - *Interim evaluations,* designed to review progress and to anticipate likely effects of the project, are carried out during the project implementation period by the PMT.
  - T*erminal evaluations* are carried out jointly at the end of the project by the government and the Bank, with both the government and the PMT having particular inputs.
  - *Impact evaluations*, measuring direct and indirect project impacts, are normally undertaken several years after final disbursement by national authorities independent from the PMT, and/or the Bank (Operations Evaluation Department).

While these guidelines are useful starting points for the design of institutional M&E components for GEF-funded IW projects, they need to be clarified and amplified in a number of areas. These areas include the need for global "accountability" required when using GEF resources, interagency coordination within national components for M&E, and regional coordination of national components.

M&E and Global Stakeholders

The international community, which has contributed collectively to the GEF, relies on monitoring and evaluation at national and local levels to measure progress toward global conservation goals. It is therefore incumbent on recipients of these resources to ensure that the greatest degree of objectivity, transparency and accuracy of reporting are reflected in the design of M&E plans for international waters projects and other GEF-funded initiatives.

The institutional arrangements to design and implement M&E plans and strategies for IW projects should therefore be based on the following four criteria:

- *Objectivity* – implying, for example, that evaluations will often require the participation of third parties to promote transparency and accountability;
- *Credibility* – building where possible on institutions, agencies, and individuals with a proven record in M&E, and strengthening them where required, rather than creating new untested institutions or agencies;

Box 3.1: Institutional Responsibilities for M&E -- Process and Performance Indicators

	Monitoring	**Evaluation**
Process Indicators	Q: What did the project do?	Q: Was project implemented efficiently?
	A: Delivery of outputs	A: Yes/No and Why?
(Responsibility)	(Project Management Team)	(Third Party)
Performance Indicators	Q: What impact did the project have?	Q: Was the correct intervention made? (Was the design correct?)
	A: Changes in the system (pressure/state)	A: Yes/No and Why?
(Responsibility)	(PMT/National Institutions)	(Bank Evaluation Team/GEF Council)

- *Capacity* – building M&E skills, where they are lacking, through appropriate investments (often as part of the project itself) in human resource development; and
- *Participation* – ensuring that local, national and, wherever possible, international stakeholders are involved in the design and the implementation of M&E plans and strategies.

Coordination within National M&E Components

While IW project management teams should be able to develop and implement the process element of project monitoring, they are not expected to design and implement the performance element of the M&E plan, that is, the monitoring of environmental and socio-economic impact indicators. IW projects are characterized by a diversity of beneficiary groups, stakeholders, and resource uses. Thus, responsibilities for the performance element of M&E are sectorally assigned and should involve stakeholders, and non-governmental organizations (NGOs). The central role of M&E in IW projects in most cases calls for a special M&E unit within the PMT, since the role of the PMT in IW project monitoring is primarily one of coordination. The special M&E unit ensures that, at the end of the project period, a long-term M&E strategy with its supporting institutional arrangements is in place.

Seeking the active involvement of stakeholders and NGOs in the design and implementation of the M&E process is crucial on several accounts. First, in establishing baseline conditions for the M&E plan, stakeholders need to participate not only to provide factual information, but also to be part of a process leading to performance indicator identification. This is important to match the expectations of how environmental or socio-economic improvements will be measured. Second, collection of field data has traditionally been done by ministry staff, including extension workers. Within the budgetary constraints of these agencies, water quality monitoring stations and fisheries production data collection activities, to take just two examples, have proven inadequate, ineffective, or unsustainable. In many cases, stakeholders with the help of local NGOs can contribute to the collection of field data, complementing at low-cost the monitoring activities best undertaken through government field programs. In addition, use of computer-based information systems and computer networking among stakeholders and government organizations can foster broad-based involvement in data collection and dissemination, which ultimately improves the scientific quality as well as the extent of public awareness of IW projects.

The performance monitoring of IW projects should also be done at the national level by the sectoral agencies responsible for such areas as water resources and pollution (effluent control), fisheries (management of fishing effort and production), wetlands (restoration), agriculture (land use), forestry (afforestation of watersheds), health (disease incidence control) and possibly others.[17] The role of the PMT is to coordinate the national efforts with the sectoral M&E programs and to ensure necessary modifications are made. Such modifications adjust the course toward fulfilling the project's M&E objectives. They may also provide compatibility with relevant M&E practices among the collaborating governments.[18]

The design and implementation capacity of many existing sectoral monitoring programs is weak and IW projects will frequently need to strengthen it. The PMT, working with the sectoral nodes of the M&E plan or strategy, should be responsible for procuring the equipment and support required for monitoring. Most importantly, it should implement the human resource development plan (individual training, workshops, study tours, etc.) to enhance M&E skills throughout the agencies involved.

Regional Coordination of National M&E Components

GEF-funded IW projects address the transboundary aspects of protecting international waterbodies and their related ecosystems. Transboundary solutions require coordination of national M&E plans under the umbrella of inter-governmental or regional cooperation to ensure sound environmental management. This coordination reinforces the sharing of M&E objectives and targets so that national M&E plans are synchronized and complementary — building gradually into a regional M&E strategy for IW protection — and ensures that methods for collecting, analyzing, and reporting data in the participating countries are compatible.

M&E coordination is part of the larger regional framework for collaboration established among the participating countries. Where such a framework does not exist, it must be established as part of the project development and implementation process. Where transboundary concerns for international waters protection are not adequately defined, the GEF operational strategy for IW requires that the countries involved prepare a Strategic Action Program to identify priority water-related joint management problems and the sectoral policy causes of these problems, and to plan a collective agenda for action (see Box 4.2).[19] This agenda should include the institutional arrangements for regional coordination of joint management, including M&E as a tool for such management. Since it may be difficult to foresee which areas will benefit from regional cooperation and which will not, establishing new, large formal structures (regional commissions, for example) should be avoided, especially in the early phases of project development. Rather, the agenda should focus on substantive issues, with the suitable structures for regional coordination following progress being made on those issues. Establishing new legal or formal structures before these lessons have been learned should be avoided.

To facilitate the creation of a collaborative framework for project management, including M&E, formation of a high level steering committee composed of representatives from the various country ministries with activities related to IW project can be helpful. The steering committee may then establish a small subcommittee or regional working group on M&E, involving representatives from national M&E units. This M&E working group can ensure that the national M&E units receive clearly defined objectives, are committed to undertaking the various project related M&E tasks (set out in national M&E plans) and will reliably report on progress.

[16] World Bank Operational Directive 10.70 (“Project Monitoring and Evaluation”).

[17] Decision making as well as data gathering and analysis are often fragmented among various institutional actors, with individual agencies focusing on discrete aspects of water use. Institutional arrangements thus need to be developed that encourage water-related agencies to coordinate their respective but related activities.

[18] The imperative for establishing coordinated national institutional arrangements for M&E is no different for GEF IW projects than for other multi-sectoral development initiatives. A great deal has been written elsewhere about creating institutional mechanisms which facilitate coordinated cross-sectoral actions. Recent Bank initiatives in the water sector may be particularly relevant (*see, e.g., Water Resources Management, A World Bank Policy Paper*, Washington, D.C.: World Bank, 1993).

[19] The preparation of a Strategic Action Program can form part of project preparation and thus be eligible for funding through the GEF Project Development and Preparation Facility (PDF), or constitute the principal or an important activity of project implementation. Guidance on GEF PDF procedures is set out in Global Environment Facility document GEF/C.3/6, which was presented at the GEF Council meeting in February 1994.

4 Monitoring and Evaluation and the Project Cycle

In addition to project M&E plans, IW projects frequently need to design, test, and launch a comprehensive M&E strategy to support the long-term management of the entire waterbody or ecosystem in which project activities take place. This follows since IW projects typically are limited either in geographic area (the project area often being more limited than that of the entire waterbody or ecosystem), in activity (project activities constitute a subset of all activities affecting ecosystem health) and project lifetime (typically 5-7 years).

As a result, the project's M&E plan and the broader and longer-term M&E strategy have common elements: the selection of relevant M&E indicators, the design of a suitable management information system, the designation of institutional arrangements, the identification and funding arrangements, and the establishment of an implementation schedule (Fig. 4.1). And the performance monitoring (environmental and socio-economic) part of the project's M&E plan becomes a sub-component of the broader ecosystem M&E strategy.

A framework for the selection of performance indicators was presented in Section 2, with illustrative examples of IW project applications provided by the annexes. Key aspects of designing the institutional framework for IW project M&E were discussed in Section 3. The remaining aspects of M&E have not been addressed in these guidelines, since they are either covered by standard task management practice (costs and funding) or are too technical and diverse in nature for the present purposes (such as the design of management information systems for specific IW project types).

The preparation and implementation of M&E plans and strategies follow the GEF project cycle. This cycle is essentially the same as that for typical Bank operations since the Bank's GEF projects have been "mainstreamed" into normal Bank procedures. GEF projects simply involve two additional processing steps. The first involves GEF Council approval of the project into its work program (typically done between Bank pre-appraisal and appraisal) and the endorsement by the GEF Chief Executive Officer, based on Council review, of the proposed grant before negotiations with the recipient government.

Key M&E Steps in the Project Cycle

The development, implementation, and evaluation of the project's M&E plan and the broader M&E strategy involve the following thirteen steps, originating with the project identification stage and concluding with terminal evaluation at the time of project completion.[20]

Identification/Preparation

During identification/preparation, task managers advising and working with country project preparation teams should consider the following M&E related tasks:

Step 1: As the first part of the *initial assessment*, compile an inventory of existing information covering:

Box 4. 1: Basic Elements of an M&E Plan or Strategy

A. *Formulate clearly defined project objectives*

B. *Selection of M&E Indicators at appropriate spatial and temporal scales* according to objectives

Process Indicators:
- Procurement and delivery of structures goods, services
- Capacity building
- Human resource development
- Stakeholder involvement in implementation

Performance Indicators:
- Environmental performance indicators
- Socio-economic performance indicators

C. *Design of Management Information system*

- Data collection (methods, geographical coverage, frequency)
- Analysis
- Information transmittal
- Diagnostic studies, including beneficiary assessments
- Technology and equipment

D. *Institutional Responsibilities and Organizational Arrangements*

- Designation of monitoring and evaluation agency(s)
- Management, technical skills, and labor requirements
- Human resource development
- Coordination at national and regional levels

E. *Costs and Funding*

- Expenditures to meet above arrangements
- Funding by source

F. *Implementation Schedule*

- environmental and socio-economic conditions in the project area (or geographical equivalent of ecosystem) gathering relevant data on water resource availability, use and quality, land use practices, biological resources and socio-political and socio-economic conditions;
- the legal, policy, and regulatory framework governing the management of water and related resources, including international conventions and agreements relevant to the management of these resources;
- institutional responsibilities, organizational arrangements, and existing resources available for environmental management, including monitoring and evaluation; mechanisms in place for regional collaboration on the management of transboundary resources; and
- gaps in the information base and arrangements (involving government agencies, NGOs and communities) to ensure that the data required for determining baseline conditions are collected. (Where baseline data are sparse, the first year of project should establish benchmarks.)

Step 2: As the second part of the initial assessment *determine baseline conditions* for the project area (or geographical area equivalent to ecosystem) — against which future changes will be compared — covering:[21]

- quantification or estimation of the extent, distribution, and condition (degree of degradation) of water resources and associated land, including vegetative and other biological resources associated with the waterbody concerned;
- the economic well-being (household income levels), nutritional status, human health (disease patterns and incidence) and degree of access to social and educational infrastructure of the people and the communities that depend on or are impacted by the water and related land and biological resources in the project area (using Rapid Rural Appraisal or Participatory Rural Appraisal techniques);
- the institutional and human resources capacity for M&E (technical skills of local staff, equipment availability, service and maintenance, management); and
- the financial resources allocated to M&E.

Step 3: *Clarify the questions to be answered by M&E* on the basis of a clear understanding of the environmental issues and associated project objectives, taking into account:

- the availability of human and financial resources, and recognizing that
- the initial assessment (and identification of indicators) can permit a refinement of the project-specific objectives and the precise outputs expected, and that
- participating countries must agree on the major environmental pressures identified as the central problems causing environmental degradation of the water system concerned.

Step 4: *Propose indicators for performance monitoring* (as discussed in Section 2 and Annexes). Based on the results of the initial assessment, the identification of environmental issues to be addressed by the proposed project, the clarification of questions to be answered by M&E, and the nature of the proposed interventions, two types of indicators should be selected:

- Environmental performance indicators. Preparation requires a group of technically skilled participants to agree on how reducing the levels of the identified pressure indicators is likely to affect the overall quality of the water system in question, and, as such, what environmental state indicators should be selected to measure that quality.[22]
- Socio-economic performance indicators. These indicators, which concern impacts on groups and communities exploiting resources or vulnerable to management measures (project actions), should be determined and agreed upon as part of the social assessment of the project.

Step 5: Propose indicators for monitoring project process (Section 2). Based on identification of project activities and outputs by component, their sequencing and the proposed project implementation schedule, identify suitable indicators for monitoring project process relative to targets for:

- procurement of project inputs and delivery of project outputs, including structures, goods, services;
- institutional capacity building, including human resource development; and
- stakeholder involvement, including use by beneficiaries of project outputs and participation of local communities in decisions on management measures and enforcement of protective measures (ideally against targets for what may be defined as "acceptable" community participation).

Step 6: *Design a management information system* to support monitoring and evaluation according to proposed indicators, covering the following items:

- Data collection, with particular attention to (i) data that need to be collected on a regular basis, including information collected directly from project participants, and (ii) methods (ranging from sampling schemes for water quality monitoring to community focus meetings or diagnostic studies to assess beneficiary use of, or reactions to, project outputs).
- Analytical methods for data evaluation.
- Information transmittal and dissemination, including sharing of information between countries. Data analysis and sharing of information among participants in all countries require quality assurance/ quality compliance programs and common information systems accessible to all parties.
- Technology and equipment. One of the primary problems in long-term monitoring programs is the maintenance of the equipment. Maintenance and calibration must be carried out on a regular basis to obtain dependable data from precise monitoring equipment.
- Regional coordination. Cooperating nations need to ensure that data collection analysis and storage methods are comparable among cooperating organizations.

Step 7: *Propose institutional responsibilities and organizational arrangements for M&E* (Section 3) covering:

- designation of in-country responsibilities for M&E, including coordination among regional, national and sub-national agencies involved;
- management, technical skills, and labor requirements;
- human resource development needs (to be met through technical assistance, training, etc.), based on capacity of local staff and institutions to monitor identified indicators and implement the M&E plan and strategy;
- mechanisms for coordination at regional levels; and
- mechanisms for stakeholder participation.

Step 8: *Estimate the costs of implementing the M&E plan* (or strategy) and identify funding arrangements, covering:

- costs of monitoring and evaluation, e.g., laboratory, equipment (including regular maintenance, replacement and calibration costs) and for training in their use; and costs of labor and institutional support of all of the above, including a demonstration of the cost-effectiveness of implementing the M&E requirements; and
- projected annual expenditures for M&E, budgetary requirements and funding sources.

Step 9: *Prepare a time-bound implementation schedule* with assigned responsibilities for the implementation of the above activities, taking into consideration *inter alia* that:

- elements (and in especially complicated cases, the whole of the design) of the management information system that support M&E may be undertaken as part of project implementation (in which detailed terms of reference would need to be agreed upon during project preparation);
- schedules for implementing national M&E activities need to be coordinated within the participating countries;
- the schedule should build in specific provisions for an interim (mid-term) evaluation of the effectiveness (technical, institutional, financial) of the M&E plan and the M&E strategy.

In supporting country teams in all of the above preparatory activities, task managers should be aware of the following opportunities and requirements raised from the GEF processing side:

- funding for the design of M&E plans and strategies is available through the GEF Project Development and Preparation Facility (PDF);[23]

- to encourage early thinking about M&E modalities during project preparation, the GEF requires that task managers address M&E in the Project Information Document;
- Project Technical Reviews (involving an independent technical review panel, once at the stage of the IEPS and, in some cases, once before submission of documentation for Council review for inclusion in the work program) are asked to specifically comment on the adequacy of proposed project M&E plans and strategies or, at a minimum, review and expand upon M&E discussions that have been prepared up to that point.

Appraisal/Negotiations

During appraisal/negotiations task managers should address the following priorities with respect to M&E plans and strategies:

Step 10: Assess the adequacy of the proposed M&E plan and strategy applying the following criteria/considerations:

- responsiveness to project objectives
- technical feasibility
- institutional capacity and human resources needs
- stakeholder and NGO involvement in design and implementation
- adequacy of proposed mechanisms for regional coordination
- cost effectiveness
- budgetary commitments by participating country governments
- sustainability (development, testing of comprehensive long-term M&E strategy)

Step 11: Negotiate grant agreements with governments participating in the IW project, ensuring that the legal agreements address the following aspects of M&E arrangements:

- Grant agreements with each of the participating governments should reflect or refer to understandings between the governments on a common set of objectives, standards for monitoring and evaluation of environmental quality in the shared waterbody or water-related ecosystem. Such understandings could form part of a Strategic Action Program agreed to by the participating governments (see Box 4.2).

Implementation

Apart from supporting the implementation of the M&E plan and strategy, country agencies responsible for M&E and Bank task managers responsible for project supervision will need to address the following priorities:

Step 12: As monitoring data become available (per target dates set out in project documents), *undertake periodic evaluation of project performance* relative to its stated objectives. The GEF has a number of interdependent goals for these evaluations. To respond to the objectives of the GEF these evaluations should attempt to:

- determine if the objectives for addressing priority threats to international waters are being achieved by the project;
- evaluate any ancillary benefits achieved by the project; and
- assess the technical and/or institutional reasons why anticipated improvements were either met, missed, or exceeded.

Step 13: Assess and improve the relevance and effectiveness of the M&E system by:

- validating the relationships between performance indicators and objectives for IW protection;
- verifying the rapidity, quality and quantity of information transfer within the management information system (lack of transfer to relevant community groups and individuals, or the distortion of messages will lead to difficulties in applying management measures);
- reviewing the extent to which implementation of the M&E plan or strategy has facilitated project management or environmental management at the ecosystem level by feeding decision makers with timely information; and

Box 4.2: Key Elements of GEF International Waters Strategic Action Programs

The GEF Operational Strategy[1] for international waters envisions the adoption by participating countries of Strategic Action Programs (SAP) to better define transboundary water system concerns, additional needed actions and the incremental costs of such actions. The SAP process includes the following elements:

1. **Transboundary water-related environmental analysis.** The process for cooperatively preparing a Strategic Action Program among countries should start with an analysis of priority transboundary environmental problems. Which ones cause actual degradation? What sectoral activities cause the degradation and how serious is it? What are the information gaps, policy distortions, institutional deficiencies? UNEP often provides support in this element, while the UNDP assists with capacity-building needs, and the World Bank with identification of priority investments and policy reforms. Stakeholder analysis and public involvement are essential so that economic and social aspects can be included.

2. **Relationship to national environmental planning and economic development documents**. National environmental documents and plans will provide valuable input in preparing this analysis as well as identifying priorities among environmental concerns. The analysis of the causes of degradation and the needs for capacity building should include examination of national economic development plans and sectoral economic policies (which establish reasonable actions for sustainable development).

3. **Establishment of clear priorities.** The SAP should establish clear priorities that are endorsed at the highest levels of government and widely disseminated. Priority transboundary concerns should be identified, as well as sectoral interventions (policy changes, program development, regulatory reform, capacity-building investments, and so on) needed to resolve the transboundary problems as well as regional and national institutional mechanisms for implementing elements of the SAP. Coordination of priorities with those identified under the climate change and biodiversity focal areas could be done during the SAP process. The SAP should provide for a balanced program of preventive and remedial actions, support both investment and capacity-building activities, and identify key activities in the following areas:

- Priority preventive and remedial actions.
- Cross-cutting issues and linkages to other focal areas.
- Institutional strengthening and capacity-building needs.
- Stakeholder involvement and public awareness activities.
- Program monitoring and evaluation.
- ·Institutional mechanisms for implementation.

4. **Establishment of a realistic baseline.** The cooperating countries and the GEF should agree on the baseline environmental commitments (which should be funded domestically or through donors or loans) and what activities are additional for solving the transboundary priority problems. It is important for activities included in the SAP to be realistically costed and consistent with projected availability of domestic and international funding.

- amending the M&E strategy accordingly, with the objective of finalizing a "tested" M&E strategy by project completion which will serve as the blueprint for long-term monitoring of the targeted water system.

Longer Term Considerations

Since GEF project stockholders are interested primarily in how projects improve environmental conditions over the long term, the objectives of the GEF M&E strategy go beyond the initial period of project operation. Indeed, given the inevitable lag in ecosystem responses to project interventions, it is critical to ensure the sustainability of M&E arrangements so that environmental improvements may be measured and assessed for a significant period beyond project completion. Ensuring the institutional capacity of participating governments to undertake long-term M&E is, therefore, critical. This places a premium on devising relatively simple and efficient M&E arrangements that can be reasonably sustained by project participants.

[20] As explained by the Bank's OD on Project Monitoring and Evaluation (OD 10.70), two approaches can be considered for designing the M&E plan: "(a) the blueprint approach in which detailed specifications are provided on what will be done and by whom; and (b) the process approach in which only the main objectives of monitoring are specified, leaving the detailed design to be undertaken by project managers during project start-up." It is assumed here that the first approach is followed.

[21] See, infra, footnote 7.

[22] In the GEF pilot phase, this work was often done by national working groups that invited the participation of a wider consortium of responsible government agencies, universities, research groups, and international scientific experts. This broader constituent involvement plays an important role in public education and may increase the potential for catalyzing other parallel activities.

[23] See footnote 19.

[24] Global Environment Facility, *Operational Strategy* (Washington, D.C., February 1996).

Illustrative Annexes: Introduction

The attached annexes provide examples of measurable indicators of project performance for the major water-related ecosystems addressed by GEF-funded projects. Performance indicators for ecosystem-based international waters projects are only in the early stages of elaboration; the examples provided in the annexes are therefore provided solely for illustrative purposes. As experience is gained, performance indicators will be further developed and the annexes made more prescriptive. The annexes survey coastal zone and large marine ecosystems (Annex A), freshwater basin ecosystems (Annex B) and transboundary groundwater ecosystems (Annex C). Each annex contains (i) a general description of the ecosystem and its associated environmental issues; (ii) elements of an initial assessment specific to the respective ecosystem, and (iii) examples of pertinent environmental indicators.

M&E indicators are organized on an ecosystem basis because the GEF operational strategy for international waters emphasizes "*ecosystem-based* approaches to managing international waters." Although each annex addresses a specific IW ecosystem, projects typically operate within a portion of one or more ecosystems. Very seldom do they address an entire ecosystem. For example, projects aimed at the comprehensive management of the international waters of small island developing states will likely include elements of large marine coastal zone and ecosystems and freshwater basin ecosystems. Thus, when selecting criteria for monitoring and evaluation, it is important to clearly define the ecosystem(s) in which a project is operating, to ensure that indicators regarding the pertinent ecosystem(s) are considered and to establish how links to other related ecosystems will be defined.

As described in the main text, pressures on the ecosystem(s) and the appropriate or actual responses to those pressures also can have a socio-economic origin. Indicators of socio-economic factors should therefore be included in project and ecosystem M&E.

Initial Assessment Indicators Common to Water-related Ecosystems

The initial assessment involves the preliminary collection and inventory of environmental and socio-economic data of the targeted ecosystem prior to project implementation to form the "baseline" or "business-as-usual" conditions of the system, including ecosystem health, against which the project objectives will be evaluated. The identification of appropriate performance indicators is directly supported by the initial assessment.

An initial assessment of water-related ecosystems may cover the following subjects:

- Description of the ecosystem, building on existing data as follows:
  - Physical data
  - Socio-economic data, population distribution and growth, economic structure, etc.

  - Sources of pollution, localization, composition, etc.
- Previous ecosystem area studies, including the manner in which a project integrates existing studies and how project objectives will augment previous work.
- Legislative and regulatory framework. What international treaties and conventions is each country a party to which have implications for joint management of the targeted ecosystem? What national legislative frameworks are in place? How are they related regionally?
- Institutional framework. What regional, national and sub-national agencies are responsible for (as applicable)
  - fisheries
  - industries
  - agriculture/irrigation, forestry
  - transport
  - infrastructure
- Previous development and ongoing activities influencing the water system by major sectoral activities.
- Nature of the problem. Identify the problem and its relationship to the ecosystem, including its links to other ecosystems and the crosscutting issues of other focal areas.

Annex A: Coastal Zone and Large Marine Ecosystems

Background

Coastal zone ecosystems (CZEs) and off shore marine systems referred to as "large marine ecosystems" (LMEs) are generally considered two distinct ecosystem management units. Yet, given the spatial continuum that links the coastal zone with offshore LMEs and the similarity of pressures which often impact the environmental conditions or states of both CZEs and LMEs, for purposes of this brief overview of illustrative indicators, the two systems are considered together.

Coastal Zone Ecosystems

Integrated management of coastal zone ecosystems seeks to monitor uses of and impacts upon coastal processes and resources and promote sustainability. The coastal zone is loosely defined as the corridor where terrestrial and marine factors interact in their influence on natural and human-altered systems. The general characteristics of the coastal zone have been defined as follows:

- The coastal zone is a dynamic area characterized by a wide variety of landforms and ecosystems
- It includes highly productive and biologically diverse ecosystems that offer nursery habitat for many marine species
- Coastal zone features, such as coral reefs, mangrove forests, and beach and dune systems serve as natural defenses against storms, flooding and erosion
- Coastal ecosystems may moderate the impacts of pollution originating from land (e.g., absorption of excess nutrient, sediment and waste)
- The coasts attract vast human settlements due to proximity to the ocean's living and nonliving resources, marine transportation and recreation;
- The seaward limit of the coastal zone can be the edge of the continental shelf, but for practical reasons, it is generally excepted as the 200-mile Exclusive Economic Zone, as well as a "feeding" section of the adjacent terrestrial area.
- Coastal zone areas of Small Island Developing States, being a small interacting zone between the marine and freshwater/ groundwater ecosystems are particularly vulnerable to degradation or pollution

Large Marine Ecosystems

Large marine ecosystems are regions of ocean space encompassing coastal areas from river basins and estuaries on or out to the seaward boundary of continental shelves and the seaward margins of coastal current systems. They are relatively large regions on the order of 200,000 km sq. or larger, characterized by distinct bathymetry, hydrography, productivity and trophically dependent populations. Several LMEs are semi-enclosed seas such as the Black Sea, the Mediterranean Sea and the Caribbean Sea. Where appropriate, LMEs are further subdivided into subsystems, or domains such as the Adriatic Sea as part of the

Mediterranean. The geographic boundaries of other LMEs are defined by the scope of the continental margins. Among these are the Northeast United States continental Shelf, the Greenland Sea and the Northwestern Australian Shelf. The seaward boundaries of these LMEs extend beyond the physical outer limits of the shelves to include all or a portion of the continental slopes. The limit of the seaward boundaries of the areas is defined by ocean currents, rather than relying simply on the limits of the 200-mile Exclusive Economic Zone (EEZ) or the fisheries zone. Among the ocean-current delimited LMEs are the Humboldt, Canary, Benguela and Kuroshio Currents.

The concept of LMEs first introduced by scientist 1984, is being used to organize and manage scientific research on natural processes occurring within marine ecosystems, to study how pollutants travel within these marine systems, to group investment projects that affect the waters in identifiable geographic areas, and to identify variations in the productivity of international waters.

In the pilot phase, the GEF included several projects to evaluate LMEs: the Gulf of Guinea, the South China Sea ecosystem, the Black Sea, and the Aral Sea Basin. The Wider Caribbean Initiative for Ship-Generated Wastes also follows many of the same research principals, as well as the Red Sea Coastal and Marine Resource Management Plan.

The ecosystem "health" of marine systems has gained wide interest. And as more attention focuses on the problems of oceans as the "global commons," the more scientific indicators are being defined. Several LME health indicators have been developed by focusing on changes in ecosystem structure and function. These indicators will be further developed for LMEs, with improvements in data quality allowing better understanding of the interactions among key LME system components. With this understanding, decision making becomes an interactive process that considers: (1) the boundary conditions of the ecosystem, (2) the structure and function of the ecosystem, (3) public opinion with regard to risk, and (4) risk assessments from the perspective of public trust institutions responsible for ensuring the sustainability of marine resources.

A core monitoring program can be made to accommodate the special characteristics of the ecosystem of interest, including systems with straddling fish stocks or highly migratory fish stocks. For example, spills of oil and other hazardous materials increasingly threaten the health of LMEs. At present, few countries bordering a LME have well-developed emergency response plans for their coastal areas, nor a unified plan for emergencies in the open waters of the LME. The LME program could provide the systematic framework for developing both domestic and international emergency plans through technical assistance and training, and an exchange of marine policy, management, and emergency response personnel.

Initial Assessment

To accomplish the initial assessment of a CZE or LME, it is important to clearly define:

- land-based activities for pollution and degradation of the coastal zone. Many coastal zones have models estimating pollutant loads, which can be useful for the initial assessment.
- sea-based sources of pollution. Approximately 20% of pollutants entering the sea and the coastal zone come from maritime transportation, offshore oil and gas activities and the international disposal of wastes and other matter at sea.

Key Environmental Indicators

The following key environmental indicators may be relevant to a management project for the coastal zone and/or LME:

Pressure Indicators

- Fishing pressure/resource exploitation:
  - trends in reported fish catch as a function of fishing effort
  - sources of overexploitation (e.g., mining, dynamiting, etc.)
  - trends in fish stock populations.
- Exploitation of other living marine resources
- Pollution inputs to coastal zone and/or to LMEs

- volumes of nutrient loading in coastal waters as measured by satellite or coastal water sampling
- volumes of land-based inorganic effluent measured by existing discharge standards and identified as contributing to declining ecosystem health
    - √ inventory of polluting industries
    - √ monitoring of point and non-point sources of pollution
- volumes of wastes entering the marine environment from
    - √ shipping (e.g., oil, noxious liquid substances, garbage)
    - √ offshore activities (e.g., oil, drilling mud, chemicals)
    - √ dredging
    - √ accidental spillage of oil and chemicals from shipping and offshore activities

- Human pressure
    - changes in land-use
    - urban expansion

State Indicators

- Assessment of broader ecosystem health, using agreed physical, chemical and biological indices
- Habitat destruction
    - coastal zone habitat loss, based on satellite data analysis
    - deterioration of coral reef, wetlands and mangrove forests within the coastal zone
- Monitoring changes in biodiversity composition, fish stock populations and LME ecosystem communities (e.g., trends or changes in long-term productivity and sustained economic yield of resources within the LME, recovery of depressed benthic communities of indicator organisms) to assess the impact of managing project-specific pressure elements.

Response Indicators

- Efforts at prevention and control of land-based sources of pollution:
    - selection of demonstration areas for mitigation actions
    - initiation of mitigation actions
    - feasibility assessment of waste management actions
    - development of effluent standards
    - initiation of incentive programs for pollution reduction
    - improvement in solid waste disposal capacity, including materials recycling
- Efforts at prevention and control of sea-based sources of pollution:
    - shipwastes collection of wastes by ports and terminals
        - √ oil (% improvement)
        - √ garbage (% improvement)
        - √ chemical residue/wash water (% improvement)
    - offshore mining - environmental performance
        - √ initiation of preventive/mitigative measures to prevent pollution from drilling mud and extraction enhancing chemical
        - √ operational performance of oil/water separation equipment and associated monitoring of effluents discharged to the sea
    - sea disposal of dredged material
        - √ permits issued for sea-disposal of dredged materials
        - √ compliance monitoring of sea-disposal sites
    - proportion of ports, terminals and offshore platforms with oil and chemical spill contingency plans in implementation. Frequency of spills per year?

- establishing/ensuring agencies to be responsible for availability of adequate waste reception facilities (agencies in place to ensure that MARPOL Annex II ships' wastes are discharged ashore under the supervision of a surveyor in accordance with IMO standards. Secure agency responsibility for enforcement action in connection with a ship's noncompliance with these standards.)

- Efforts at prevention and control of resource overexploitation:
  - establish fish catch quotas
  - reduce fishing activities during critical spawning or migratory periods
  - establish legal actions against overfishing
  - develop fisheries sustainability standards
  - initiate incentive programs for fishing effort reduction
  - implement a strategic plan for fisheries management
  - reduce overpumping of freshwater resources
- Efforts at prevention and control of habitat degradation:
  - inventory the protection of selected habitats
  - monitor sources of habitat degradation
  - assess feasibility of fisheries management options
  - develope of habitat sustainability standards
  - initiate of incentive programs for habitat improvement
  - implement a strategic plan for habitat management
  - reduce in overcutting of coastal forests, with a resulting decrease in sediment transport
  - level or reduce in impervious surface area; reduce in flash flooding from stormwater events; reduce sedimentation and water turbidity in near shore waters
- Establishment of strategic plans for land-use in coastal areas.
- Establishment of strategic plans including institutional capacity for effective implementation and public awareness.

Annex B: Freshwater Basin Ecosystems

Background

Preserving the quantity and quality of water resources has become a global issue. Scientists calculate that over the past 30 years, the actual freshwater available per capita has decreased by half in Africa, Asia, and South America. Surface water in rivers and lakes amounts to only 0.26% of total global freshwater resources. The freshwater stored as groundwater is estimated to be 30.1% of the total. The rest is mainly freshwater locked into ice caps and permanent snow cover in polar regions. Problems of water scarcity are exacerbated by the unequal distribution of water both between and within continents.

International freshwater problems are not restricted, however, to problems of water supply and scarcity. Increasingly they are precipitated by the degradation of water quality associated with changes in the collapse of ecosystems. This leads to impaired public health and the huge costs of restoring water quality. The global dimensions of freshwater pollution are difficult to estimate due to inadequate data in much of the world, however the problem can only be accentuated by a decrease in available resources. The data problem is particularly severe in developing countries where funding, infrastructure and technical capacity can be limited. In many international freshwater projects, overcoming the data problem will be one of the major challenges.

The United Nations GEMS/Water Program estimates that 30-40% of the world's lakes and reservoirs suffer from moderate to severe levels of eutrophication caused by organic pollution from, primarily, domestic wastes and agricultural runoff. While data are not precise to quantify change in global levels of eutrophication or available amounts, this type of pollution is decreasing in developed countries but is likely increasing in developing countries due to population growth and lack of sewage treatment. Contaminants are of particular concern because national data for organic contaminants in many rapidly industrializing countries are unavailable. Also insufficient are global statistics on numbers, levels or trends of contaminants (metals and synthetic organic micro-pollutants) in freshwater.

Water quality impairment is almost always the result of water being ignored as an economic factor in the decision process of economic development. As a result water quality is becoming one important limiting factor in sustainable development. For example, many countries have completely used up the water available so pollution management by discharge manipulation is no longer possible. Also, serious degradation of water quality has serious social and economic costs in both lost opportunity in diversion of development funds into remediation activities.

Lake and reservoir basins are particularly vulnerable to unsound sectoral development policies and projects, and they demand high priority. GEF projects addressing freshwater basins seek to establish mechanisms to jointly manage transboundary drainage basins in support of sustainable use, conservation and development. Pollution abatement, equitable and sustainable sharing of water for sectoral uses, pollution abatement and providing sufficient instream flows to support biodiversity are common goals.

Initial Assessment

The initial assessment of a freshwater ecosystem should be based on most of the data suggested within the introductory remarks. In assessing water quality and water quantity, it is particularly important to have background data on the sectoral use of water, agriculture/land use, industry, and domestic use.

- The amount of freshwater available within the ecosystem should be assessed from a hydrological cycle perspective.
- Baseline water quality data should be assessed in as broad a perspective as possible to secure a holistic perspective and include, as applicable, assessment of bacterial contamination, industrial pollution, nutrient pollution, eutrophication, agricultural pollution, ecosystem disfunction and fisheries degradation.

Socio-economic factors influencing the system and being influenced by changes in the system are particularly important.

Key Environmental Indicators

The following key environmental indicators may be relevant to freshwater basin projects:

Pressure Indicators

- Pollution from municipal sources
  - nutrient, metal, pathogen inputs from municipal sewage treatment plant
  - new sewage and infrastructure facilities
  - nutrient, metal, organic contaminant, pathogenic inputs from urban runoff
- Pollution from industrial sources
  - metals, organic contaminants, nutrients
  - thermal waste
- Eutrophication control
  - input loads of limiting nutrients (phosphorus, nitrogen) from point and non-point sources
  - input loads of sediment-associated phosphorus from agriculture
- Pollution from agriculture, forestry and other land uses
  - pesticide use in agriculture, forestry
  - erosion and/or sediment transport in rivers
  - runoff of pollutants from animal wastes
  - forestry lands undergoing logging
  - tonnage of hazardous wastes being handled and/or disposed
  - leaches from landfill and waste disposal sites
  - surface-water use for aquaculture
- Pollution from ship navigating in waters
  - discharges, including sewage, from ships
  - spills from vessels and harbor activities
  - use of anti-fouling compounds
- Pollution from dredging activities
  - tonnage of contaminated sediments disposed
- Pollution from onshore and offshore facilities
  - leaking underground storage tanks
  - spills from oil and gas wells, tank farms and refinery operations
  - spills from pipelines
- Hazardous and persistent polluting substances atmospheric deposition
  - stack emissions which do not conform with emission standards
  - atmospheric emissions of controlled gases (NOx, SOx, VOx)
- Contaminated groundwater
- Factors having a pressure effect on water quantity
  - population distribution and growth

- water demand for drinking water supply and sanitation
- water demand for agriculture including diversion for irrigation, yield for floodplain farming
- water demand for industry
- water demand for energy, including diversion for dams etc.

State Indicators

These indicators provide evidence of the stresses shown by the environment and society as a result of the pressuresdescribed above.

- Freshwater quality
  - trophic state of lakes
  - dissolved oxygen levels
  - chlorophyll-a, especially in lakes at critical times of the year
  - numbers and duration of algae blooms
  - levels of turbidity
  - filamentous algae in rivers, lakes and reservoirs
  - stream length that conforms to higher water quality classification objectives
  - body burden of toxic chemicals, especially in top predators
  - fish tumors, deformities, and reproductive failure
- Habitat restoration
  - Area of suitable habitat
  - area of "normal" benthic community
  - population of threatened species
  - change in ratio of undesirable to desirable fish species
  - appearance of migratory (especially anadromous) fish species
  - area of anoxic bottom sediments in lakes and reservoirs
- Socio-economic indicators
  - number of persons with access to safe potable water
  - water-related diseases linked to specific pollutants
  - taste and odor episodes in municipal water supplies
  - incidence of beach closures
  - tainting of fish flavor and other wildlife
  - epidemiological diseases as an effect of polluted water
  - health among the population, including fisherfolk
- Water quantity indicators
  - flood events and area of flood
  - drought events

Response Indicators

These indicators describe the extent to which activities, undertaken as part of the project, contribute to the reduction in environmental pressure.

- Influence from municipal sources:
  - % reduction in nutrients, metals, pathogens from municipal sewage treatment plants
  - % increase in new sewage and infrastructure facilities
  - % change in increased operating efficiency of sewage treatment facilities
  - % reduction in nutrients, metals, organic contaminants, pathogens from urban runoff
- Influence from industrial sources:
  - % reduction in metals, organic contaminants, nutrients
  - % reduction in inputs of thermal waste
  - % change in industries with in-plant pretreatment prior to discharge to municipal systems
- Eutrophication control:
  - % reduction in limiting nutrients (phosphorus, nitrogen) from point and non-point sources
  - % reduction in sediment-associated phosphorus from agriculture

- Influence from agriculture, forestry and other land uses:
  - % increase in water availability due to change in agriculture structure
  - % reduction in pesticide use in agriculture, forestry, and other land uses
  - % reduction in erosion and/or sediment transport in rivers
  - % area converted to lower intensity land use through alternative tillage
  - % change in marginal land removed from production
  - % reduction in runoff of pollutants from animal wastes, including those applied to frozen ground
  - % reduction in risk of spills etc. from onshore and offshore facilities
  - % of forestry lands with improved logging practices
  - % improvement in tonnage of hazardous wastes correctly handled or disposed
  - % reduction in leachates from landfill and waste disposal sites
- Influence from shipping activities:
  - % reduction in discharges, including sewage, from vessels
  - % increase in onshore waste handling facilities
  - % reduction in spills from vessels and harbor activities
  - % reduction in use of anti-fouling compounds such as TBT
- Influence from dredging activities:
  - % increase in tonnage of contaminated sediments correctly disposed
- Influence from onshore and offshore facilities:
  - See Annex A for further details
- Hazardous and persistent polluting substances -- number of substances banned or subject to limitations in production, use and disposal:
  - Atmospheric deposition
    - √ % change in stack emissions that conform with emission criteria
    - √ % reduction in atmospheric loadings of controlled gases (NOx, SOx, VOx)
  - Contaminated groundwater
    - √ See Annex C for further details
- Habitat restoration
  - Area of wetland or habitat restored, and as a percent of target
- Spill management and early warning
  - Decrease in number and duration of spill incidences
- Vector management
  - Number of programs implemented, success rate, schedule, etc.
- Proactive measures
  - Flood warnings
- Strategic plan for establishment of appropriate mechanisms and capacity
  - Institutional capacity for effective implementation and public awareness
  - Mechanisms for agreed water sharing

Annex C: Transboundary Groundwater Ecosystems

Background

Groundwater

Groundwater occurs in a variety of geological conditions and scales, from local perched water tables to multilayered aquifer systems spanning continents. Representing more than one-fifth of all freshwater on earth, groundwater is drawn mostly from annually recharged occurrences, such as springs, wells and boreholes. These sources furnish major population centers and dispersed rural communities with reliable sources of high quality raw water. Groundwater also plays a primary role in the natural environment as a component of the hydrological cycle. Flow regimes of most surface waters are regulated through interactions with groundwater. Soil moisture levels are regulated through exchanges with groundwater across unsaturated-saturated zone boundaries. The conservation of groundwater flow regimes is, therefore, essential to sustaining the diverse fauna and the natural and cultivated vegetation of many freshwater ecosystems.

Groundwater occurrences are ubiquitous—their greatest advantage as a globally distributed natural resource. However, occurrences are part of complex hydrogeological systems that cannot be directly observed, measured and analyzed in the same manner as surface water systems (where catchment boundaries are clearly defined and system outputs neatly integrated at a single discharge point). The obscurity of groundwater makes the precise definition of transboundary groundwater difficult. Moreover, groundwater characteristics make the adequate rehabilitation of aquifers beyond "admissible" levels generally infeasible, which only underscores the importance of *preventing* degradation.

Aquifer systems

Groundwater occurrences in aquifer systems are a function of recharge, transmission, storage and discharge characteristics in a specific geological framework. Groundwater flow is bound either by low permeability barriers or by constant flux boundaries (lateral connections to surface water bodies). Such boundaries are two-dimensional and are not static, and they may vary under seasonal, annual and pluri-annual influences—whether natural or human-induced. These characteristics of groundwater flow in aquifer systems explain why the usually simple and easily detectable limits of drainage basins are not found in aquifer systems. It follows that: (i) the common use of drainage basins as natural units to manage groundwater resources is not suitable and (ii) transboundary groundwater flow has to be considered using a specific approach and in accordance with relevant international treaties and conventions.

Most intermediate and local aquifer systems in national or state border regions can be considered transboundary waters, shared between at least two countries or states within countries. Regional aquifer systems may extend over several countries with flow recharge and discharge areas situated in different countries. The sustainable management of these transboundary waters, in terms of pollution control, rational exploitation and equitable resource allocation demands a joint approach at multilateral, bilateral or sub-regional levels.

Degradation of groundwater resources

The growing concern for groundwater is easily justified. Population increase and associated agricultural, industrial and urban development initially increased pollution and diversion of surface waters, and are now increasingly stressing ubiquitous groundwater resources. Aquifer systems are being contaminated directly through percolation of pesticides, industrial chemicals and untreated liquid municipal wastes and through solid waste disposal sites to the phreatic surface. Indirect contamination occurs through interaction with polluted surface waters. In arid and semi-arid regions, groundwater has always been crucial in sustaining livelihood. Population pressure and economic development in these areas are now rapidly depleting aquifers that have in the past secured the water-supply of many communities. Furthermore, reduced recharge due to large scale surface water diversions, urbanization and deforestation causes a severe depression of the potentiometric surface, which "dries out" entire ecosystems and affects large communities relying on shallow aquifer systems.

Initial Assessment

The initial assessment of a transboundary groundwater ecosystem should build on a variety of the parameters presented in the introductory remarks. The main part of the assessment must assess the following characteristics of the groundwater ecosystem:

- Groundwater resources depletion
- Groundwater quality degradation

Key Environment Indicators

The following key environmental indicators may be relevant to groundwater protection projects:

Pressure Indicators

- Groundwater depletion
  - aquifer susceptibility to falling water levels
  - indicators influencing vertical and lateral recharge and drawdown
  - indicators of saline intrusion due to overexploitation
  - aquifer susceptibility to subsidence
- Groundwater quality degradation due to
  - effluent discharge and surface water disposal sites
  - movement of pollutants from deep injection of liquid wastes
  - aquifer contamination from non-point sources
- Radioactive contamination
- Competition over groundwater resources

State Indicators

- Aquifer volume, pressure and discharge rate
- Salinity, chemical composition, including toxic organic solvents
- Flora and fauna composition, including existing microorganisms

Response Indicators

- Indicators of effectiveness of remedial action in terms of groundwater *processes* - flow, quality, aquifer status, etc. Does the remedial action fit the hydrogeological scheme? Is it effective? Is it measurable?

- in recharge zones:
  - √ direct (diffuse) recharge enhanced through watershed conservation
  - √ indirect recharge enhanced (maximized transmission losses - hydrography analysis)
  - √ artificial recharge (increased natural infiltration);
  - √ location of industrial and agricultural polluters (land use versus water use - zoning)
  - √ pollution prevention: (environmental audits)
- in transmission/storage zones:
  - √ aquifer "restoration" - storage increased, piezometric heads increased, de-watered aquifers become confined again
  - √ pollution control and aquifer protection (industrial zoning in non-sensitive areas)
- in discharge zones:
  - √ baseflow norms re-established
  - √ discharge zones re-established
  - √ spring water quality improved
- in coastal zones (e.g., small island developing states):
  - √ well interference (reduced interference for optimized benefits)
- abstraction points (effectiveness of aquifer protection schemes and artificial recharge):
  - √ appropriate size and geometry of aquifer protection zones (groundwater quality improvement in vicinity of point sources)
  - √ effective aquifer protection and borehole catchment
  - √ impact indicators minimized - use of re-circulation of leachate, treatment of effluents and leachates. To what level is treatment taken? Percentage of effluent treated (to determine overall coverage)

- Indicators of benefits of effective remedial action in the short and long-term, particularly biological and environmental beneficiaries. Environmental benefits of restoring or preserving the natural regime of aquifer quantity and quality (reforestation to enhance recharge and maintaining ecosystems through restoring natural aquifer regimes)
  - short term indicators:
    - √ environmental health improvement (reduced incidence of diseases related to environmental degradation, including poor access to safe water)
    - √ wetlands re-established (% coverage)
    - √ re-colonization of degraded habitats (% land re-colonized, conserved)
  - long term indicators of reversed degradation (and links to groundwater)
    - √ habitat conservation
    - √ sustained recharge
    - √ water quality maintenance
- Strategic plan for establishment of appropriate mechanisms and capacity
  - √ institutional capacity for effective implementation and public awareness
  - √ mechanisms for agreed water sharing

Bibliography

Adriaanse, A., *Environmental Policy Performance Indicators*. The Hague: Ministry of Housing, Physical Planning and the Environment, 1993, *cited in* Dixon, John, Arundhati Kunte and Stefano Pagiola, "Environmental Performance Indicators," World Bank Environment Department Note, Washington, D.C., February 1996.

Dixon, John, Arundhati Kunte and Stefano Pagiola, "Environmental Performance Indicators," World Bank Environment Department Note, Washington, D.C., February 1996.

Global Environment Facility, "General Requirements for a Coordinated GEF-Wide Monitoring and Evaluation System," Document GEF/C.4/6 (document presented at GEF Council meeting, Washington, D.C., May 3-5, 1995).

Global Environment Facility, *Operational Strategy*. Washington, D.C., February 1996.

Hammond, Allen, *et al.*, *Environmental Indicators: A Systematic Approach to Measuring and Reporting on Environmental Policy Performance in the context of Sustainable Development*. Washington, D.C.: World Resources Institute, May 1995.

Organization for Economic Cooperation and Development (OECD), *Environmental Indicators*. Paris: OECD, 1994.

World Bank, *An Overview of Monitoring and Evaluation in the World Bank*. OED Report No. 13247, Washington, D.C., 1994.

World Bank, "Good Practices for Social Assessment in World Bank-GEF Projects." Environment Department Paper (forthcoming).

World Bank, "Greenhouse Gas Abatement Investment Project Monitoring and Evaluation." Environment Department Paper, Washington, D.C., June 1994.

World Bank, "Guidelines for Monitoring and Evaluation of GEF Biodiversity Projects." Environment Department Paper, Washington, D.C., December 1992.

World Bank, "Monitoring and Evaluation Guidelines for ODS Phaseout Projects." Environment Department Paper, Washington, D.C., October 1995.

World Bank, *Water Resources Management, A World Bank Policy Paper*. Washington, D.C., 1993.