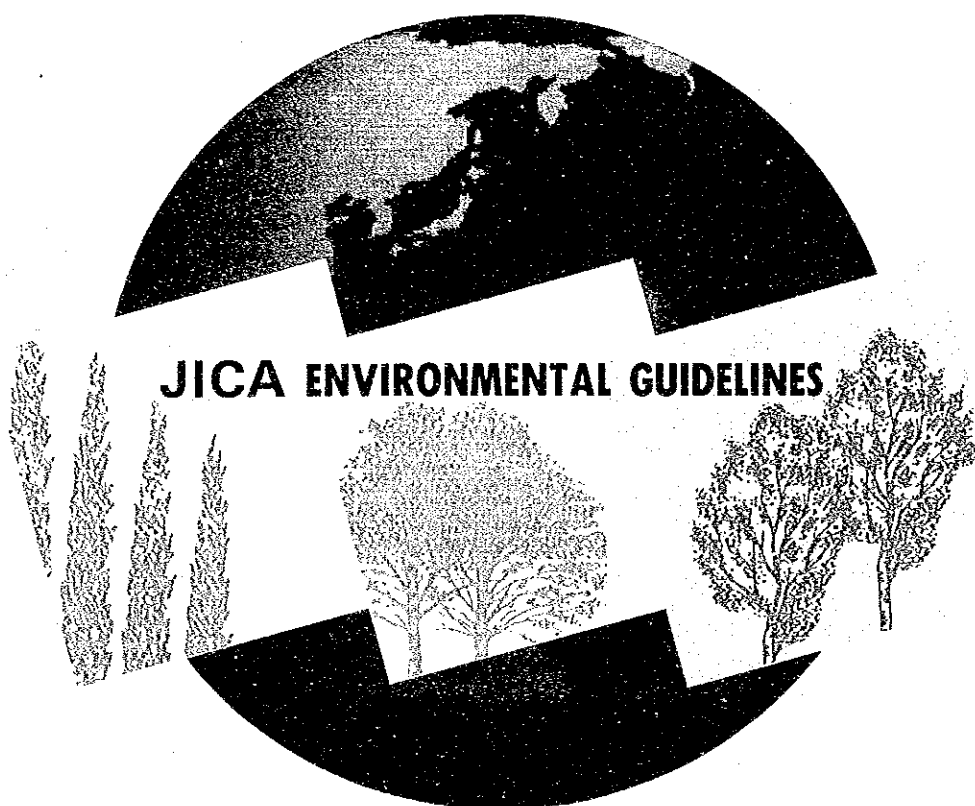


# ENVIRONMENTAL GUIDELINES FOR INFRASTRUCTURE PROJECTS

## III AIRPORTS



SEPTEMBER 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

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# **ENVIRONMENTAL GUIDELINES FOR INFRASTRUCTURE PROJECTS**

## **III AIRPORTS**

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Environmental Guidelines  
for Infrastructure Projects

"Environmental Guidelines for Infrastructure Projects" was prepared to enable preparatory study members to conduct screening and scoping of environmental impact studies effectively and efficiently while maintaining a dialogue with their counterparts and officials concerned in the host countries for the purpose of predicting possible environmental problems caused by the infrastructure projects and to incorporate adequate environmental consideration into the projects.

The guidelines consist of the thirteen sectors below. This volume deals with environmental consideration for "Airports".

Sector I	Ports and Harbors
Sector II	Airports
Sector III	Roads
Sector IV	Railways
Sector V	River and Erosion Control
Sector VI	Solid Waste Management
Sector VII	Sewerage
Sector VIII	Groundwater Development
Sector IX	Water Supply
Sector X	Regional Development
Sector XI	Tourism Development
Sector XII	Transportation Development
Sector XIII	Urban Transportation Development

Note: The guidelines for dam construction were published in February 1990 as a separate volume.



## PREFACE

In order to support sustainable development in developing countries, it is of great importance to give sufficient consideration to the environment in the implementation of development programs.

The Japan International Cooperation Agency (JICA) has continually placed special emphasis on environmental technical cooperation and has taken into account pertinent environmental consideration in development studies and implementation of projects.

Based on the recognition of the importance of environmental issues, JICA has prepared the guidelines concerning screening and scoping methods of environmental impact studies for the purpose of contributing to the planning of infrastructure development projects with sufficient environmental consideration.

The guidelines are to be used by JICA study team members when conducting preparatory studies of social and economic infrastructure development projects.

JICA committed the preparation of the guidelines to the International Engineering Consultants Association and organized an advisory group headed by Mr. Michio Hashimoto, president of the Overseas Environment Cooperation Center. Designated advisors of the group were from the Ministry of Health and Welfare, the Ministry of Transportation, the Ministry of Construction, and the Environment Agency. Also, the Ministry of Foreign Affairs provided sound and useful advice to the advisory group.

To all of these organizations and the personnel involved, I wish to acknowledge their much appreciated support.

September 1992

Akira Kasai  
Managing Director  
Institute for International Cooperation  
Japan International Cooperation Agency





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## **TERMINOLOGY**

### **Environmental Consideration**

To study whether a development project will have serious environmental impacts on the project site and its surrounding areas, analyze the study results, and establish necessary measures for avoiding or alleviating any adverse environmental impacts.

### **Environmental Impact**

The undesirable effect on the existing overall conditions of air, water, soil, and living things, assets, social information and circulation of goods, which are related to human life, or on their combined structures.

### **Preliminary Environmental Survey**

The environmental survey conducted during the preparatory study stage of a development project. This includes screening and scoping of the environmental impacts of a particular project. This survey is regarded as a component of the initial environmental examination.

### **Initial Environmental Examination (IEE)**

The examination undertaken at the outset of the development project planning stage to determine the environmental impacts that may be created by the particular project based on existing information and data, easily accessible information relating to the particular project, and comments and judgements of specialists who are familiar with the environmental impacts of past similar projects. This examination should be carried out in a short period at a low cost.

IEE has the following two objectives : 1) to evaluate whether EIA is necessary for the project and, if so, to define its contents; 2) to examine, from an environmental viewpoint, the measures for alleviating the effects of the project which requires environmental consideration but not a full-scale environmental impact assessment.

### **Environmental Impact Assessment (EIA)**

To study, forecast, and evaluate the environmental impacts of a development project, which is judged a detailed environmental examination, and to propose the establishment of an environmental protection standard and measures for avoiding or alleviating environmental impacts.

### **Environmental Management Plan**

To formulate an environmental monitoring system or methods based on the environmental protection standard to monitor the project's environmental impacts on surrounding areas, aiming at adequately protecting the environment both during and after project implementation.



**Screening**

To evaluate whether or not it will be necessary to include an environmental consideration in a development project. Screening conducted in Japan before the preparatory study is called preliminary screening.

**Scoping**

To identify the important environmental impacts among those which can be caused by the implementation of a development plan or development project, and to define the study items of the IEE or EIA based on the findings.

**Project Description (PD)**

The major contents and features of the project. It includes the background of the project (including its upper level plan), the objectives, the executing agency, the beneficiary population, and the project scale.

**Site Description (SD)**

The compact description of the project site which includes the natural and social environmental conditions in the areas that may be affected by the project.

**Preparatory Study (PS)**

To examine the contents of the full-scale study of a requested project and to discuss the scope of work (S/W) of the full-scale study with the host country. This study is conducted at the preparatory stage of the project prior to conducting the full-scale study including the master plan and the feasibility study.

**Full-scale Study**

The study generally conducted continuously after the preparatory study by carrying out field surveys to prepare the study report of a development project. The study report, with its conclusions and recommendations for project realization or project implementation, is submitted to the government of the host country. The full-scale study includes the master plan study, feasibility study, detailed design study, and map preparation.



**Master Plan Study (M/P)**

The study for preparing the basic plans for various development projects. In general, it is sectoral, or for each project.

**Feasibility Study (F/S)**

The study for evaluating the possibility, adequacy, and investment efficiency of a project. In general, it attempts to objectively verify the feasibility of a project from social, technical, economic, and financial viewpoints.

F/S is the core of JICA's development studies. The study report provides the government of the host country with the information needed to decide whether or not to implement the project. It is also used by international financial institutions to evaluate the appropriateness of financing the project once the government submits its loan request.





## ABBREVIATIONS

TOR (T/R) :	Terms of Reference
S/W :	Scope of Work
M/M :	Minutes of Meeting
Q/N :	Questionnaire
IC/R :	Inception Report
DF/R :	Draft Final Report
F/R :	Final Report
OECD :	Organization for Economic Cooperation and Development
DAC :	Development Assistance Committee



## Use of the Guidelines

The guidelines were prepared to provide personnel involved in JICA's preparatory study (including the preparatory work in Japan) with information that can be used to prepare the preparatory study report or compile project specifications while carrying out field surveys, hearings, and holding discussions with the officials of the host country during a short-time visit.

The use of the guidelines is shown in Figure i and explained herewith.

### «Preparatory work in Japan»

#### 1) Examination of the request

After examining the request, follow the procedure given below, unless it is judged a soft-type infrastructure project, which is supposed to have no serious environmental impacts, such as the preparation of topographical maps or a telecommunication project.

#### 2) Preliminary screening

Based on the request, collect and analyze the data and information and prepare the PD and SD in Japan, and conduct the preliminary screening by using them.

If any serious environmental impacts are suspected, the preparatory study team should include an environmental specialist.

Prepare questionnaires to the recipient government concerned and the draft of S/W including environment related items.

### «Work in the host country»

#### 3) Examination of the country's guidelines

At first, investigate the country's IEE/EIA implementing structure, the laws, and any existing guidelines (hereinafter referred to as the country's EIA guidelines). Then, it should be confirmed whether or not the project is subjected to IEE/EIA.

Case 1: If the contents of the country's EIA guidelines are sufficient, follow their guidelines.

Case 2: If the contents of the country's EIA guidelines are insufficient, follow their guidelines and add JICA's screening and scoping items.

Case 3: If the country has no EIA guidelines, follow JICA's guidelines.

#### 4) Screening

Reexamine the PD, SD, and the contents of screening prepared in Japan, based on the findings of the field surveys and data analysis. If it is evaluated that an IEE or EIA is required for the project, scoping should then be undertaken.

5) Scoping

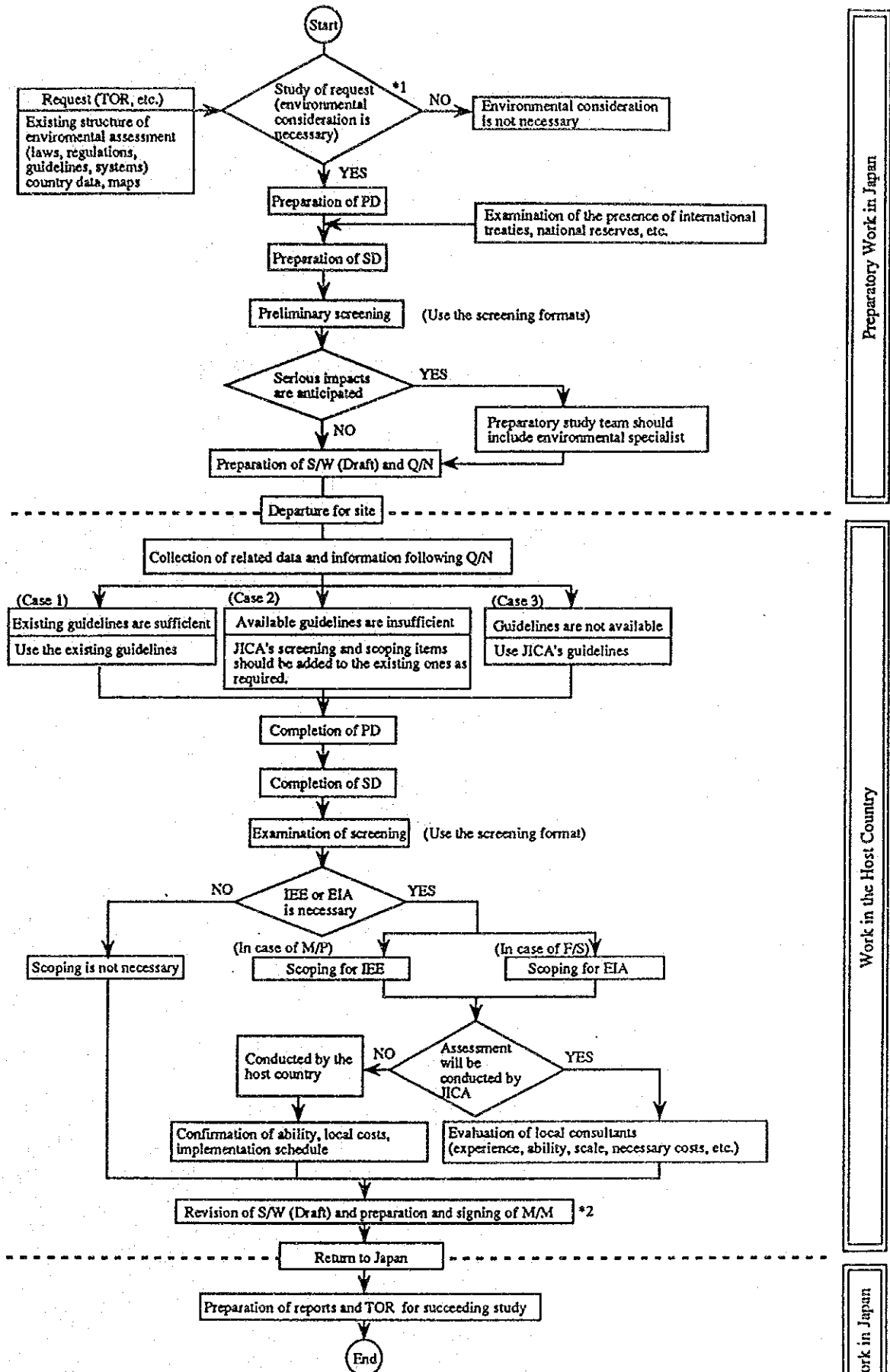
Evaluate the magnitude of impact on each environmental item, using the checklist method, to specify the items that are to be studied in IEE for M/P or EIA for F/S. In this process, making use of the explanation of items in the guidelines, try to grasp the features of possible environmental impacts. The results should be noted in the scope of work (S/W) and the minutes of meeting (M/M). When the environmental factors which may have serious impacts are not identified, it is necessary to mention in the M/M that such factors would be clarified through the full-scale study.

«Work in Japan»

6) Report preparation

Based on the above-mentioned results, compile a preparatory study report which makes it possible to carry out the appropriate IEE or EIA in the full-scale study. TOR for the succeeding study should reflect the contents of the report.

Figure i Procedure of Environmental Consideration



Note : \*1. The environmental consideration is not necessary when infrastructure projects are not anticipated to have serious impacts, such as preparation of topographic maps and telecommunication projects, etc.  
 \*2. When the environmental factors that may have serious impact are not identified, it is necessary to mention in the M/M that such items would be clarified in the full-scale study.



## **CHAPTER 1**

# **OUTLINE OF ENVIRONMENTAL CONSIDERATION**





## CHAPTER 1 OUTLINE OF ENVIRONMENTAL CONSIDERATION

### 1.1 Basic Concept

JICA's aid study report "Sectoral Study for Development Assistance-Environment" published in 1988 defined that "Environmental Consideration" is to study whether a development project will have significant impacts on the environment or not, to assess the impacts and to incorporate measures to prevent or alleviate their effects, if necessary.

The premise of this definition is the understanding that development aid should not end with a one-time involvement but should be continuous and sustainable. Thus, it is believed that environmental consideration is prerequisite for securing the sustainability of the development.

For the implementation of development projects in developing countries with the cooperation of the Japanese government, a careful environmental consideration should be carried out from the early stages of project planning with a long-term perspective in order to accomplish a well-balanced development.

As such development projects are implemented in the host countries, based on the decision making process of these countries, it is necessary to conform to their laws, rules and regulations related to environmental consideration.

In some developing countries, however, such laws, rules and regulations do not exist, while in others they are not properly enforced. The policies and structures for environmental consideration vary from one country to another.

Therefore, when undertaking the environmental consideration, it is necessary to take into account of the developing country's policies and structures and to understand the country's awareness of environmental problems, while holding sufficient discussions with the people concerned in a flexible manner.

With regard to environmental consideration, JICA's basic principles are to promote sustainable development aimed at improving the living standard of the residents, and harmonize the development with a desirable environment based on the country's willingness.

If environmental consideration is not sufficiently undertaken for implementing a development project and, if careful attention is not paid to the management of the surrounding natural resources, the base of the development might be jeopardized and the development might be halted. The base of the people's livelihood or even their subsistence can be also threatened. It is necessary, therefore, to try to ensure the sustainable development by harmonizing the development project with natural resources and the base of livelihood and subsistence of the residents in the area.

The guidelines describe screening and scoping procedures at the preparatory study stage to deal with the negative impacts of a development project on the environment of the project site and its surrounding area.

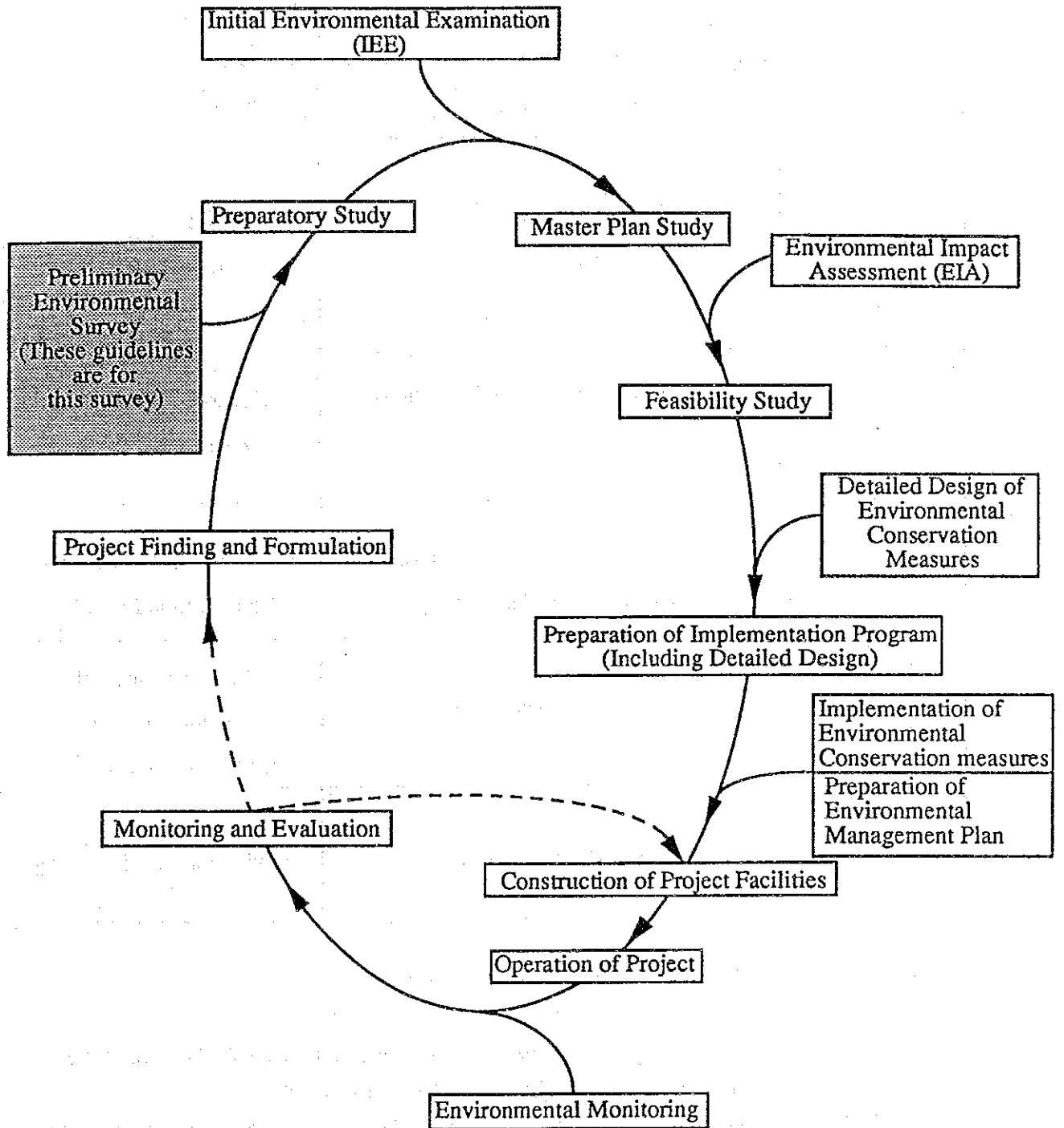
The process of environmental consideration in a project cycle is shown in Figure 1-1.

A development project begins with its finding and formulation. At each stage of the cycle, a series of environmental considerations, such as a preliminary environmental survey, an initial environmental examination (IEE), environmental impact assessment (EIA), and the design of environmental protection measures take place. Environmental monitoring is then conducted with project implementation. Through this process, sustainable development can be attained.

Definition of the environmental management plan mentioned here is limited to the monitoring system which handles the environmental impacts caused by the project.

Tables 1-1 and 1-2 illustrate the time flows corresponding to the project implementation stages and the environmental consideration stages. The flows start with an environmental survey, followed by the EIA, proceed to the examination of environmental conservation measures, and then to the monitoring stage.

Figure 1-1. Flow of Environmental Considerations in Project Cycle



**Table 1-1 Project Implementation Stages and Corresponding Environmental Consideration Stages**

Project Implementation Stages				Environmental Consideration Stages
Implementation by JICA	Preparatory Study			Preliminary Environmental Survey
	Full-scale Study	Master Plan Study	Feasibility Study	Initial Environmental Examination (IEE)
		Feasibility Study		Environmental Impact Assessment (EIA)
Implementation by Executing Agency	Preparation of Project Implementation Plan (Including Detailed Design)			Examination of Environmental Conservation Measures
	Project Construction			Implementation of Environmental Conservation Measures
	Project Facility Operation			Environmental Monitoring

- Notes: 1. This table does not indicate strict correspondence.  
 2. Some projects do not require IEE or EIA.  
 3. Preparation of the project implementation plan includes the detailed design of the environmental conservation facilities and their construction.  
 4. The item enclosed in a separate box indicates the major boundary for the guidelines.

**Table-1.2 Incorporation of Environmental Consideration into JICA's Development Studies**

	Study Flow	Contents and Timing Investigation	Examination Items
Project Finding	Request/Project Finding ↓ Acceptance of TOR ↓ Study on TOR	(Preliminary Screening) Judgment on necessity of IEE or EIA ↓	The project judged to cause serious environmental impact shall be rejected.
Preparatory Study	Preparatory Study ↓ Discussion and Agreement on S/W ↓ Preparation of Preparatory Study Report ↓	(Screening) Review of preliminary screening  (Scoping) Decision of important items for IEE or EIA Decision of work boundaries ↓	(Preparation of M/M, S/W) Examine the description of agreed items on screening and scoping. (Reporting) Clarification of background and agreed items.
Selection of Consultants	Preparation of Project Specification ↓ Selection of Consultants ↓		(Project Specification) Define the boundary and work volume of IEE or EIA to be conducted by consultants  (Selection of consultants) Evaluate the appropriateness of the proposal for the project specification.
Full-scale Study	Preparation of and Discussion on IC/R ↓ Implementation of IEE or EIA ↓ Explanation of and Discussion on DF/R ↓ Preparation of F/R ↓		(IEE or EIA) Discussion and decision on IEE/EIA items and methods based on the results of scoping.  (Supervision of survey) Check whether IEE or EIA is conducted properly.  (Final reporting) Clarification of IEE or EIA results and recommendations.

Source: JICA, "Sectoral Study for Development Assistance-Environment", 1988.

Note: The shaded part is mainly covered by the guidelines.

## 1.2 Environmental Consideration for Airport Projects

### 1.2.1 Definition of Airport Projects in the Guidelines

Airport projects in the guidelines deal with the construction and operation of airports, which consist of runways and airport facilities, and access roads. When the project site is located on the seashore or riverside, reclamation work would be included. Burrow pits and sand collections are excluded.

### 1.2.2 Typical Possible Impacts and the Points of Environmental Consideration

Typical impacts in airport projects needing particular consideration are as follows:

#### Resettlement

Inhabitants would be resettled due to land acquisition for airport construction. Loss of livelihood of inhabitants, difficulty in social and cultural adaptation to the relocation site may take place.

Conditions of inhabitants to be resettled and relocation site should be investigated thoroughly.

#### Fauna and Flora

Vegetation on airport sites would be removed. This may bring about the loss of animal habitats. The breeding and habitation of animals may be affected by exhaust gas and noise from aircraft; migratory routes and habitat areas could be disturbed by airport facilities.

The above impacts may lead to a decrease in wild animals and the extinction of precious species. The decrease of natural enemies and the extinction of other species could bring about an outbreak of other animals and vermin.

The value of plants and animals and features of the ecosystem of the area should be considered.

### Noise and Vibration

Noise and vibration would be generated by the operation of construction equipment and detonations during the construction stage. In the operational stage, aircraft may cause noise and vibration.

Facilities which require particular tranquillity, such as hospitals and schools, would be affected. Livestock breeding would be affected and wild animals may disperse.

Careful consideration is needed in areas which are highly populated or have unique religious facilities.





## **CHAPTER 2**

### **PROJECT DESCRIPTION AND SITE DESCRIPTION**



## CHAPTER 2 PROJECT DESCRIPTION AND SITE DESCRIPTION

### 2.1 Basic Concept

To conduct screening and scoping of the potential environmental impacts that may be caused by a development plan or project, it is essential to fully understand the "project description" and "site description" at the earliest stage.

Project description includes the contents and features of the project, such as its background, objectives, location, executing agency, number of beneficiaries, scale, structure, construction method, operation and maintenance, etc..

Site description includes the present conditions of the natural and social environment and pollution in and around the project area.

In particular, if the project site includes such areas as follow, they should receive special attention:

- a) Areas requiring soil conservation (high risk areas of erosion, salinization, etc.).
- b) Arid and semiarid areas subject to desertification.
- c) Tropical forests.
- d) Water sources.
- e) Habitats of value for the protection and conservation and/or sustainable use of fish and wildlife resources (wetlands, mangrove, swamps, coral reefs, etc.)
- f) Areas of unique interest (historical, archaeological, cultural, aesthetic and scientific).
- g) Areas of concentrations of population or industrial activities where further industrial development or urban expansion could create significant environmental problems.
- h) Areas of particular social interest to specific vulnerable population groups (e.g., nomadic people or other people with traditional life styles).

It should be borne in mind that the above items must be thoroughly studied in each project step.

### 2.2 Project Description and Site Description of Airport Projects

The project description and the site description should be clarified in the formats shown in Tables 2-1 and 2-2 for screening and scoping.

However, at the project finding and preparatory study stages, sufficient information for the project description and site description may not be available. Thus, during the preparatory work prior to the preparatory study in the host country, the formats of Tables 2-1 and 2-2 should be filled in as complete as possible using all available information. The additional necessary information should be supplemented during the field surveys.

**Table 2-1 Format for Project Description ( Airports )**

Item	Description
Project Name	
Background	
Objectives	
Location	
Executing Agency	
Beneficiaries	
Project Components	
Type of Project	Construction / Improvement
Type of Airport	International / Domestic
Scale	Area :                      ha, Length of Runway :                      m
Incidental Facilities	Terminal Buildings / Lighting Facilities / Radiotelegraphy / Fuel Facilities
Demand / Aircraft Type	Passengers :                      person ( In year of                      ) Cargo:                      ton ( In year of                      ) Aircraft Type:
Number of Take off and Landing	flights / day
Others	

Note: The format should be filled in on the basis of the available existing data and information.

Table 2-2 Format for Site Description ( Airports )

Item		Description
Project Name		
Social Environment	Inhabitants: (residents/indigenous people/their views on the project, etc.)	
	Land Use: (urban area / farmland / historic site / scenic spot / hospitals, etc.)	
	Economy / Transport: (commerce / agriculture / forestry / industrial zone / bus terminal, etc.)	
Natural Environment	Topography, Geology: (steep slopes / soft ground / wetlands / faults, etc.)	
	Fauna and Flora and their habitats: (rare species / mangroves / coral reefs, etc.)	
Pollution	Complaints: (pollution of the utmost concern, etc.)	
	Measures taken: (institutional measures/ compensation, etc.)	
Others		

Note: The format should be filled in on the basis of the available existing data and information.



## **CHAPTER 3**

## **SCREENING**





## CHAPTER 3 SCREENING

### 3.1 Basic Concept

JICA's 1988 report, "Sectoral Study for Development Assistance-Environment," defines screening as "a process of judgement on whether a development project requires an environmental impact study or not." That is to say, screening is the first judgement in the process of environmental consideration and should commence at the initial stage of the project, such as project finding.

Screening in the guidelines is also based on the above definition. However, the evaluation of whether or not the IEE/EIA is required for a project should be based on appropriate ideas and views for harmonizing the sustainable development with the residents' livelihood and surrounding environment by taking into consideration the project features and its environment, but not on the quantitative standards.

### 3.2 Screening Methods

#### 3.2.1 Outline

As for the procedures for screening in addition to the provisions detailed in the annex to the 1985 OECD council recommendations, JICA's report, "Sectoral Study for Development Assistance-Environment", describes the following cross-sectional viewpoints:

- Can the project adversely affect the sustainability of production which depends mainly on natural resources ?
- Will the project significantly affect people's health ?
- Will the project lead to a deterioration or loss of valuable living resources and their habitats ?
- Will the project have an unreasonable impact on the livelihoods and subsistence of the people concerned ?

Based on the above viewpoints, the screening method should be examined in detail.

If there are laws or regulations concerning the environmental impact assessment for the project in the host country, it is necessary to discuss with the officials concerned of the country to make better environment considerations in accordance with the laws and regulations by referring to the guidelines.

On the other hand, if there are no such laws or regulations in the host country, it may be possible to formulate a standard with respect to the project scale and the land-use conditions for evaluating whether the development project requires an environmental

impact assessment or not. However, setting up a quantitative standard for judgement is not only difficult but its effectiveness is also doubtful because Japanese development assistance is provided to various countries and their environmental characteristics are vastly different.

It is considered to be more effective, therefore, to formulate certain ideas and viewpoints with qualitative expressions for evaluating screening.

### 3.2.2 Screening of Airport Projects

Based on the above consideration, the following concepts are established in the preliminary environmental survey :

- The development project should be planned in such a way as to provide society with sufficient benefits while securing the areas' sustainable development and growth without being detrimental to the lives and existence of the residents.
- The development project should be planned in such a way as to maintain harmony with the natural environment, while avoiding significant damage to the existing environment, and preserve valuable natural environmental assets.

The examination of screening should be conducted from practical viewpoints for each environmental item based on the above concepts. The results of the examination should be clarified by using the screening format as shown in Table 3-1 and should be included in the preparatory study report.

The evaluation result of each environmental item should be noted on the format whether or not environmental impacts exist. As the overall evaluation, the conclusion and the reason for evaluating whether or not IEE/EIA is required should be described briefly on the format.

The guidelines should be applied for all environmental impacts that may be caused by the project implementation not only in the project area but also in any area that may be directly or indirectly affected during the construction and after the operation of project facilities.

Table 3-1 Format for Screening ( Airports )

No.	Environmental Item	Description	Evaluation	Remarks (Reason)
<b>Social Environment</b>				
1.	Resettlement	Resettlement due to land occupancy (transfer of rights of residence/land ownership)	[Y][N][?]	
2.	Economic Activities	Loss of bases of economic activities, such as land, and change of economic structure	[Y][N][?]	
3.	Traffic and Public Facilities	Impacts on schools, hospitals and present traffic conditions, such as the increase of traffic congestion and accidents	[Y][N][?]	
4.	Split of Communities	Community split due to interruption of area traffic	[Y][N][?]	
5.	Cultural Property	Damage to or loss of value of churches, temples, shrines, archaeological remains or other cultural assets	[Y][N][?]	
6.	Water Rights and Rights of Common	Obstruction of fishing rights, water rights, rights of common	[Y][N][?]	
7.	Public Health Condition	Deterioration of public health and sanitary conditions due to generation of garbage and the increase of vermin	[Y][N][?]	
8.	Waste	Generation of construction and demolition waste, debris and general waste	[Y][N][?]	
9.	Hazards (Risk)	Increase in danger from landslide and aircraft accidents, etc.	[Y][N][?]	
<b>Natural Environment</b>				
10.	Topography and Geology	Changes of valuable topography and geology due to excavation or filling work	[Y][N][?]	
11.	Soil Erosion	Topsoil erosion by rainfall after reclamation and deforestation	[Y][N][?]	
12.	Groundwater	Exhaustion of groundwater due to over drafting and pollution by leachate	[Y][N][?]	
13.	Hydrological Situation	Changes of river discharge and riverbed condition due to landfill and drainage inflow	[Y][N][?]	
14.	Coastal Zone	Coastal erosion and sedimentation due to coastal reclamation and change of marine conditions	[Y][N][?]	
15.	Fauna and Flora	Obstruction of breeding and extinction of species due to changes of habitat conditions	[Y][N][?]	
16.	Meteorology	Changes of temperature, precipitation, wind, etc. due to large-scale land reclamation and building construction	[Y][N][?]	
17.	Landscape	Change of topography and vegetation due to reclamation. Deterioration of aesthetic harmony by structures	[Y][N][?]	
<b>Pollution</b>				
18.	Air Pollution	Pollution caused by exhaust gas or toxic gas from vehicles and aircraft	[Y][N][?]	
19.	Water Pollution	Pollution caused by inflow of silt, sand and effluent from factories, etc.	[Y][N][?]	
20.	Soil Contamination	Soil contamination by dust and asphalt emulsion	[Y][N][?]	
21.	Noise and Vibration	Noise and vibration generated by vehicles, airplanes and factory operations	[Y][N][?]	
22.	Land Subsidence	Deformation of land and land subsidence due to the lowering of groundwater table	[Y][N][?]	
23.	Offensive Odor	Generation of exhaust gas and offensive odor by facility construction and operation	[Y][N][?]	
<b>Overall Evaluation:</b> Either IEE or EIA is necessary for the project implementation?			[Y][N]	



## **CHAPTER 4**

### **SCOPING**



## CHAPTER 4 SCOPING

### 4.1 Basic Concept

In JICA's 1988 report, "Sectoral Study for Development Assistance-Environment," scoping is defined as "a process of identification of the critical environmental impacts out of the possible environmental impacts of a development project. Through the scoping process, the priority fields or items of an environmental impact assessment are also identified". Further, it recommends that scoping should be carried out through discussions with the government of the host country. These discussions are to be based on discussion items prepared in advance, and by taking into account the aforementioned cross-sectional judgement provisions.

With the above definition and the methods used by various agencies, the guidelines provide material for conducting adequate scoping. The guidelines would enable even those who are not IEE and EIA specialists to understand the overall picture of the development project to conduct the sufficient scoping work during the short-term preparatory study period.

### 4.2 Scoping Methods

#### 4.2.1 Outline

There are several technical methods for environmental impact assessment and its scoping. Each of them is selected in accordance with the project type, the project planning level, the features of the environmental conditions, etc. The most common methods are the checklist method, the matrix method, the overlay method, and the network method. In particular, the checklist and the matrix methods are commonly used by most agencies.

For "identification of the critical environmental impacts out of the possible impacts of a development project," as required by the definition of scoping in the "Sectoral Study for Development Assistance-Environment," it is necessary to include all environmental items which can be predicted to arise along with implementation of the project. To accomplish this, the checklist method seems to be the easiest to understand and the most useful.

Based on the above consideration, the checklist method is proposed for scoping in the guidelines.

To clarify important fields and items among those listed on the checklist, it is necessary to understand the causal relationships between the environmental items and the project related activities during the construction and the operation periods. Thus, to make it easier to understand scoping, the guidelines show typical causal relationships between development activities and environmental items by using the matrix as well as the checklist.

For reference purposes, a comprehensive matrix covering 13 sectors of social and economic infrastructure development projects is shown in Table 4-1.

#### 4.2.2 Scoping of Airport Projects

The checklist for scoping of airport projects is shown in Table 4-2. The matrix for understanding the causal relationship between the development activities and the environmental items is shown in Table 4-3.

To use the checklist for scoping, the following conditions and procedures should be taken into account:

(1) Application conditions

1) Periods covered by scoping

Scoping should cover both the construction and operation periods.

2) Spatial extent of scoping

Scoping should cover the entire area where the impacts of the construction and operation of the facilities are expected to reach.

3) Types of Environmental Impacts

Environmental impacts subject to scoping are those having negative impacts on the existing environment.

(2) Evaluation method of important fields and items

The evaluation of each item should be rated according to the following categories:

A (serious impact is expected);

B (some impact is expected);

C (extent of impact is unknown but further examination is required because it might become clear as the study progresses);

D (no impact is foreseeable and IEE/EIA is not required).

Important fields and items for IEE/EIA should be identified with reference to "possible environmental impacts," "useful factors for evaluation," "measures," and "related subjects for study" as listed in Table 4-5.

The opinions and views of the host country should also be taken into consideration for the evaluation.



(3) Overall Evaluation

The evaluation results of each environmental item and the reasons for the evaluation should be clearly described on the checklist. The items evaluated as A, B, or C should be examined based on the screening concept to determine whether or not IEE/EIA is required, and the policies for further study of those items should be outlined. If it is possible to alleviate or avoid some environmental impacts by taking adequate measures, the contents should be described.

If, as the result of the evaluation, there are items which are evaluated as "C" or higher, some studies should be conducted for these items.

For the overall evaluation, opinions and views of the host country should be taken into consideration.

The overall evaluation form is shown in Table 4-4.

Table 4-1 Comprehensive Matrix

Project Type		Sectoral Development									Comprehensive Development			
		Sectors												
Environment Items		1. Ports and Harbors	2. Airports	3. Roads	4. Railways	5. River and Erosion Control	6. Solid Waste Management	7. Sewerage	8. Groundwater Development	9. Water Supply	10. Regional Development	11. Tourism Development	12. Transportation Development	13. Urban Transportation Development
		Social Environment	1	Resettlement	⊙	⊙	⊙	⊙	⊙	○	○	○	○	○
2	Economic Activities		○	○	○	○	○	○	○	○	○	○	○	○
3	Traffic and Public Facilities		○	○	○	○	○	○	○	○	○	○	○	○
4	Split of Communities		○	○	○	○	○	○	○	○	○	○	○	○
5	Cultural Property		○	○	○	○	○	○	○	○	○	○	○	○
6	Water Rights/Rights of Common		⊙	○	○	○	⊙	○	○	○	○	○	○	○
7	Public Health Condition		○	○	○	○	○	○	○	○	○	○	○	○
8	Waste		○	○	○	○	○	○	○	○	○	○	○	○
9	Hazards ( Risk )		○	○	○	○	○	○	○	○	○	○	○	○
Natural Environment	10	Topography and Soil Condition	○	○	○	○	○	○	○	○	○	○	○	○
	11	Soil Erosion	○	○	○	○	○	○	○	○	○	○	○	○
	12	Groundwater	○	○	○	○	○	○	⊙	○	○	○	○	○
	13	Hydrological Situation	○	○	○	○	⊙	○	○	○	○	○	○	○
	14	Coastal Zone	⊙	○	○	○	○	○	○	○	○	○	○	○
	15	Fauna and Flora	⊙	⊙	⊙	⊙	⊙	○	○	○	○	○	○	○
	16	Meteorology	○	○	○	○	○	○	○	○	○	○	○	○
	17	Landscape	○	○	○	○	○	○	○	○	○	○	○	○
Pollution	18	Air Pollution	○	○	⊙	○	○	○	○	○	○	○	○	○
	19	Water Pollution	○	○	○	○	○	○	○	○	○	○	○	○
	20	Soil Contamination	○	○	○	○	○	○	○	○	○	○	○	○
	21	Noise and Vibration	○	⊙	⊙	⊙	○	○	○	○	○	○	○	○
	22	Ground Subsidence	○	○	○	○	○	○	○	⊙	○	○	○	○
	23	Offensive Odor	○	○	○	○	○	○	○	○	○	○	○	○

Note: ⊙ : The environmental items to which special attention has to be paid  
 They might cause serious impacts that may affect the project formulation depending on the magnitude of the impacts and the possibility of the measures.  
 ○ : The environmental items which may have a significant impact depending on the scale of project and site conditions  
 No mark : The environmental items requiring no impact assessment since the anticipated impacts are, in general, not significant.  
 In case of the comprehensive development projects, all the items are classified in ○, because their studies are usually at the master planning stage and the extent of impacts are not clear.

**Table 4-2 Checklist for Scoping ( Airports )**

No.	Environmental Item	Evaluation	Reason
<b>Social Environment</b>			
1.	Resettlement		
2.	Economic Activities		
3.	Traffic/Public Facilities		
4.	Split of Communities		
5.	Cultural Property		
6.	Water Rights and Rights of Common		
7.	Public Health Condition		
8.	Waste		
9.	Hazards (Risk)		
<b>Natural Environment</b>			
10.	Topography and Geology		
11.	Soil Erosion		
12.	Groundwater		
13.	Hydrological Situation		
14.	Coastal Zone		
15.	Fauna and Flora		
16.	Meteorology		
17.	Landscape		
<b>Pollution</b>			
18.	Air Pollution		
19.	Water Pollution		
20.	Soil Contamination		
21.	Noise and Vibration		
22.	Land Subsidence		
23.	Offensive Odor		

Note 1: Evaluation categories :

A: Serious impact is expected.

B: Some impact is expected.

C: Extent of impact is unknown ( Examination is needed. Impacts may become clear as study progresses.).

D: No impact is expected. IEE/EIA is not necessary.

Note 2: The evaluation should be made with reference to the "explanation of item" (Table 4-5)

Table 4-3 Matrix for Scoping ( Airports )

Major Facilities / Activities Activities which may cause impacts Environmental Items		Airports / Access roads					
		Overall Evaluation	Before Operation		After Operation		
			Reclamation and Spatial Occupancy	Operation of Construction Equipment and Vehicles	Spatial Occupancy	Operation of Vehicles	Operation of Airplanes
Social Environment	1 Resettlement	◎	◎				
	2 Economic Activities	○	○		○		○
	3 Traffic and Public Facilities	○			○	○	○
	4 Split of Communities	○			○		
	5 Cultural Property	○	○				○
	6 Water Rights/Rights of Common	○			○		○
	7 Public Health Condition						
	8 Waste	○	○				○
	9 Hazards ( Risk )	○	○				○
Natural Environment	10 Topography and Geology	○	○				
	11 Soil Erosion	○	○				
	12 Groundwater						
	13 Hydrological Situation	○	○		○		○
	14 Coastal Zone	○	○				
	15 Fauna and Flora	◎	◎	○	○	○	○
	16 Meteorology						
17 Landscape	○	○		○			
Pollution	18 Air Pollution	○		○		○	○
	19 Water Pollution	○	○				○
	20 Soil Contamination						
	21 Noise and Vibration	◎		○		○	◎
	22 Land Subsidence						
	23 Offensive Odor						

Note:◎ : The environmental items to which special attention has to be paid. They might cause serious impacts that may affect the project formulation depending on the magnitude of the impacts and the possibility of the measures.

○ : The environmental items which may have a significant impact depending on the scale of the project and site conditions

No mark : The environmental items requiring no impact assessment since the anticipated impacts are, in general, not significant.



Table 4-5 Explanation of Item 1 (Airports)

Item	1. Resettlement
Description	Resettlement due to occupancy of land (transfer of rights of residence and/or land ownership)
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Land acquisition for airport construction</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Loss of living foundation of inhabitants to be resettled. Social and cultural inadaptability to the new settlement site may occur.</li> <li>2. Conflict between the permanent residents and resettlers over social and economic burden</li> <li>3. Deterioration of living standard after resettlement due to the poor compensation system in some countries or the status of illegal occupants</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. If the following conditions are involved, resettlement would be difficult:               <ol style="list-style-type: none"> <li>a) The lives of inhabitants rely upon the special environmental resources of the site.</li> <li>b) The inhabitants are currently well-off.</li> <li>c) Favorable relocation site is not available in the vicinity.</li> </ol> </li> <li>2. Careful handling is needed if racial or tribal problems exist.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Resettlement site selection considering the wishes of the inhabitants</li> <li>2. Meetings with the inhabitants and provision of necessary information</li> <li>3. Improvement of living and economic conditions of the resettlement site</li> <li>4. Compensation</li> <li>5. Job training and guidance</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Population of the inhabitants to be resettled and their economic condition</li> <li>2. Condition of the resettlement site</li> <li>3. Past cases of resettlement</li> </ol>

Table 4-5 Explanation of Item 2 (Airports)

Item	2. Economic Activities
Description	Loss of bases of economic activities, such as land, and change of economic structure
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Loss of arable land, forest and fishing grounds</li> <li>2. Land reclamation and change in land use</li> <li>3. Change of traffic system by airport construction</li> <li>4. Change of commodity distribution routes and its volume</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Effects on the local economy because of a decrease in agriculture, forestry and fishery production due to loss of arable land and forests, change of population distribution caused by alternate land use, change of commercial activities and job opportunities.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. In case an important industry exists in the site, the effect of resettlement on local economy and employment may be significant.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Sufficient compensation to the land owners and people engaged in related economic activities</li> <li>2. Securing of substitute</li> <li>3. Provision of alternate crossing routes</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Local economy and urban planning</li> <li>2. Future plans of the area, such as a regional development plan</li> </ol>

Table 4-5 Explanation of Item 3 (Airports)

Item	3. Traffic and Public Facilities
Description	Impacts on schools, hospitals and present traffic conditions, such as the increase of traffic congestion and accidents
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Interruption of existing transport by airport construction</li> <li>2. Emergence and/or increase of traffic on access roads</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Increase in traffic accidents and other traffic problems caused by traffic congestion</li> <li>2. Community split may affect the lives of inhabitants due to the inconvenience of access to schools, hospitals and other public facilities</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. In case an existing transport is destroyed, alternate transport facilities should be considered.</li> <li>2. It is necessary to refer to the regional land use plan .</li> <li>3. Careful consideration should be paid when there are schools, hospitals, religious sites and other public facilities in the area.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Improvement of the existing traffic system</li> <li>2. Installation of safety facilities</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Land use and traffic conditions</li> <li>2. Future land use plan and transportation plan</li> <li>3. Higher level regional development plan</li> <li>4. Distribution of the public facilities</li> </ol>



Table 4-5 Explanation of Item 4 (Airports)

Item	4. Split of Communities				
Description	Community split due to interruption of area traffic				
<table border="1" style="width: 100%;"> <tr> <td style="width: 30%;">Causes of Impacts</td> <td></td> </tr> <tr> <td colspan="2"> <ol style="list-style-type: none"> <li>1. Interruption of existing route by the construction of airports</li> <li>2. Interruption of traffic of inhabitants and commercial distribution by the spatial occupancy of airports</li> </ol> </td> </tr> </table>		Causes of Impacts		<ol style="list-style-type: none"> <li>1. Interruption of existing route by the construction of airports</li> <li>2. Interruption of traffic of inhabitants and commercial distribution by the spatial occupancy of airports</li> </ol>	
Causes of Impacts					
<ol style="list-style-type: none"> <li>1. Interruption of existing route by the construction of airports</li> <li>2. Interruption of traffic of inhabitants and commercial distribution by the spatial occupancy of airports</li> </ol>					
<table border="1" style="width: 100%;"> <tr> <td style="width: 30%;">Possible Environmental Impacts</td> <td></td> </tr> <tr> <td colspan="2"> <ol style="list-style-type: none"> <li>1. Inconvenience in the daily activities of inhabitants and the effect on economic activities</li> <li>2. Creation of detached territories or isolated areas</li> </ol> </td> </tr> </table>		Possible Environmental Impacts		<ol style="list-style-type: none"> <li>1. Inconvenience in the daily activities of inhabitants and the effect on economic activities</li> <li>2. Creation of detached territories or isolated areas</li> </ol>	
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<table border="1" style="width: 100%;"> <tr> <td style="width: 30%;">Useful Factors for Evaluation</td> <td></td> </tr> <tr> <td colspan="2"> <ol style="list-style-type: none"> <li>1. In case isolated areas are created, the effect is obvious and countermeasures should be considered.</li> <li>2. Careful consideration is needed if there are communities having long existing customs or traditional events and are tightly united in their social activities.</li> </ol> </td> </tr> </table>		Useful Factors for Evaluation		<ol style="list-style-type: none"> <li>1. In case isolated areas are created, the effect is obvious and countermeasures should be considered.</li> <li>2. Careful consideration is needed if there are communities having long existing customs or traditional events and are tightly united in their social activities.</li> </ol>	
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<table border="1" style="width: 100%;"> <tr> <td style="width: 30%;">Measures</td> <td></td> </tr> <tr> <td colspan="2"> <ol style="list-style-type: none"> <li>1. Sufficient compensation</li> <li>2. Creation of new community centers</li> <li>3. Arrangement of new traffic system</li> </ol> </td> </tr> </table>		Measures		<ol style="list-style-type: none"> <li>1. Sufficient compensation</li> <li>2. Creation of new community centers</li> <li>3. Arrangement of new traffic system</li> </ol>	
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<table border="1" style="width: 100%;"> <tr> <td style="width: 30%;">Related Subjects for Study</td> <td></td> </tr> <tr> <td colspan="2"> <ol style="list-style-type: none"> <li>1. Social structure of the region</li> <li>2. Transportation system, distribution of goods, and regional economy</li> <li>3. Higher level regional development plan</li> </ol> </td> </tr> </table>		Related Subjects for Study		<ol style="list-style-type: none"> <li>1. Social structure of the region</li> <li>2. Transportation system, distribution of goods, and regional economy</li> <li>3. Higher level regional development plan</li> </ol>	
Related Subjects for Study					
<ol style="list-style-type: none"> <li>1. Social structure of the region</li> <li>2. Transportation system, distribution of goods, and regional economy</li> <li>3. Higher level regional development plan</li> </ol>					

**Table 4-5 Explanation of Item 5 (Airports)**

Item	5. Cultural Property
Description	Damage to or loss of the value of churches, temples, shrines and archaeological remains and other cultural assets
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Damage to and/or loss of historical assets and cultural property by land reclamation and vibration for airport construction</li> <li>2. Increase in traffic of people</li> <li>3. Vibration and air pollution caused by aircraft operation</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Damage to or vanishing of unique cultures, loss of opportunity for academic research and damage to tourism business opportunities which depend on the cultural property</li> <li>2. Aggravation of inhabitants' feeling caused by loss of precious cultural assets in the area</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Impacts would be critical when the cultural property is recognized historically and culturally important from global viewpoints or is unique to the area</li> <li>2. Countries with longer histories are likely to have more cultural property to preserve</li> <li>3. Careful consideration is required to the officially registered cultural assets</li> <li>4. Careful attention should be paid to buildings and other facilities in unique communities.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Reexamination of the location and contents of the airport</li> <li>2. Preservation or relocation of cultural property</li> <li>3. Meetings with the inhabitants and provisions of necessary information</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Laws and regulations concerning the preservation of cultural property</li> <li>2. Local history and folklore</li> <li>3. Preservation or relocation plans and measures</li> </ol>

Table 4-5 Explanation of Item 6 (Airports)

Item	6. Water Rights, Rights of Common
Description	Obstruction of fishing rights in rivers, water rights and land use rights
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Occupancy or alteration of arable land, forests, fishing grounds by airport facilities and access roads</li> <li>2. Increase in traffic</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Effect on economic activities, such as marine product industry, domestic water-use(e.g., bathing), and irrigation, when the airport is located near the sea or a river</li> <li>2. Effect on agriculture due to the occupancy or alteration of land when the airport is located inland. It would also make access to the forests easier and cause illegal entry and logging.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Impacts would be significant when the water use of the rivers and the sea is important for local industries or for the lives of the inhabitants.</li> <li>2. Water rights and rights of common are often recognized by custom even if they are not recognized by the law.</li> <li>3. Water rights or land use rights may be recognized practically if water intake facilities and navigation facilities, etc. exist.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Reexamination of the location and contents of the airport</li> <li>2. Meetings with inhabitants</li> <li>3. Sufficient compensation</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Distribution and use of forests and water area, and local economy including the markets</li> <li>2. Type of land ownership</li> </ol>

Table 4-5 Explanation of Item 8 (Airports)

Item	8. Waste
Description	Generation of construction and demolition waste, debris and general waste
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Generation of debris and construction waste due to construction of the airports</li> <li>2. Generation of general waste from passenger facilities after operation</li> <li>3. Waste from freight facilities.</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. If the airport is located in a coastal zone, aquatic life and birds will be affected by water pollution caused by the inflow of waste into the sea. In case there is no waste disposal site, the aesthetic value will deteriorate.</li> <li>2. An outbreak of pathogenic insects and animals would aggravate the sanitary conditions of the area.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. The impacts would be larger in an area abounding with aquatic life and birds..</li> <li>2. The volume of debris can be estimated from the scale of excavation.</li> <li>3. The volume of waste discharged from aircraft should be examined.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Securing of sufficient waste disposal site</li> <li>2. Establishment of proper waste collection system and disposal system</li> <li>3. Careful construction planing and management</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Volume of the waste, physical and chemical characteristics of the waste</li> <li>2. Land ownership and land use to determine a suitable disposal site</li> </ol>

**Table 4-5 Explanation of Item 9 (Airports)**

Item	9. Hazards ( Risk )
Description	Increase in risk of landslides and aircraft accidents
Cause of Impacts	<ol style="list-style-type: none"> <li>1. Construction of storage facilities for hazardous materials, such as fuel for aircraft</li> <li>2. Occurrence of aircraft accidents</li> <li>3. Large-scale land reclamation</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. The loss of or damage to the lives and livelihood (e.g., production activities, houses and food collection) of inhabitants by hazardous material accidents, aircraft crashing onto the land, destruction of facilities by natural disasters or landslides</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. The possibility of an accident may be higher in an area having complicated topography and unstable meteorology.</li> <li>2. Damage from a disaster would be significant if a project includes such facilities having the possibility of leaking hazardous materials or exploding.</li> <li>3. If large birds inhabit the nearby area, they may collide with aircraft.</li> <li>4. Probability of landslides is higher in the areas where steep hills of soft soil with high porosity exist or where landslides have occurred before.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Selection of the site with low potential for natural disaster</li> <li>2. Installation of a system for minimizing the possibility of a disaster at facilities storing hazardous materials</li> <li>3. Protection of the slopes</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Meteorological study</li> <li>2. Laws and regulations on handling and storage of hazardous materials</li> <li>3. Topographical and geological surveys</li> <li>4. Case study of past natural disasters</li> </ol>

**Table 4-5 Explanation of Item 10 (Airports)**

Item	10. Topography and Geology
Description	Changes to valuable topography and geology by excavation and land reclamation
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Vegetation removal and change of topography for airport construction</li> <li>2. Dredging and reclamation, in the case of a coastal airport</li> <li>3. Change of marine conditions and littoral drift by dredging and reclamation</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Change of topography and geology by large-scale cut and fill</li> <li>2. Cave-ins and upheaval caused by the corruption of soil balance due to large-scale cut</li> <li>3. Occurrence of water pollution and flooding because of landslides and soil erosion caused by the reclamation of an inclined area</li> <li>4. Effect on coastal topography and vegetation by erosion and sedimentation in coastal zone</li> </ol>
Useful Factors for Evaluation	<p>Careful attention should be paid to the following types of areas:</p> <ol style="list-style-type: none"> <li>1. areas which have academically important topography and/or geology,</li> <li>2. areas where coastal erosion and landslides have already progressed,</li> <li>3. areas which have heavy rainfall.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Reexamination of the project contents</li> <li>2. Protection against soil erosion, such as vegetation coverage of slopes</li> <li>3. Restriction of land use in the vicinity</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Topographical and geological survey</li> <li>2. Land use</li> </ol>

Table 4-5 Explanation of Item 11 (Airports)

Item	11. Soil Erosion
Description	Topsoil erosion caused by rainfall after land reclamation or vegetation removal
Cause of Impacts	<ol style="list-style-type: none"> <li>1. Exposure of topsoil and paving of large area because of land reclamation or removal of vegetation for airport construction.</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Loss of topsoil by surface runoff may affect the growth of plants and animals, agriculture and forestry.</li> <li>2. Paving of a large area would reduce permeability and increase surface runoff in a short period of time. This would cause flood and soil erosion.</li> <li>3. Water use and fishery would be affected or degraded in value by water polluted by soil.</li> <li>4. Foundation of airport may be damaged.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. The impacts would be larger in an area having soil of high porosity.</li> <li>2. The impacts would be larger when the water is widely utilized in the surrounding areas.</li> <li>3. It would happen more often in an area having heavy rainfall or intense rainfall in a short period of time and strong wind.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Reexamination of the project contents</li> <li>2. Adequate drainage treatment</li> <li>3. Reexamination of construction schedule and methods</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Water use and land use condition</li> <li>2. Geological survey</li> <li>3. Meteorological survey</li> </ol>

Table 4-5 Explanation of Item 13 (Airports)

Item	13. Hydrological Situation
Description	Change of river discharge and riverbed condition due to inflow of drainage or landfill
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Reclamation and inflow of turbid water during the construction in cases where an airport is located near a lake or river</li> <li>2. Inflow of drainage into lakes and rivers during facility operations</li> <li>3. Large-scale paving of runways, etc.</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Alteration of the lake and river regimes caused by the inflow of turbid water during the construction and the drainage after the operation which would affect the ecosystem</li> <li>2. Change of the river regime which would affect riverside topography</li> <li>3. Effect on the groundwater and surface water regimes due to the paving of a large area which would obstruct the infiltration of rainwater</li> </ol>
Useful Factors for Evaluation	<p>Careful consideration is required under the following conditions:</p> <ol style="list-style-type: none"> <li>1. Fishery and fish farming are prospering in the area.</li> <li>2. There are villages and other public facilities along the lakeshore and riverside.</li> <li>3. The lakes and rivers are utilized as tourism resources.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Reexamination of the project contents</li> <li>2. Study of the adjustment with the basin-wide development plans</li> <li>3. Compensation for water use</li> <li>4. Creation of habitats for valuable aquatic life</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Hydrological survey</li> <li>2. Water use in the area and the condition of industries related to the water use</li> <li>3. Aquatic life</li> </ol>



**Table 4-5 Explanation of Item 14 (Airports)**

Item	14. Coastal Zone		
Description	Coastal erosion and sedimentation due to landfill or change in marine condition		
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; padding: 2px;">Causes of Impacts</td> <td style="padding: 2px;"> <ol style="list-style-type: none"> <li>1. Excavation and dredging for construction of facilities when the airport is constructed on reclaimed land in a coastal zone</li> <li>2. Increase or decrease in sediment supply to the surrounding marine area owing to the change in tide</li> </ol> </td> </tr> </table>		Causes of Impacts	<ol style="list-style-type: none"> <li>1. Excavation and dredging for construction of facilities when the airport is constructed on reclaimed land in a coastal zone</li> <li>2. Increase or decrease in sediment supply to the surrounding marine area owing to the change in tide</li> </ol>
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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; padding: 2px;">Possible Environmental Impacts</td> <td style="padding: 2px;"> <ol style="list-style-type: none"> <li>1. Damage to and loss of mangrove forests and/or coral reefs caused by altered coastal topography, coastal erosion and extinction of tideland due to change of littoral drift, which would affect tourism and fishery</li> <li>2. Impacts on natural environment, including an increase in risk of coastal disaster resulting from the depression of wave dissipation effect by the natural coast</li> </ol> </td> </tr> </table>		Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Damage to and loss of mangrove forests and/or coral reefs caused by altered coastal topography, coastal erosion and extinction of tideland due to change of littoral drift, which would affect tourism and fishery</li> <li>2. Impacts on natural environment, including an increase in risk of coastal disaster resulting from the depression of wave dissipation effect by the natural coast</li> </ol>
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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; padding: 2px;">Measures</td> <td style="padding: 2px;"> <ol style="list-style-type: none"> <li>1. Alternate route selection</li> <li>2. Installation of wave dissipation revetment and breakwater</li> <li>3. Artificial nourishment</li> <li>4. Compensation for damage in fishery</li> </ol> </td> </tr> </table>		Measures	<ol style="list-style-type: none"> <li>1. Alternate route selection</li> <li>2. Installation of wave dissipation revetment and breakwater</li> <li>3. Artificial nourishment</li> <li>4. Compensation for damage in fishery</li> </ol>
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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; padding: 2px;">Related Subjects for Study</td> <td style="padding: 2px;"> <ol style="list-style-type: none"> <li>1. Valuable natural environment, e.g., mangrove forests and coral reefs</li> <li>2. Fishery and related industries</li> <li>3. Industries which utilize the coastal zone</li> <li>4. Case study on disaster related to high waves, etc.</li> </ol> </td> </tr> </table>		Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Valuable natural environment, e.g., mangrove forests and coral reefs</li> <li>2. Fishery and related industries</li> <li>3. Industries which utilize the coastal zone</li> <li>4. Case study on disaster related to high waves, etc.</li> </ol>
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Table 4-5 Explanation of Item 15 (Airports)

Item	15. Fauna and Flora
Description	Obstruction of breeding and extinction of species caused by changes to habitat conditions
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Removal of vegetation and change of topography for airport construction</li> <li>2. Generation of noise and vibration by construction work and airport operations</li> <li>3. Generation of waste by the use of facilities and water pollution due to the inflow of drainage</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Depopulation of terrestrial and aquatic life due to a change in habitat conditions</li> <li>2. Effect on biodiversity if some species become extinct</li> </ol>
Useful Factors for Evaluation	<p>Special attention should be paid to the following cases:</p> <ol style="list-style-type: none"> <li>1. The site includes vulnerable ecosystem, such as mangrove forests, tideland and coral reefs.</li> <li>2. There are some species peculiar to the region.</li> <li>3. There are bilateral and/or multilateral conventions on wildlife.</li> <li>4. There are endangered and/or rare species listed in the Red Data Books by the International Union for Conservation of Nature and Natural Resources ( IUCN ).</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Reexamination of the project contents</li> <li>2. Adequate drainage and waste treatment plan</li> <li>3. Relocation of plants and animals</li> <li>4. Monitoring before and after operation</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Fauna and flora</li> <li>2. Ecological survey of plants and animals</li> </ol>

Table 4-5 Explanation of Item 17 (Airports)

Item	17. Landscape
Description	Change of topography and vegetation by land reclamation. Deterioration of aesthetic harmony by appearance of structures
Cause of Impacts	<ol style="list-style-type: none"> <li>1. Change of topography and vegetation for construction and appearance of airport facilities</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Local landscape and scenery would be changed by the appearance of large-scale artificial landscape components.</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Particular attention should be paid to landscape having academic, religious and tourism values.</li> <li>2. Recreational areas would be susceptible to the impact.</li> <li>3. Special consideration is required in areas having valuable cultural assets.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Attention to the laws and regulations of the host country</li> <li>2. Consideration on arrangement, scale, figure, materials and coloring at the planning stage</li> <li>3. Reforestation using indigenous trees</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Distribution of recreational facilities</li> <li>2. Tourism</li> <li>3. Distribution of natural and cultural landscape</li> </ol>

**Table 4-5 Explanation of Item 18 (Airports)**

Item	18. Air Pollution
Description	Pollution caused by exhaust gas and toxic gas from vehicles and aircraft
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Operation of construction equipment and vehicles</li> <li>2. Takeoff, landing and flight of aircraft, and operation of access vehicles</li> <li>3. Oil spills during refueling</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Air pollution by exhaust gas and dust would harm the health of inhabitants and deteriorate the living environment when there are villages in and around the project site and access roads</li> <li>2. Impacts on plants and animals which are sensitive to air pollution</li> </ol>
Useful Factors for Evaluation	<ol style="list-style-type: none"> <li>1. Attention should be paid to facilities requiring clean air, such as hospitals and rest homes.</li> <li>2. Dust and exhaust gas would affect the inhabitants if the roads around the facilities are unpaved and traffic is heavy.</li> <li>3. Particular attention is required if the project includes the handling and storage of fuels and other hazardous materials, especially volatile substances.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Reexamination of contents of the project, such as location</li> <li>2. Careful construction planning and management</li> <li>3. Dust prevention, such as water sprinkling</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Meteorological data, e.g., wind direction and speed, temperature gradient</li> <li>2. Topographical information concerning valleys and undulations</li> <li>3. Past cases of damage by air pollution</li> <li>4. Air quality standard and regulations</li> </ol>

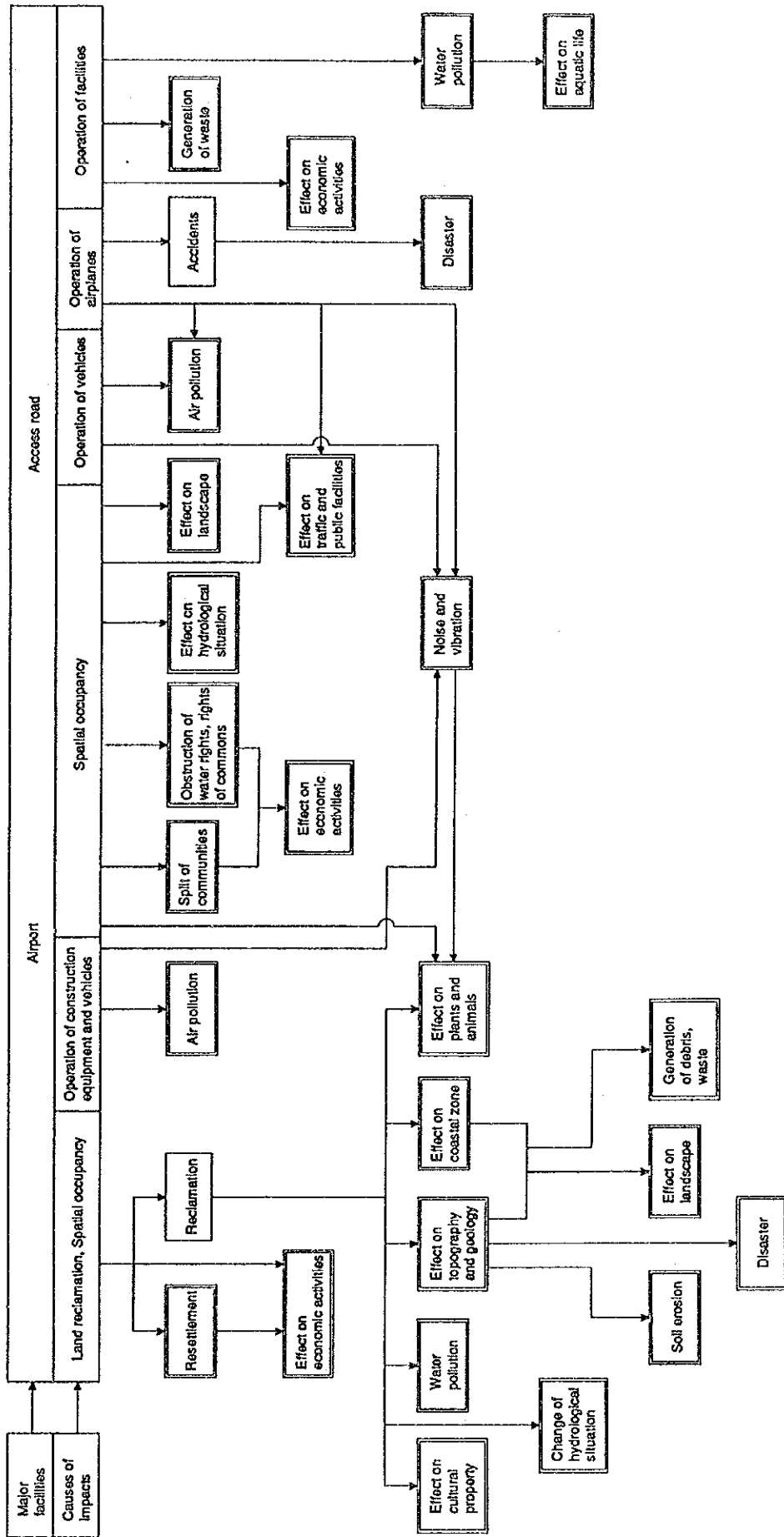
Table 4-5 Explanation of Item 19 (Airports)

Item	19. Water Pollution
Description	Pollution by inflow of silt , sand, and effluent into rivers and groundwater
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Generation of turbid water by rainfall during the construction, inflow and disturbance of sand and silt caused by land reclamation</li> <li>2. Discharge of waste water from airport operation, runoff of spilt oil and dust washed from runways by rainfall</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Effect on aquatic life by polluted water if the drainage is not adequately treated</li> <li>2. Effect on water use of inhabitants and industries which utilize the water zone, such as fishery and tourism</li> <li>3. Health hazards to inhabitants through food chain if drainage contains toxic substances</li> </ol>
Useful Factors for Evaluation	<p>Impacts would be significant under the following conditions:</p> <ol style="list-style-type: none"> <li>1. The water is utilized in the area and downstream of the area.</li> <li>2. Water use industries exist in the area and downstream of the area.</li> <li>3. Valuable aquatic life exists in the area and downstream of the area.</li> <li>4. The drainage flows into closed water or stagnant water zones.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Reexamination of the project contents</li> <li>2. Installation of waste water treatment plant</li> <li>3. Dust prevention and erosion prevention measures</li> <li>4. Proper management and storage of hazardous materials</li> <li>5. Compensation</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Laws and regulations on waste water treatment method and standard</li> <li>2. Water-use and watershed-use industries</li> <li>3. Valuable aquatic species</li> </ol>

Table 4-5 Explanation of Item 21 (Airports)

Item	21. Noise and Vibration
Description	Noise and vibration generated by vehicles, aircraft and factories
Causes of Impacts	<ol style="list-style-type: none"> <li>1. Operation of construction equipment and vehicles for construction and detonations</li> <li>2. Operation of aircraft and by vehicles using the access road</li> </ol>
Possible Environmental Impacts	<ol style="list-style-type: none"> <li>1. Effect on the life of inhabitants, such as by the disturbance of sleep by landings and takeoffs at night. Especially serious at hospitals and schools.</li> <li>2. Obstruction to cattle breeding and the dispersion of wildlife</li> <li>3. Cracks in buildings on soft ground caused by vibrations</li> </ol>
Useful Factors for Evaluation	<p>Impacts would be significant under the following conditions:</p> <ol style="list-style-type: none"> <li>1. There are facilities requiring calm circumstance or in densely populated areas.</li> <li>2. There is an important cattle industry.</li> <li>3. There are valuable wildlife habitats.</li> <li>4. There is weak ground, such as filled land or a clayey soil layer.</li> </ol>
Measures	<ol style="list-style-type: none"> <li>1. Reexamination of the project contents</li> <li>2. Land-use plan of the area</li> <li>3. Use of low noise and vibration construction equipment</li> <li>4. Careful construction planning and management considering schedule of the work</li> <li>5. Compensation for damages</li> </ol>
Related Subjects for Study	<ol style="list-style-type: none"> <li>1. Land use, distribution of inhabitants and public facilities, living condition of inhabitants</li> <li>2. Habitats of valuable wildlife</li> <li>3. Geological survey</li> </ol>

Appendix Flowchart of the Environmental Impacts of Airport Projects



Note :  : Indicates the environmental items shown in Table 4-3.

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