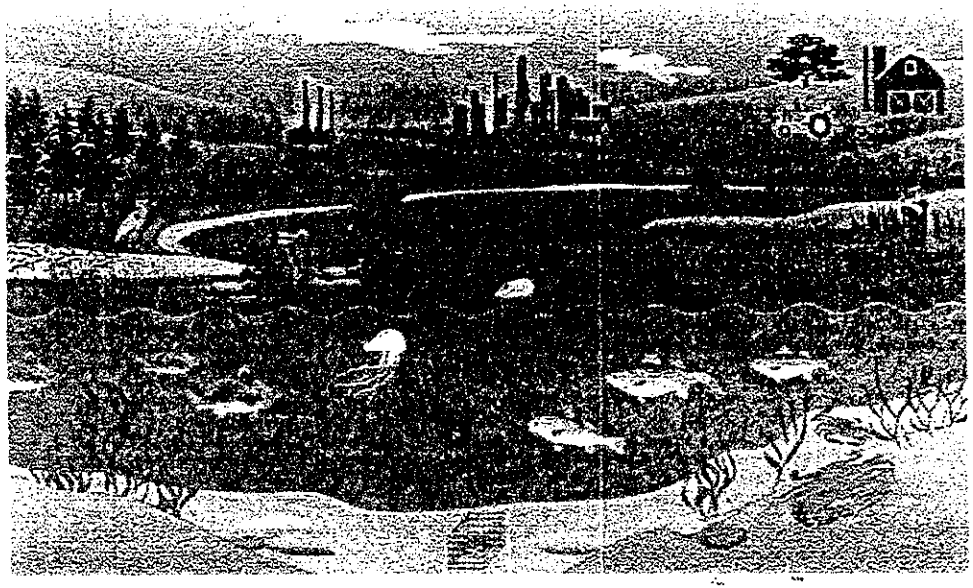
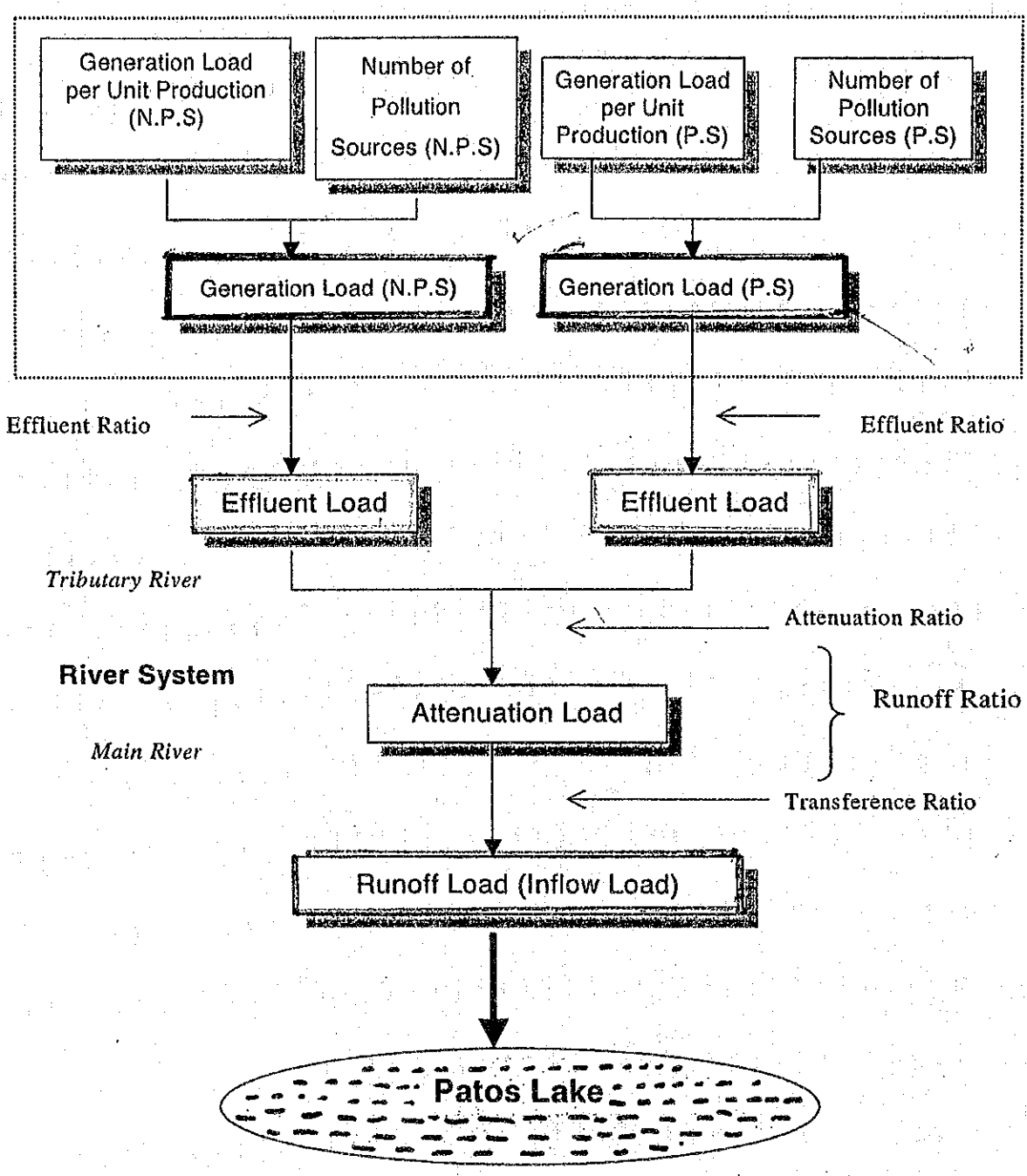
COMPONENT(1)
WATER QUALITY MANAGEMENT PLAN

JICA Study Team: Masahiro TAJIMA



Topics:

- *Calculation Results of Runoff Load flowing into Patos Lake*
- *Preparation of Water Quality Management Plan*



- Runoff Load = Discharge x Concentration
- Runoff Ratio = Attenuation Ratio x Transference Ratio

Fig. 2.1-1 Definition of Load (Generation Load, Effluent Load and Runoff Load)

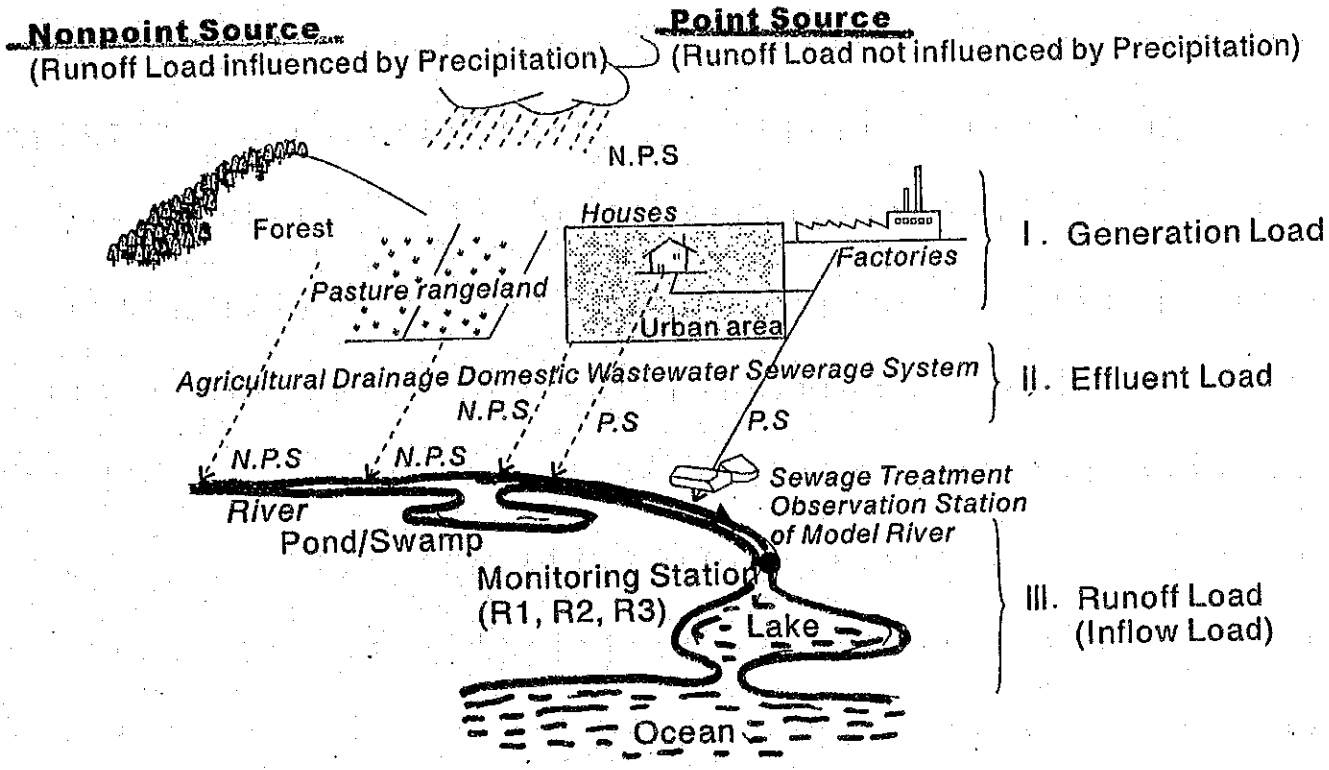
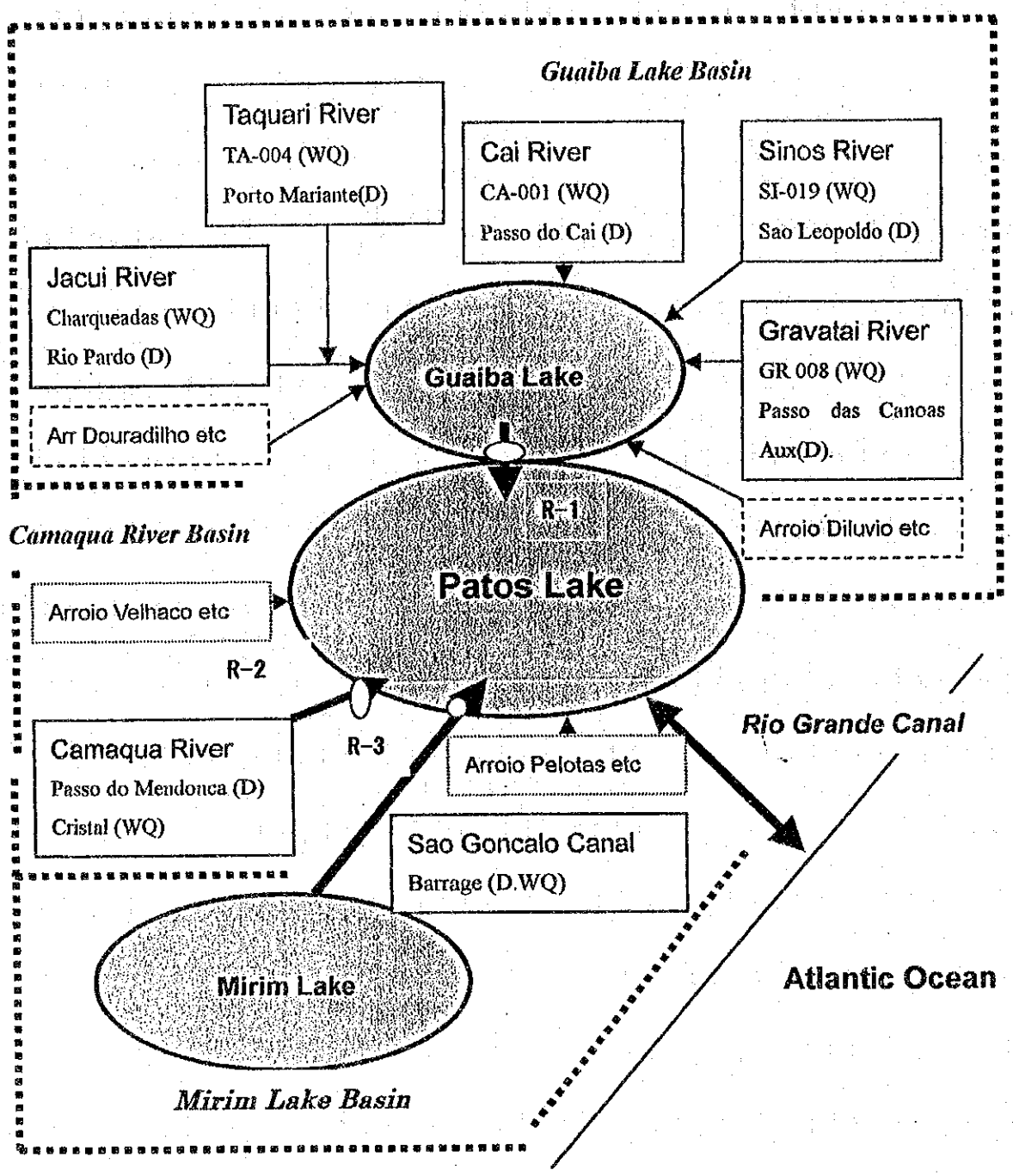


Fig.2.2-1 Definition of Load (Point Source and Nonpoint Source)



Remarks D: Discharge, WQ: Water Quality, R-1,2,3 : Monitoring Stations of JICA Study

Fig. 2.3-1 Runoff Load Inflow Mechanism to Patos Lake

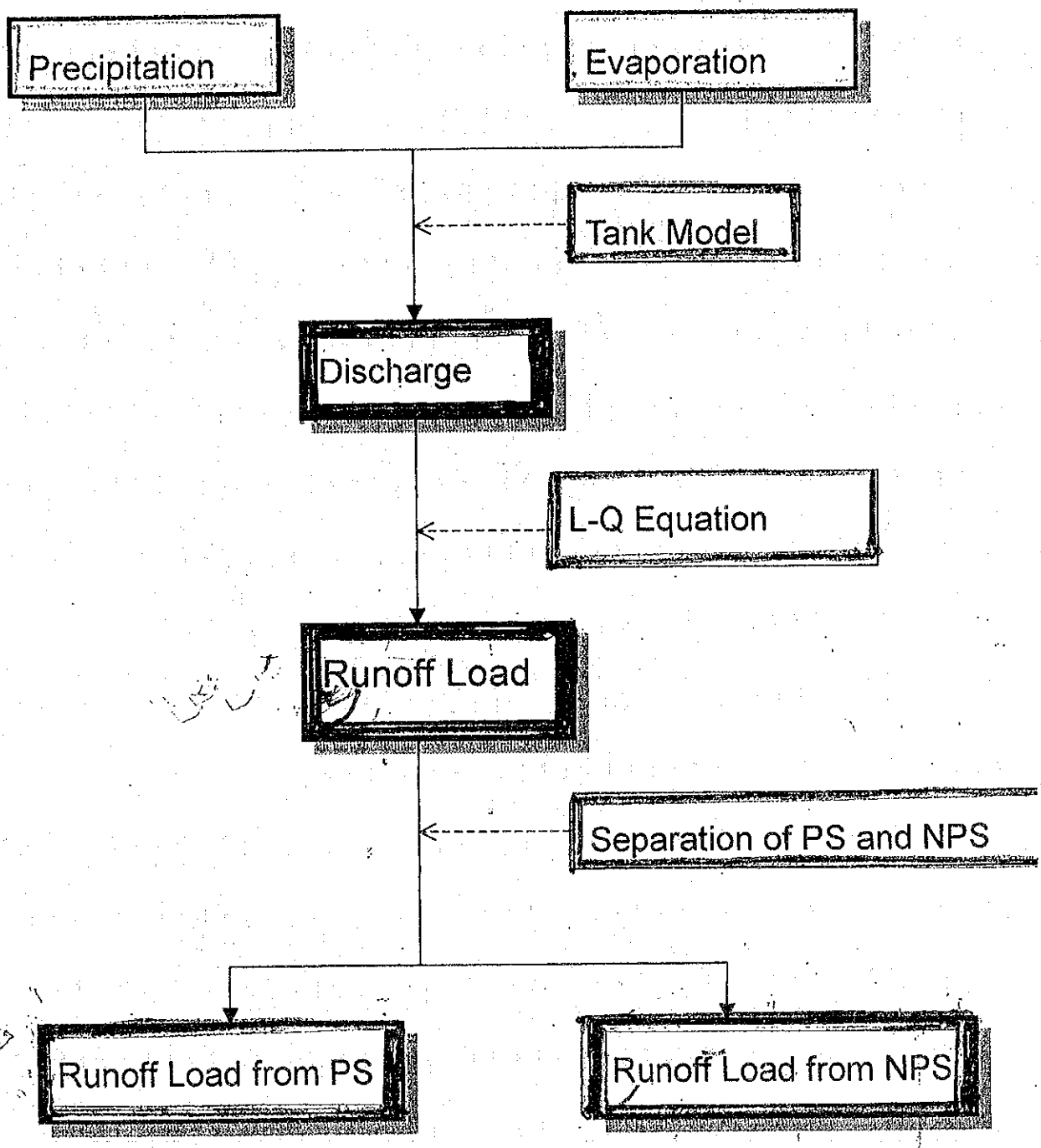
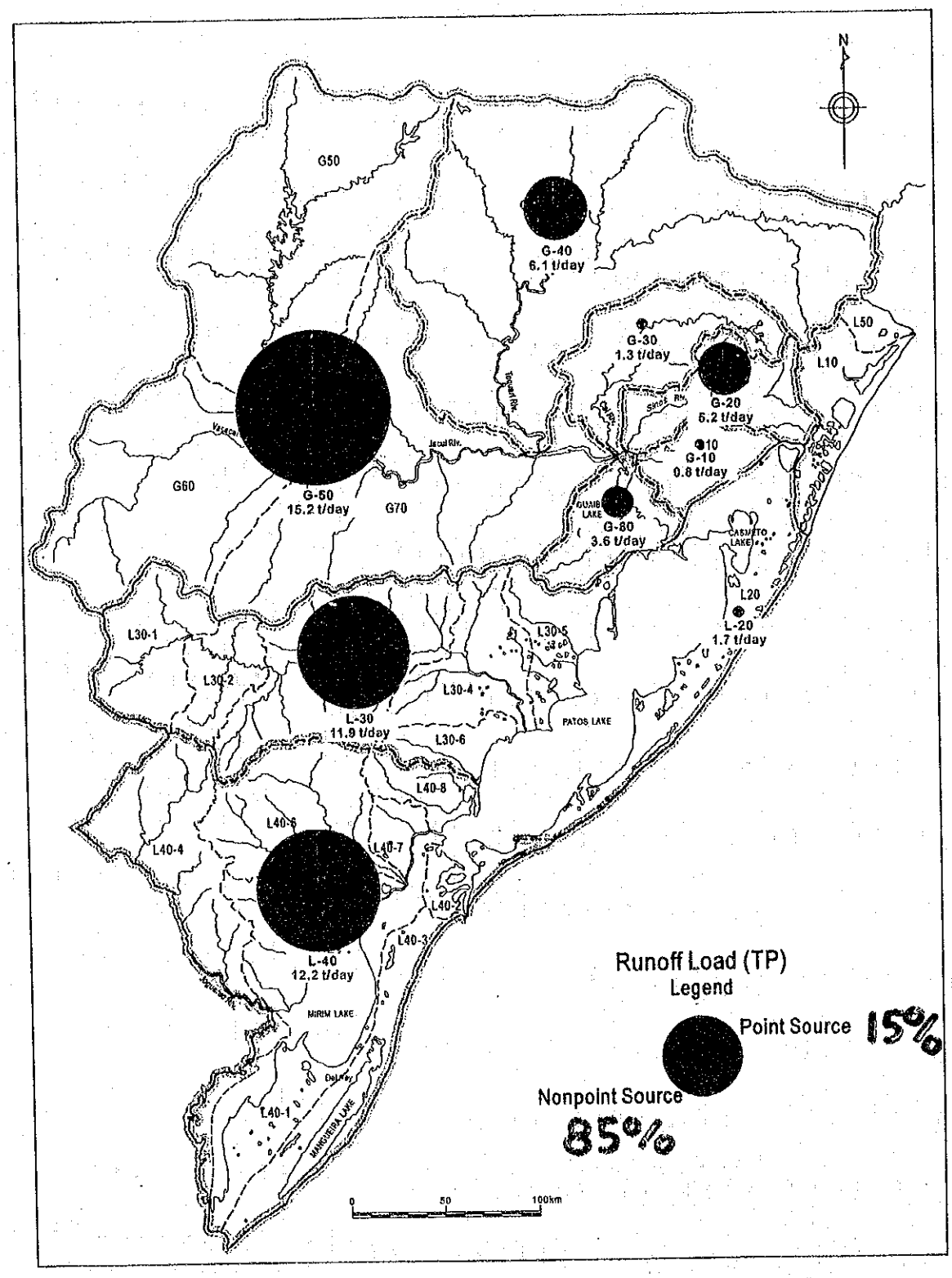
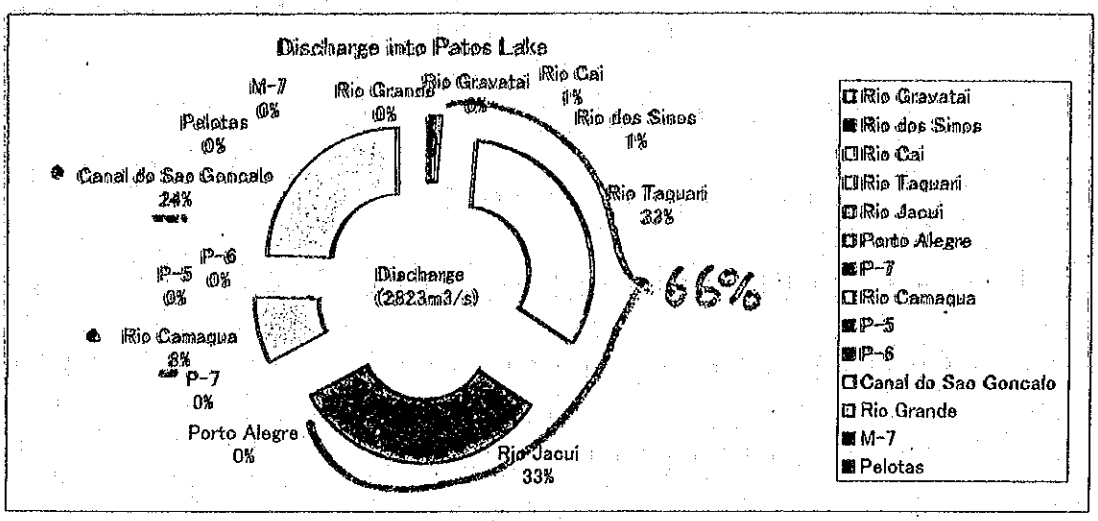


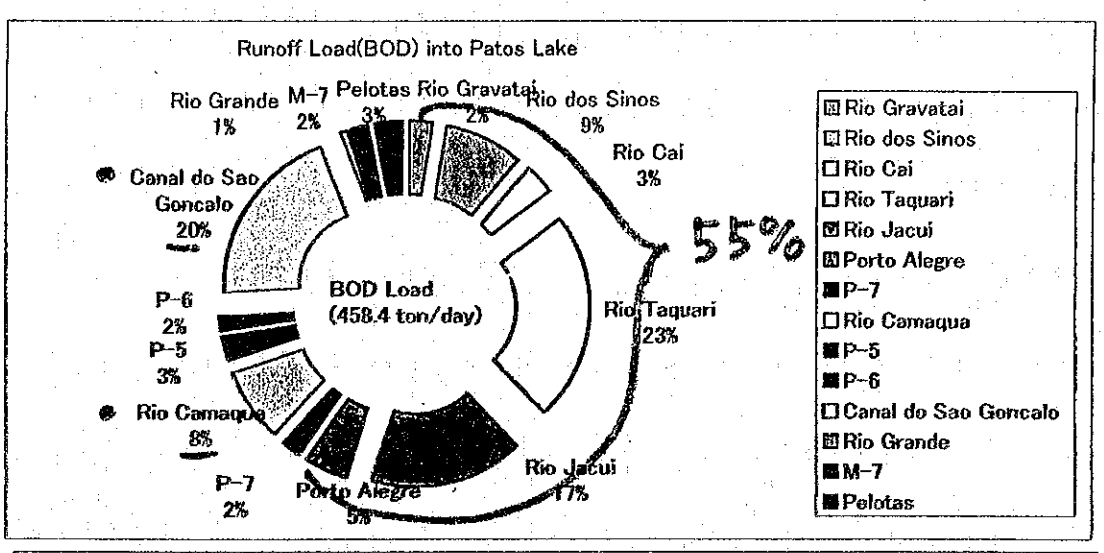
Fig Pollution Load Estimation Model



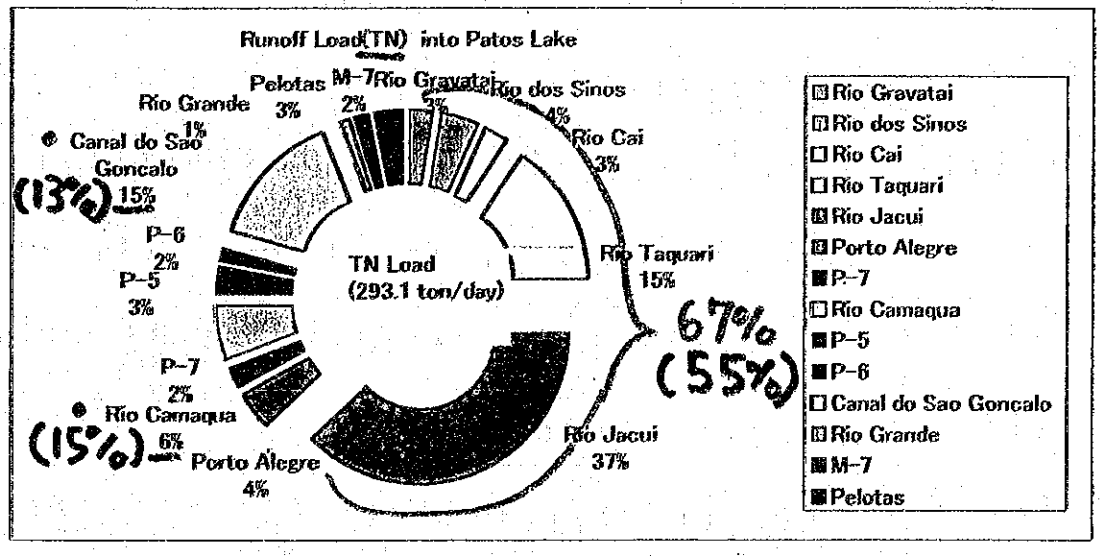
THE STUDY ON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES IN THE FEDERATIVE REPUBLIC OF BRAZIL	Fig. 2-3
JAPAN INTERNATIONAL COOPERATION AGENCY KOKUSAI KOGYO CO., LTD. / PACIFIC CONSULTANTS INTERNATIONAL	Runoff Load from the Sub-basins



Discharge



BOD Load



TN Load
(TP Load)

POL Fig.2-1 Runoff Load flowing into Patos Lake(Total)

( ) : TP

Basic Policy

<TOPICS>

<POLICIES>

① · Reduction of fecal pollution

③ · Reduction of organic pollution

② · Prevention of eutrophication

④ · Understanding the conditions of pesticide pollution

⑤ · Reinforcement of monitoring of industrial pollution sources

⑦ [redacted]

⑥ [redacted]

Promotion of existing plan focusing on point source load measures

- Promotion of domestic wastewater treatment measures
- Promotion of industrial wastewater measures
- Promotion of industrial load reduction measures
- Promotion of measures in the priority areas

Actual start of NPS load reduction measures

- Reduction of agricultural load
- Reduction of urban load

Further improvement of treatment standards and measures to stimulate the natural purification process

[redacted]

[redacted]

[redacted]

Basic viewpoint on water quality management

- Further reduction of BOD, nitrogen and phosphorus
- Elimination of freshwater red tide and water-bloom
- Elucidation of water pollution mechanism of Patos Lake and detailed understanding of pollution sources
- Improvement of natural purification process through conservation and restoration of wetlands
- Establishment of monitoring system

[redacted] : Described in subsequent chapters

7

<MEASURES>

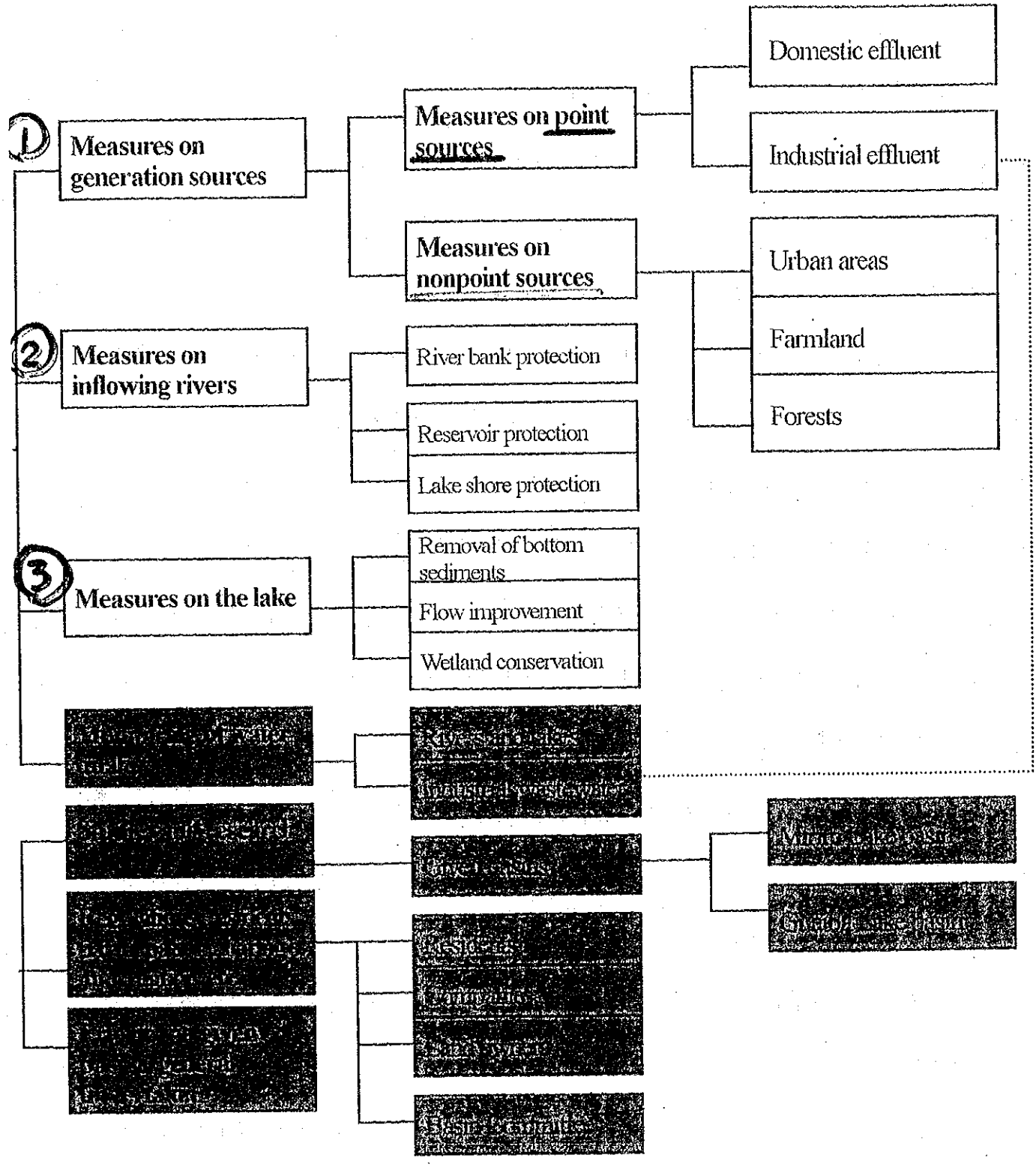

1
Measures on generation sources
Measures on point sources
Domestic effluent
Industrial effluent
Measures on nonpoint sources
Urban areas
Farmland
Forests
2
Measures on inflowing rivers
River bank protection
Reservoir protection
Lake shore protection
3
Measures on the lake
Removal of bottom sediments
Flow improvement
Wetland conservation

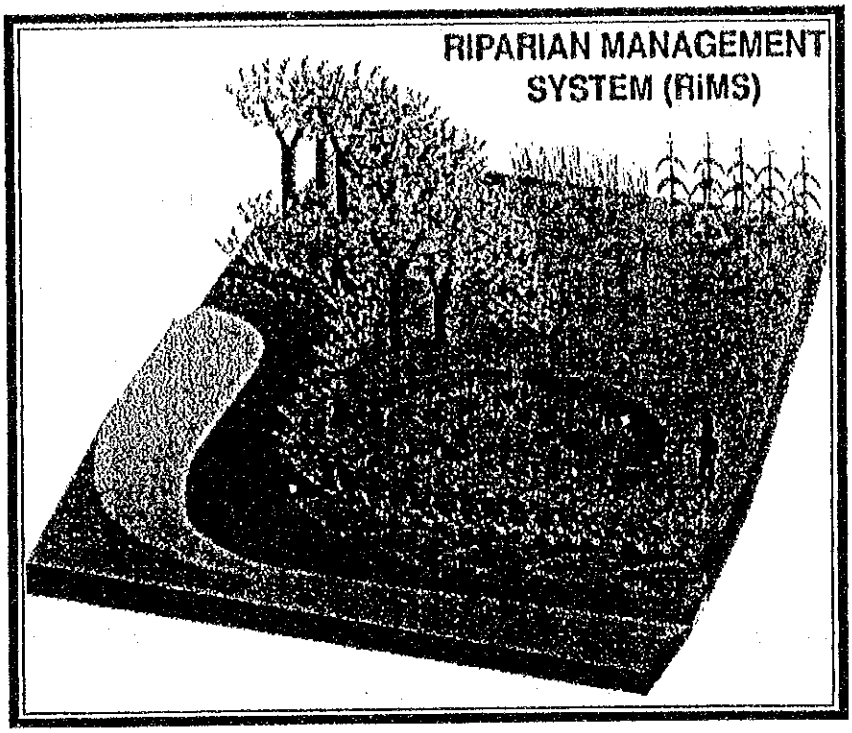
Table 5-2 Comparative Evaluation among Load Reduction Measures

Object (wastewater)	Method	Load Reduction Rate (%)				Evaluation Items						Comprehensive Evaluation
		BOD	TN	TP	TSS	Load reduction effect	Cost effective ness	Quickness in effect	Local suitability	Technical ease	Impact on Environment	
Domestic w.w.	Oxidation ditch+wetland	90	90	80	90	◎	○	○	○	○	○	◎
	Stabilization pond	90			90	○	◎	○	○	◎	○	◎
	Activation sludge method	90			90	○	△	○	○	○	○	○
	Combined type private sewerage system	65			65	△	■	○	○	■	◎	△
Industrial w.w.	Wastewater treatment Plant					◎	△	○	○	○	○	○
	Adequate treatment of Sludge					○	△	○	○	○	○	○
	Cleaner production					○	○	○	■	○	○	○
Urban w.w.	Retardation pond	10-90	10-90	10-90	50-90	○	○	○	○	○	○	○
	Artificial wet pond	20-80	0-40	0-80	50-90	○	○	○	○	○	○	○
	Improvement of solid waste collection rate	20-28	3.6	1.7	25-40	○	○	△	○	○	○	○
Agricultural w.w. (Field)	Reduced Tillage system		55	45	75	○	○	○	○	○	○	○
	Diversion System		10	30	35	○	△	△	○	○	○	○
	Terrace System		20	70	85	○	△	△	△	○	○	○
	Tilter Strip		70	70	65	○	○	○	○	○	○	○
	Fertilization control		15	35	-	○	○	○	○	○	○	○
	Riparian buffer strip (Width:4.1m)		4.0	28.5	61	◎	○	○	○	○	○	○
	Riparian buffer strip (Width:9.2m)		22.7	24.2	74.6	◎	○	○	○	○	○	○
Agricultural w.w. (Paddy)	Controlled Drainage		45	47	25	○	○	○	○	○	◎	○

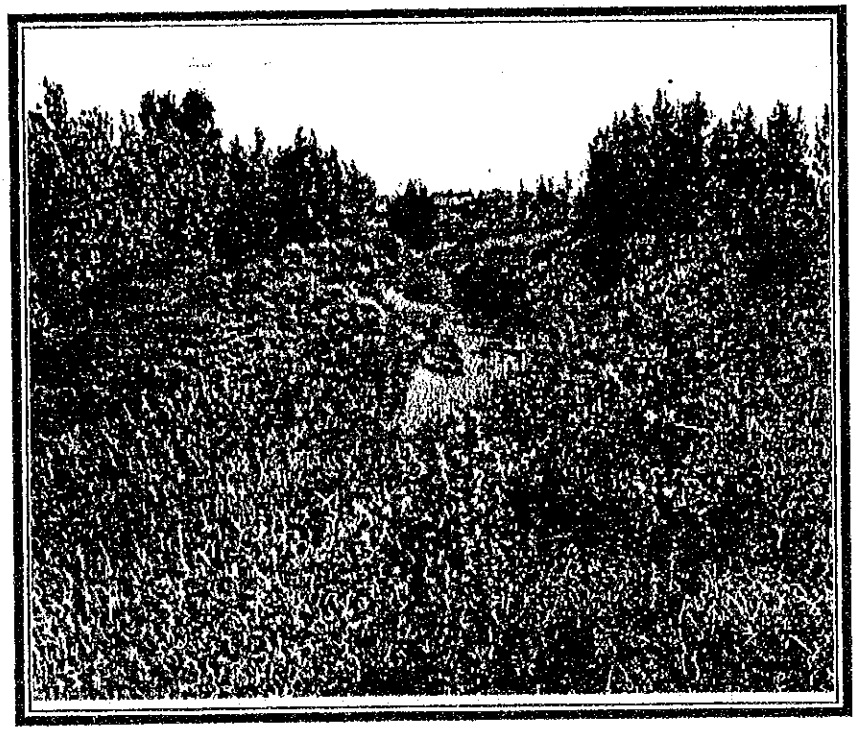
Note:◎:Excellent,○:Fair,△:Good,■:Poor, U:Unknown, Source:

Load reduction rate was quated from the following materials

1) IDI-Japan(1993) : Technical guidelines for the treatment of urban wastewater and sewage in developing countries
2) EPA(19992) : Guideline specifying management measures for source of nonpoint pollution in coastal waters
3) North Carolina State University(1997) : Selected agricultural best management practive to control nitrogen in Nuese river basin



Model of a Riparian Management System



A four-year old multi-species buffer strip.

Results

Table 5.3-4 Scope of Measures to Reduce TP Inflow Load by 20%

	Target	Method	Scope
Point source	Domestic wastewater	• Sewerage treatment	• Establishment of sewer systems covering the whole urban area (target population: 620,000) • In addition to existing wastewater treatment plants, establishment of wet ponds for N and P removal • Establishment of sewerage treatment plants in 5 cities, including Pelotas. • Implementation of leachate countermeasures at waste disposal sites (2 sites)
	Industrial wastewater	• Construction of wastewater treatment plants • Regulations on factory wastewater • Reinforcement of monitoring	• Reinforcement of monitoring for the factories located in the Mar de Dentro district
Nonpoint source	Urban area	Establishment of retardation ponds	• Implementation of countermeasures to 50% of the urban land area
	Paddy/pasture	• Dissemination of appropriate water management techniques • Establishment/dissemination of riparian buffer strip	• Implementation of countermeasures to 50% of the paddy/pasture land area • Model area (AUD area)
	Pasture	Establishment/dissemination of riparian buffer strip	• Implementation of countermeasures to 50% of the pasture land area
	Upland crop /pasture	Dissemination of tillage system	• Implementation of countermeasures to 50% of the upland crop/pasture land area • Model area for soil conservation measures (Sutil, Duro, Cangucu areas)

Note: It is assumed that no countermeasures will be applied to forests, wetlands, seashore/bare land and water areas.

COMPONENT(2): SEWAGE TREATMENT PLAN

Basic Policy

(1) Service Population

- The domestic wastewater from the 5 municipalities will be fully (100%) treated by 2010

(2) Sewage Collection Method and Sewage Targeted for Treatment

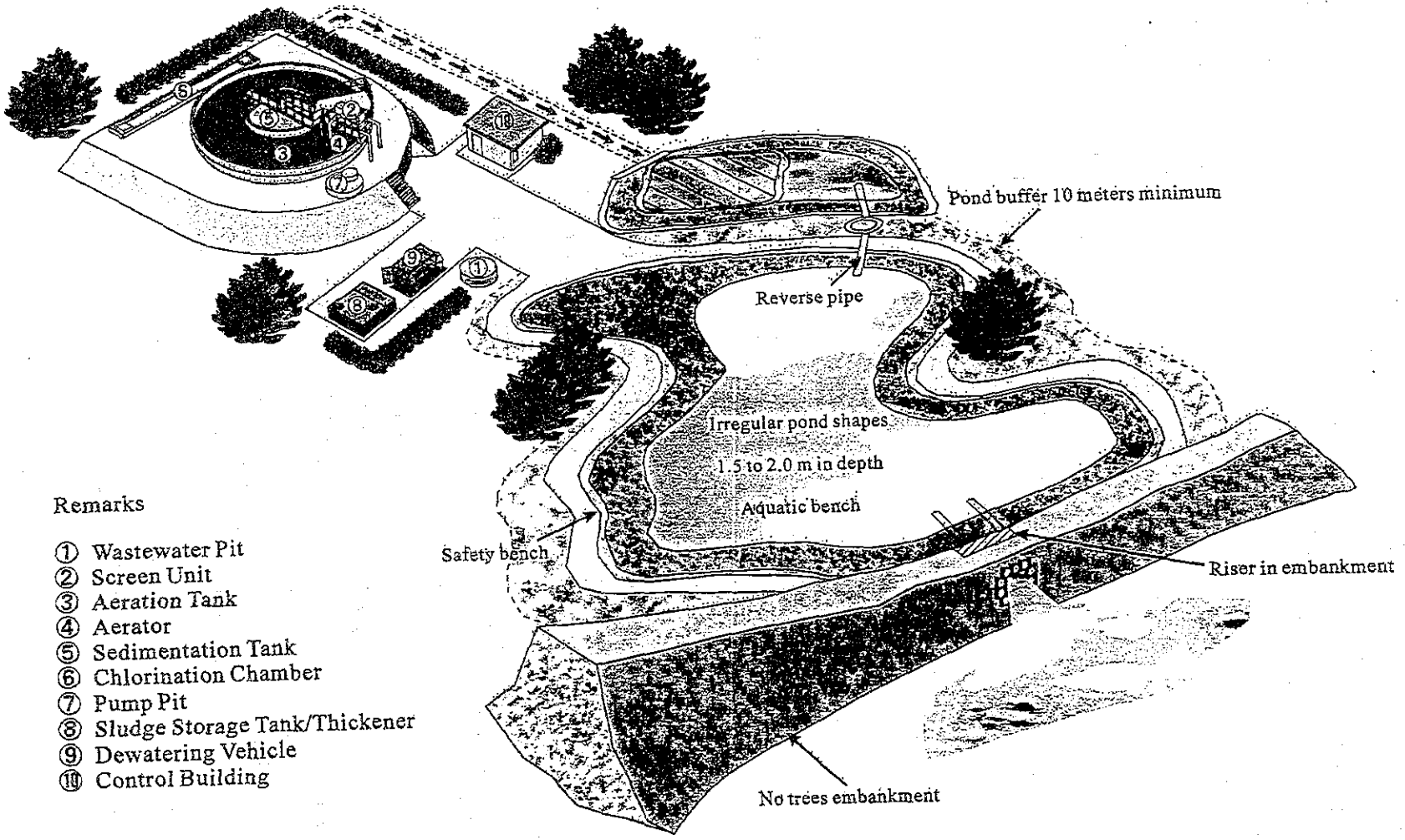
- Separate type sewerage system
- Domestic wastewater (night soil + wastewater). (Rainwater and industrial wastewater are not collected).

(3) Treatment Method

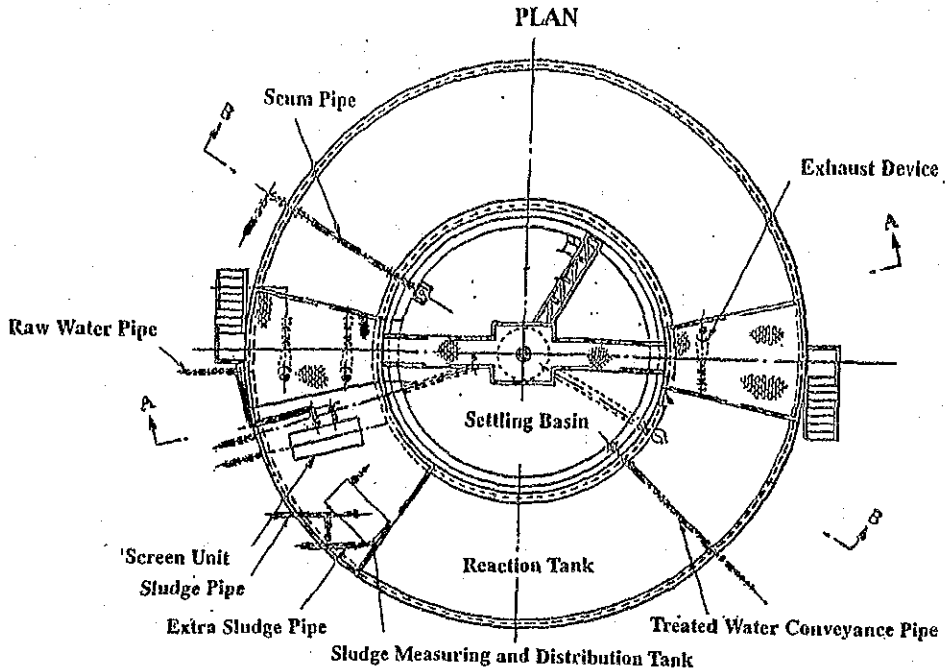
- Oxidation ditch + wetland treatment method

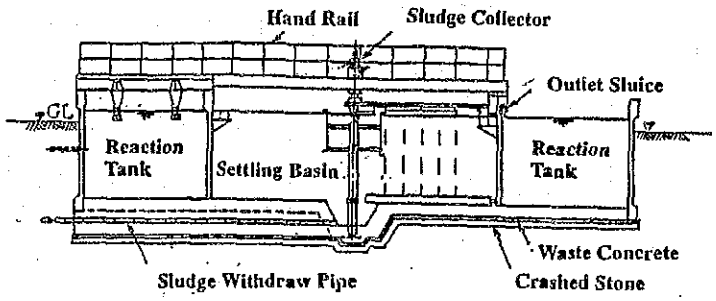
(4) Number and Scale of Treatment Plants

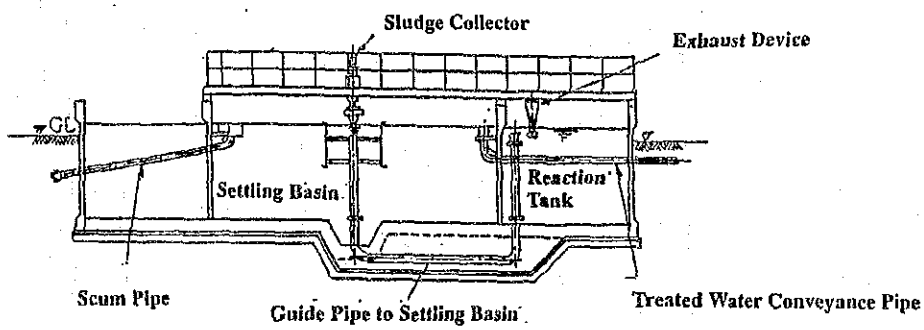
- Distributed treatment
- Units and scale of the oxidation ditch



THE STUDY ON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES IN THE FEDERATIVE REPUBLIC OF BRAZIL	Fig. 6-1
JAPAN INTERNATIONAL COOPERATION AGENCY KOKUSAI KOGYO CO., LTD. / PACIFIC CONSULTANTS INTERNATIONAL	Schematic View of a Sewage Treatment System by *Combination of Oxidation* Ditch and Wetland



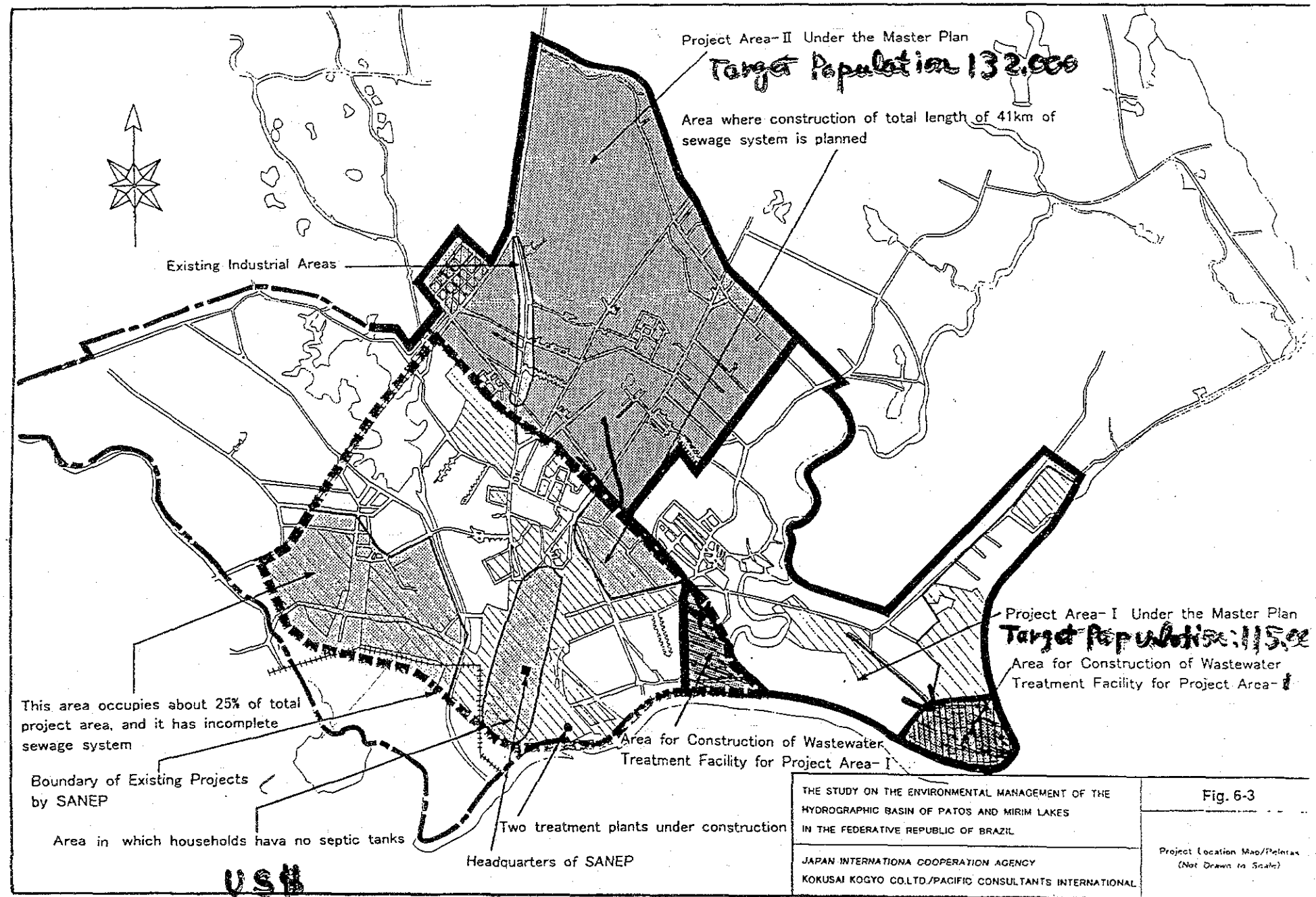




Original drawing is taken from [The Design and Planning Criteria for Sewage Facilities] prepared and printed by JAPAN Sewage Association In 1994.

THE STUDY ON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES IN THE FEDERATIVE REPUBLIC OF BRAZIL	Fig. 6-2
JAPAN INTERNATIONAL COOPERATION AGENCY KOKUSAI KOGYO CO., LTD. / PACIFIC CONSULTANTS INTERNATIONAL	Schematic Structural View of an Oxidation Ditch

Pelotas

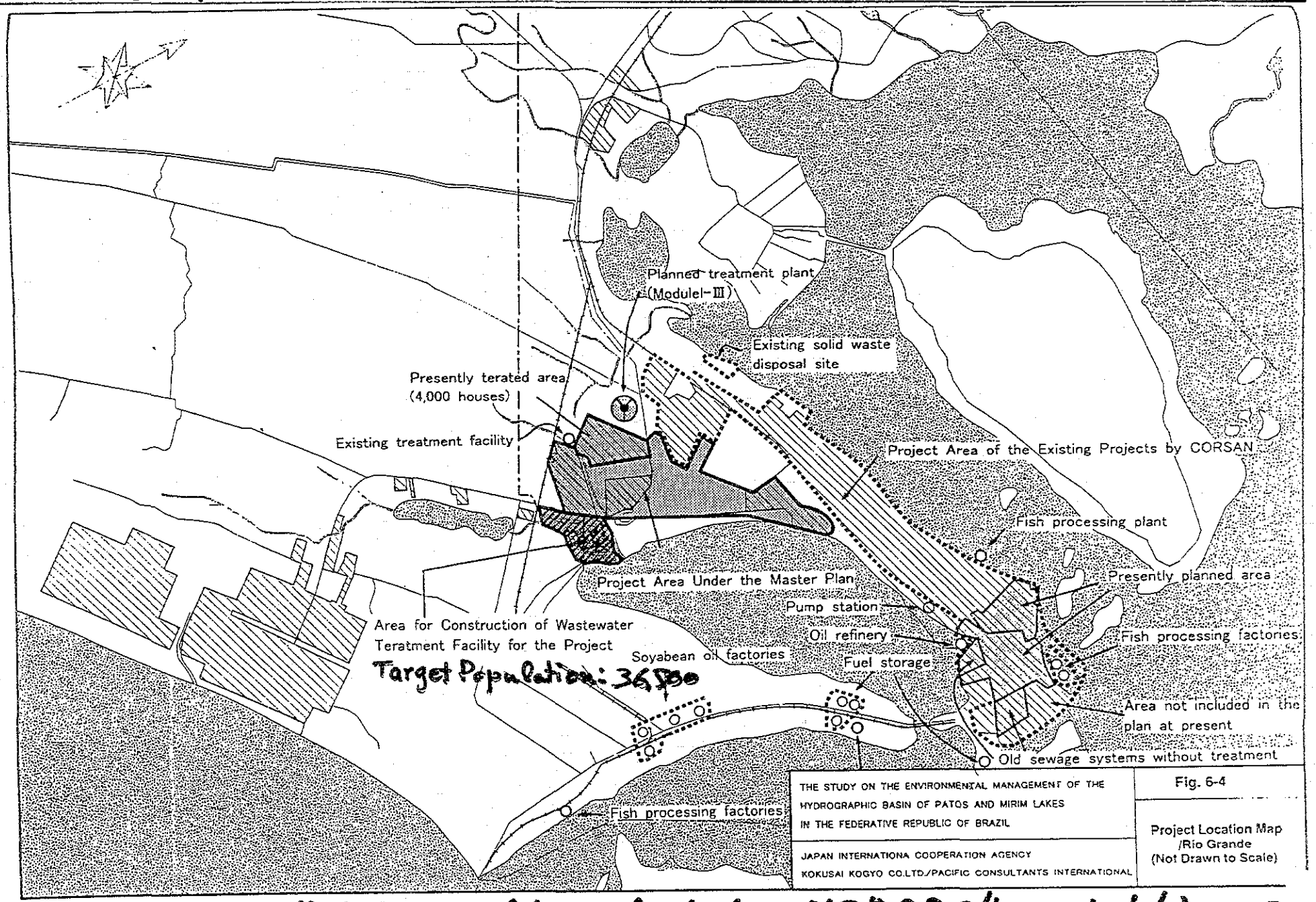


THE STUDY ON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES IN THE FEDERATIVE REPUBLIC OF BRAZIL	Fig. 6-3
JAPAN INTERNATIONA COOPERATION AGENCY KOKUSAI KOGYO CO.LTD./PACIFIC CONSULTANTS INTERNATIONAL	Project Location Map/Pelotas (Not Drawn to Scale)

US$

Cost: 25.900.000 (Annual O/M fee : US$ 23.2/household)

Rio Grande



Cost: US$ 5,500,000 (Annual O/M fee: US$ 23.2/household) 15

COMPONENT(3) : SOLID WASTE MANAGEMENT PLAN

Basic Policy

(1) Development of a Sanitary Landfill Site

(2) Reduction of Disposal Amount

- Recycling and composting of organic waste.

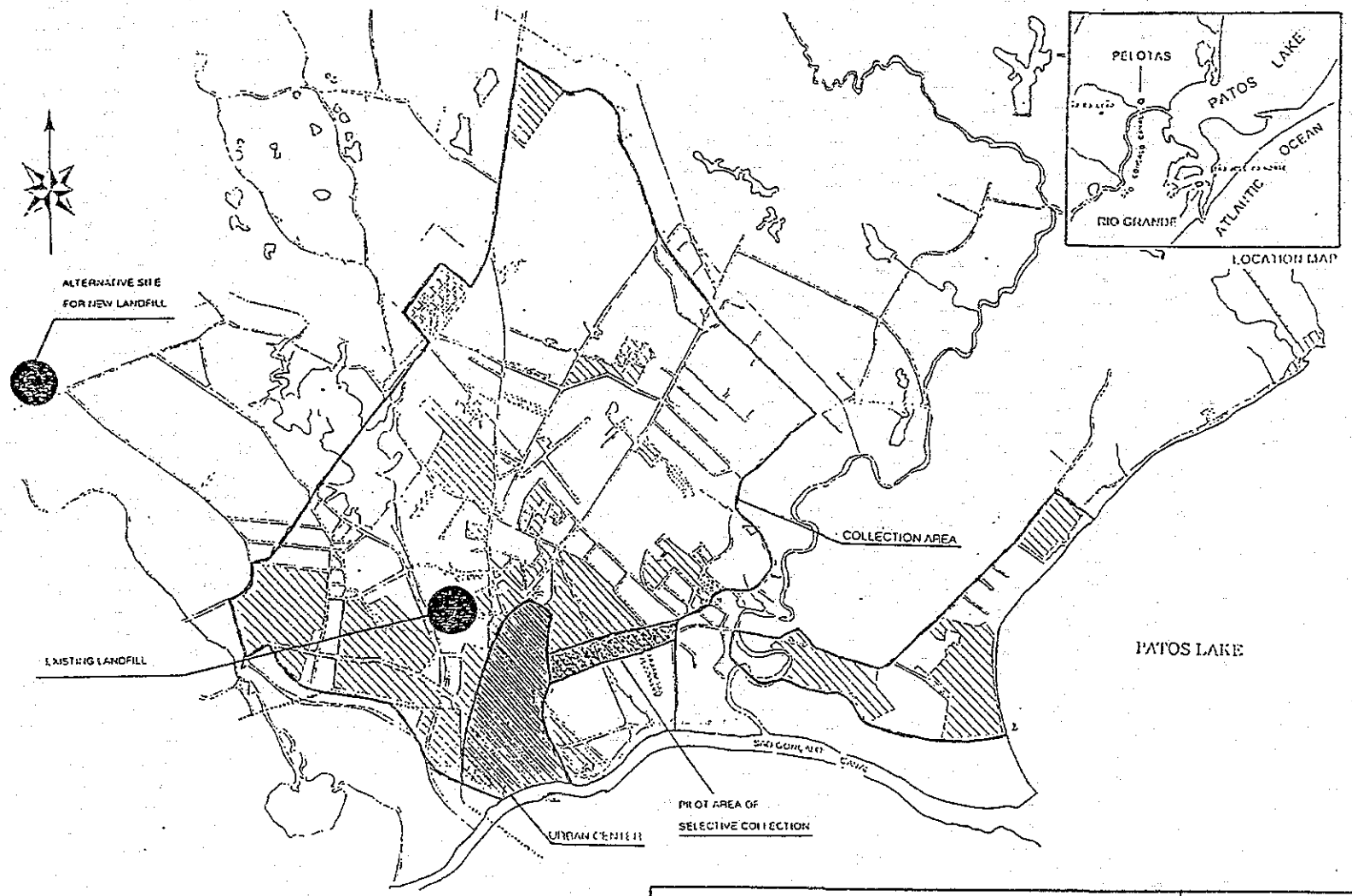
(3) Management of Medical Waste

(4) Improvement of the Collection System

(5) Beneficiaries' Share in the Operation and Maintenance Cost

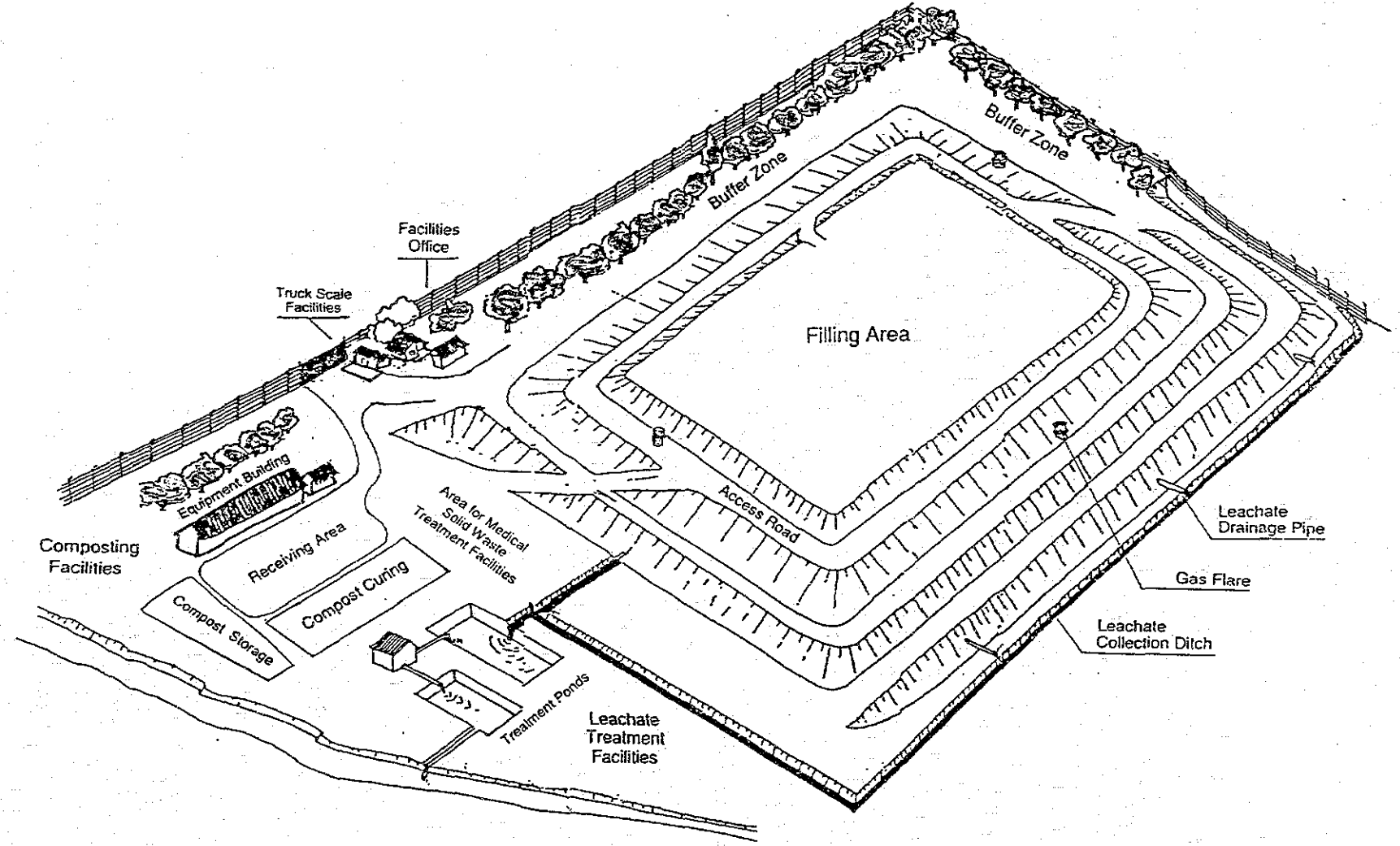
(6) Resident Participation Management

Pelotas

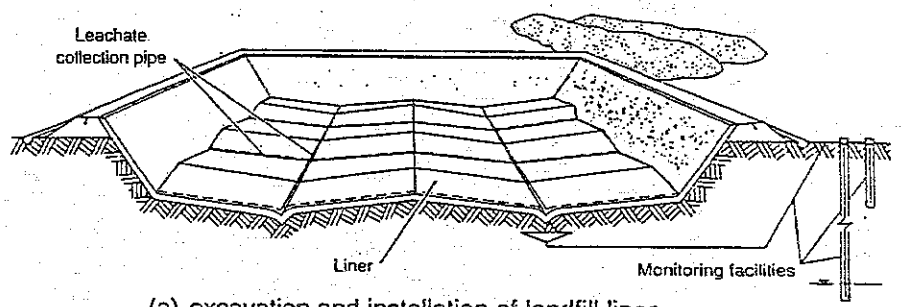


THE STUDY ON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES IN THE FEDERATIVE REPUBLIC OF BRAZIL JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 7-3 Location of Existing and Alternative Site for New Landfill in Pelotas

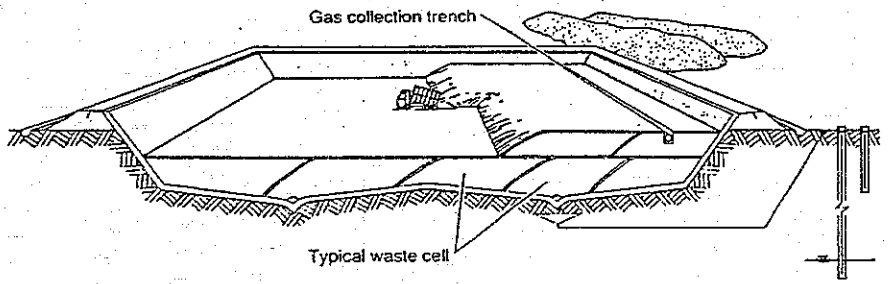
87



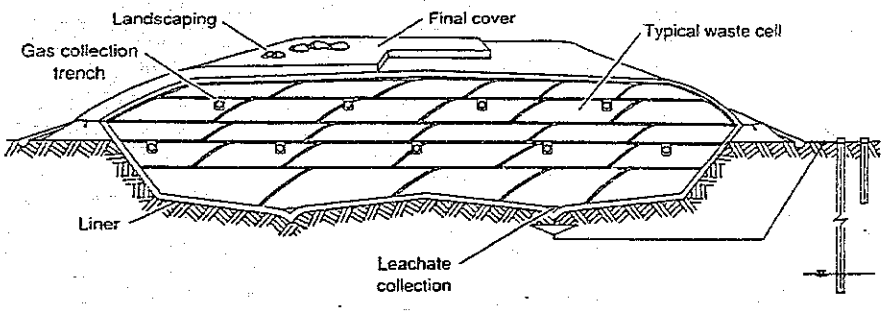
THE STUDY ON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES IN THE FEDERATIVE REPUBLIC OF BRAZIL	Fig. 7-1
JAPAN INTERNATIONAL COOPERATION AGENCY KOKUSAI KOGYO CO., LTD. / PACIFIC CONSULTANTS INTERNATIONAL	General View of a Solid Waste Sanitary Landfill



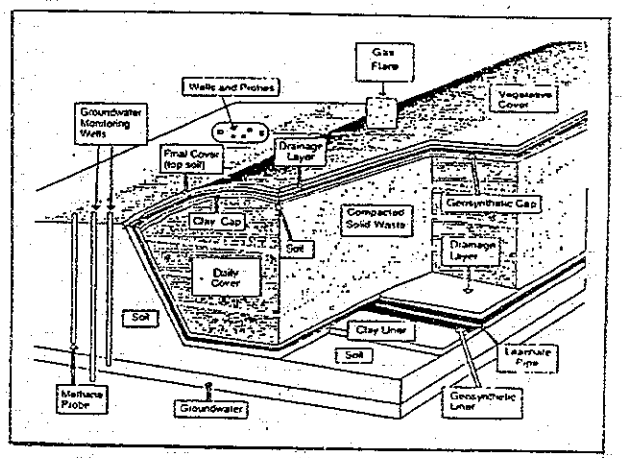
(a) excavation and installation of landfill liner



(b) placement of solid waste in landfill

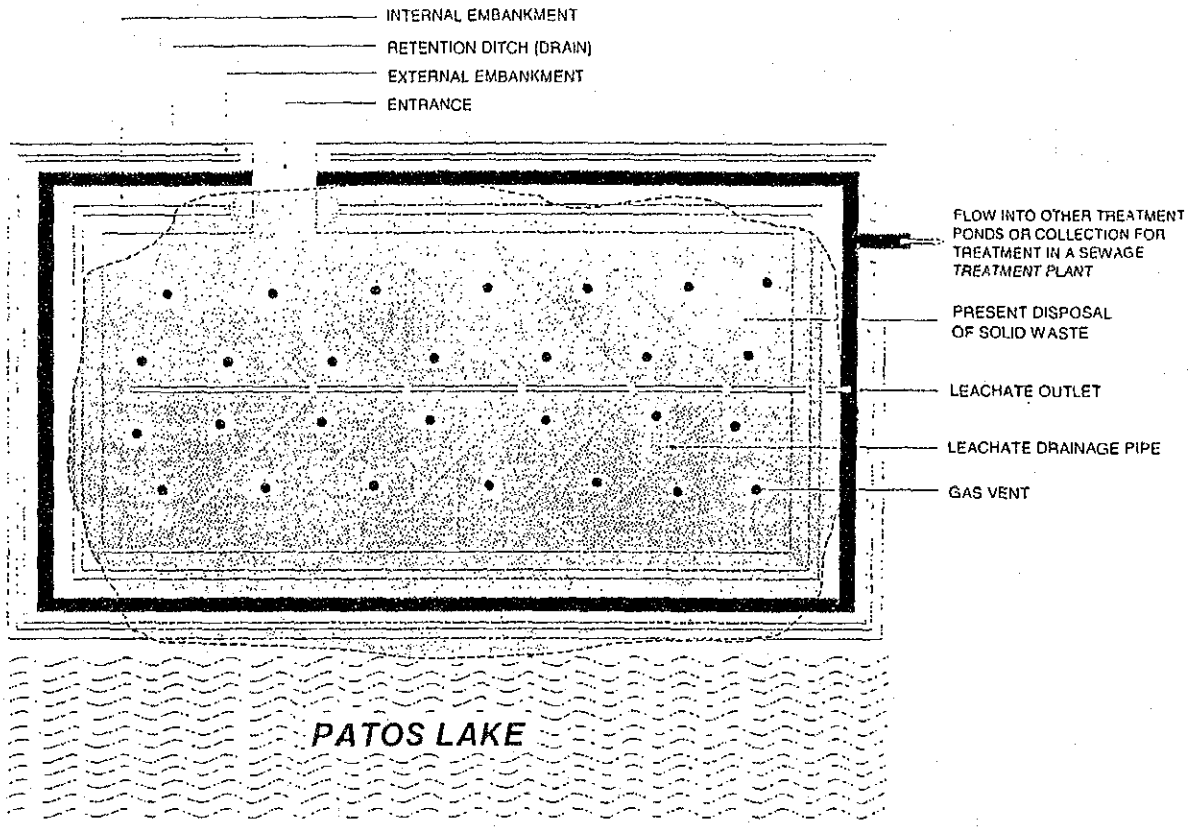


(c) cutaway through completed landfill

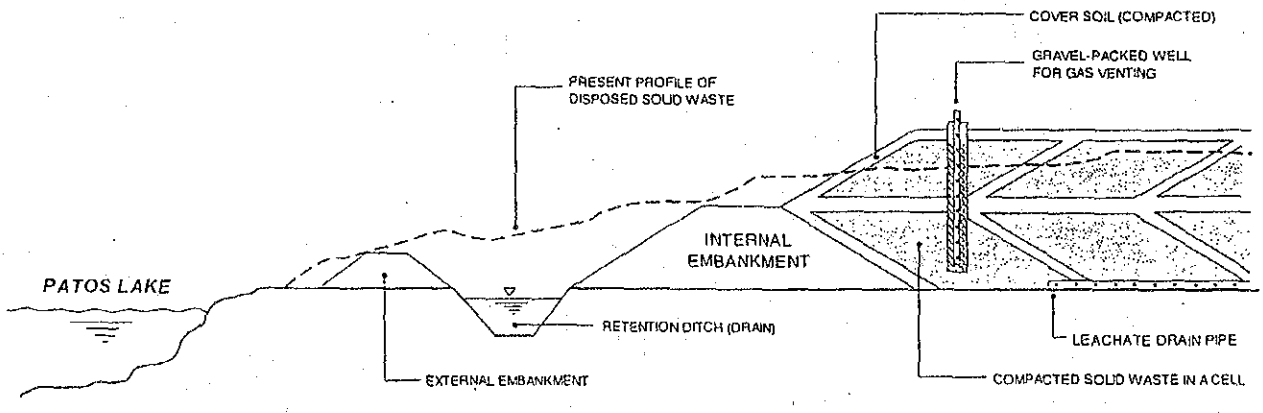


Detail of a Sanitary Landfill Construction

THE STUDY ON THE ENVIRONMENTAL MANAGEMENT OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES IN THE FEDERATIVE REPUBLIC OF BRAZIL	Fig. 7-2
JAPAN INTERNATIONAL COOPERATION AGENCY KOKUSAI KOGYO CO., LTD. / PACIFIC CONSULTANTS INTERNATIONAL	Development and Completion of a Solid Waste Sanitary Landfill



SCHEMATIC LAYOUT



LATERAL SECTION (PARTIAL)

THE STUDYON THE ENVIRONMENTAL MANAGEMENT
OF THE HYDROGRAPHIC BASIN OF PATOS AND MIRIM LAKES
IN THE FEDERATIVE REPUBLIC OF BRAZIL

JAPAN INTERNATIONAL COOPERATION AGENCY
KOKUSAI KOGYO CO., LTD./ PACIFIC CONSULTANTS INTERNATIONAL

Schematic Layout of Mitigation Measures for the Rio Grande Disposal Site

OHP1

Conservaçao da Agua e de Solos

August 09, 2000

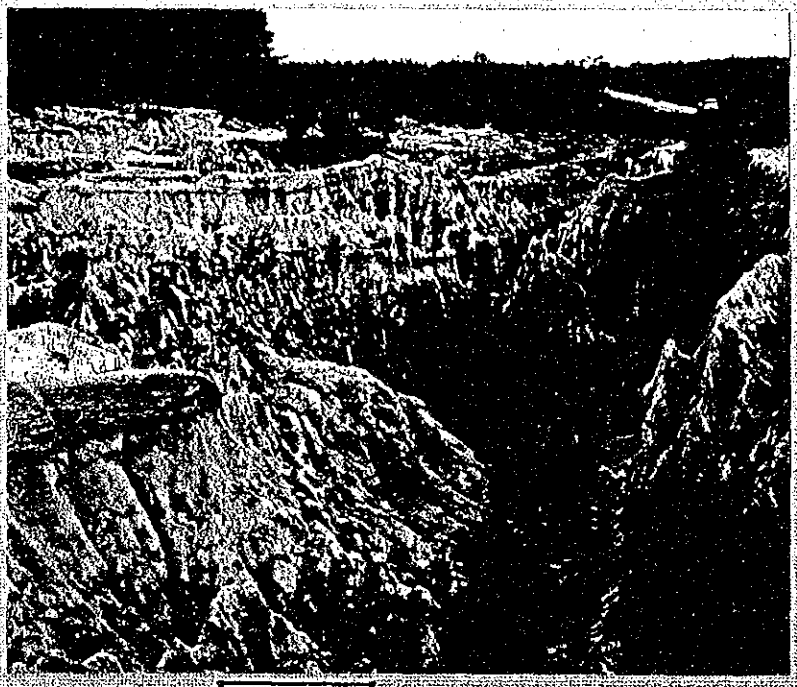
JICA Study Team

Shinichiro MATSUMOTO

- Erosão na Área do Mar de Dentro (OHP-3, 4)
- Capacidade de Uso do Solo (OHP-5)
- Mapa de Geologia, Solo e Uso do Solo (OHP-A)
- Uso do Solo e Declive na Área do Mar de Dentro (OHP-B)
- Proposta de Mapa de Risco de Erosão (OHP-6)
- Contramedidas `a Erosão (OHP-7)
- Fotos de Contramedidas (OHP-8, 9, 10)
- Relação entre Agricultura e Meio Ambiente (OHP-C)
- Restrições e Planos Necessários (OHP-11)
- Projeto de Canguçu (OHP-12, 13)
- Projeto dos Arroios Sutil e Duro (OHP-14, 15)
- Planejamento Participativo (OHP-D)
- Construção de Consenso Conforme o Propósito (OHP-19)

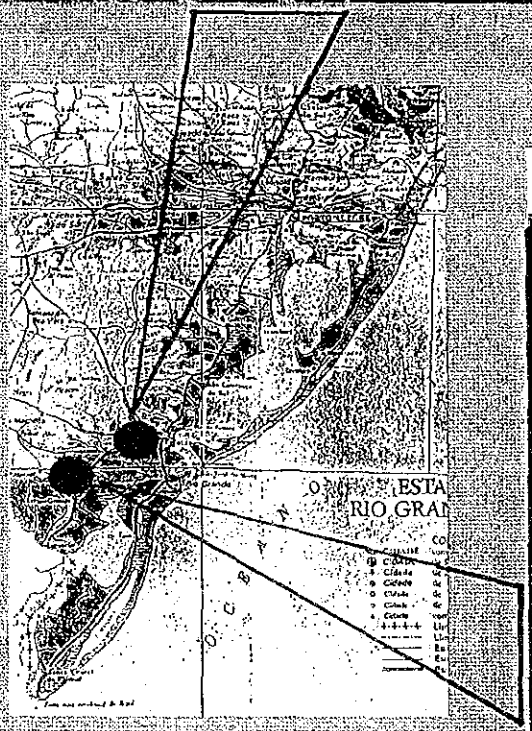
OHP3

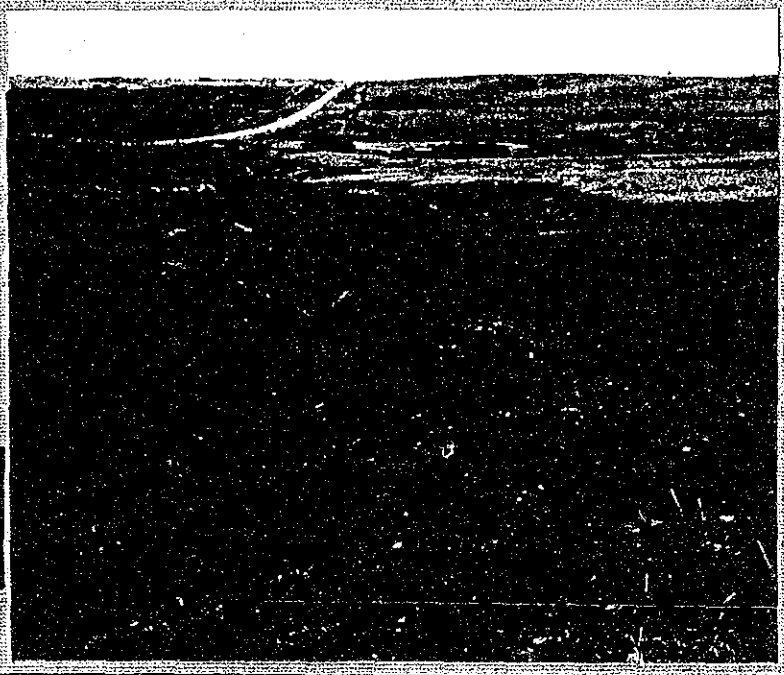
Soil Erosion in Mar de Dentro



Along BR-116
near Pelotas

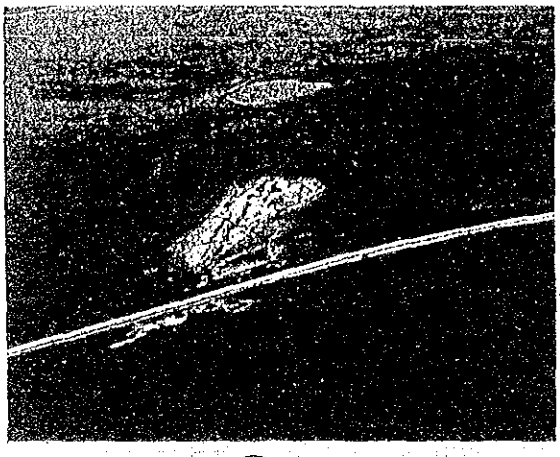
Along BR-116
in Sub-basin L40-5



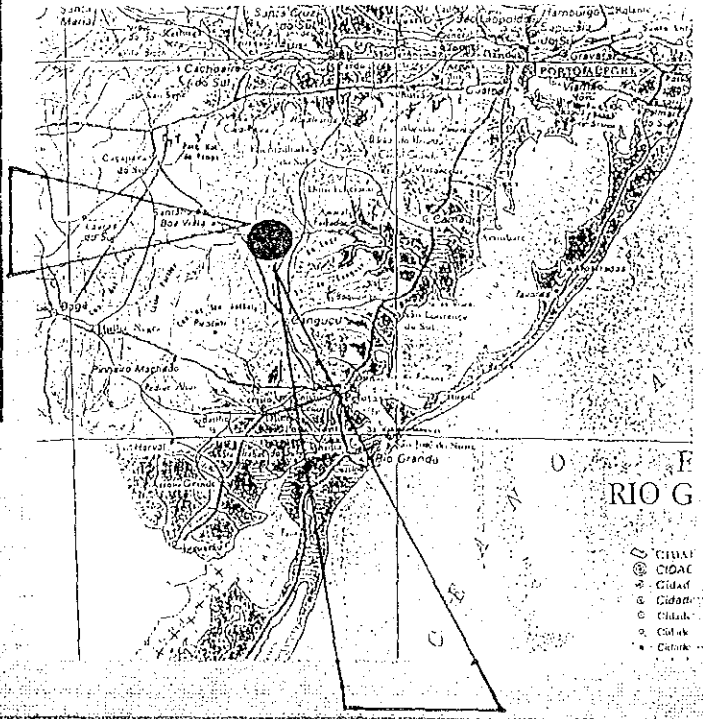


OHP4

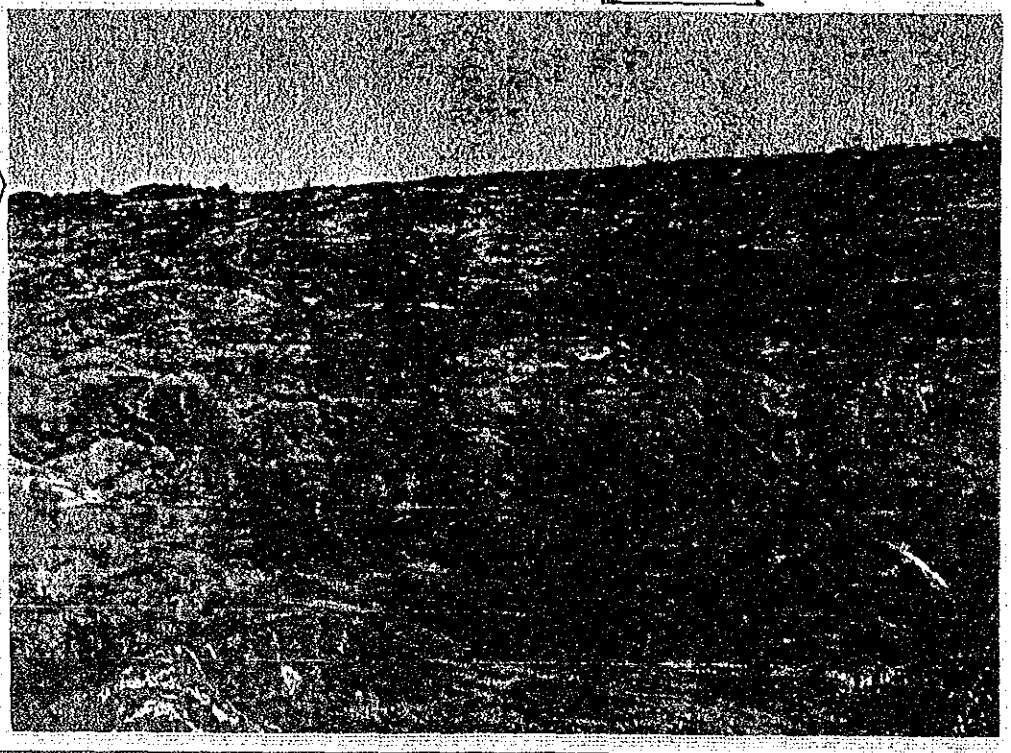
Soil Erosion in Mar de Dentro



Along BR-471 in
Sub-basin L30-3

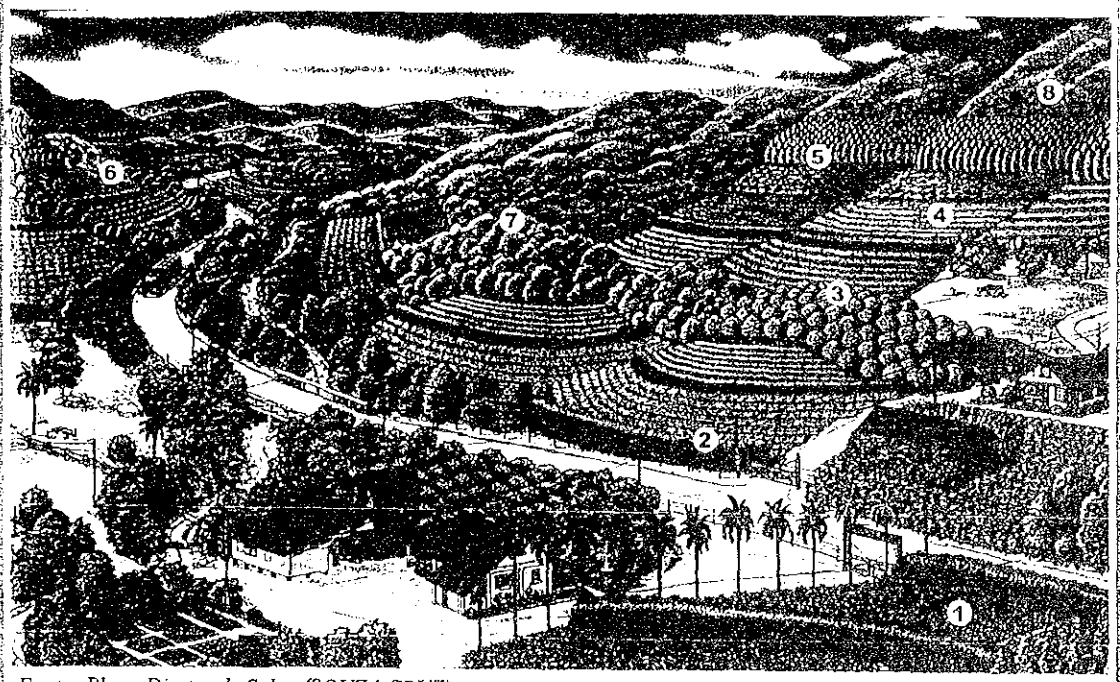


Magnified
Photo



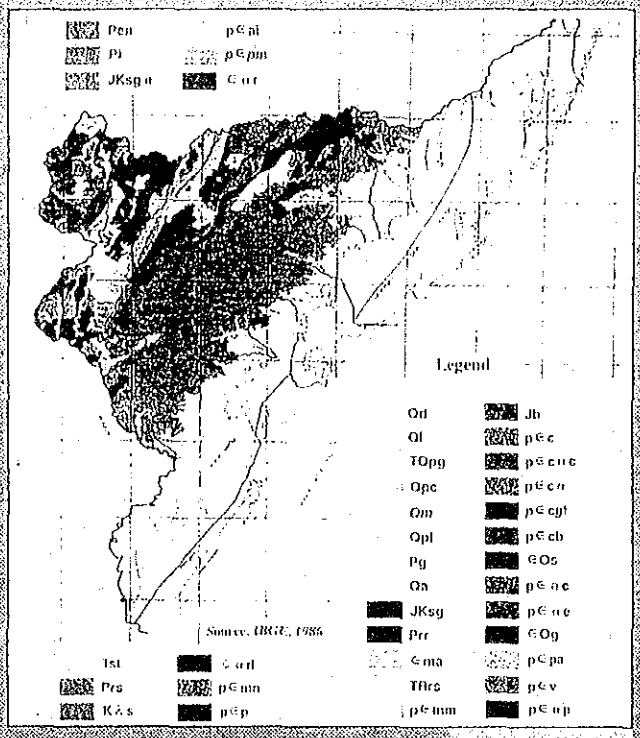
Capacidade de Uso da Terra

Classe	Segundo a Capacidade de Uso
1	terras cultivaveis aparentemente sem problemas de conservaçao; são as **áreas planas**
2	terras aptas para agricultura que exigem trabalho de conservaçao; são os **terrenos pouco inclinados**
3	terras cultivavéis com grande exigências de conservaçao; são **terrenos inclinados**
4	terras muito inclinadas cultivades apenas ocasionalmente, exigindo grande trabalho de conservaçao; são as **encostas ingremes**
5	terras cultivavéis apenas em casos especiais e com culturas parmanentes, as quais, uma ves estabelecidas, exigem pouco trabalho de conservaçao, como é o caso dos **reflorestamento ou pastagens**
6	terras de difícil cultivo devido à grande presença de **pedras e ao relevo montanhoso**
7	terras onde as restrições para o cultivo anual são totais; são terras altamente **susceptíveis à degradaçao pela erosão**
8	terras impróprias para culturas anuais, pastagens e reflorestamento, sendo utilizadas apenas para **abrigo da fauna silvestre, preservaçao recreaçao e armazenamento de água**



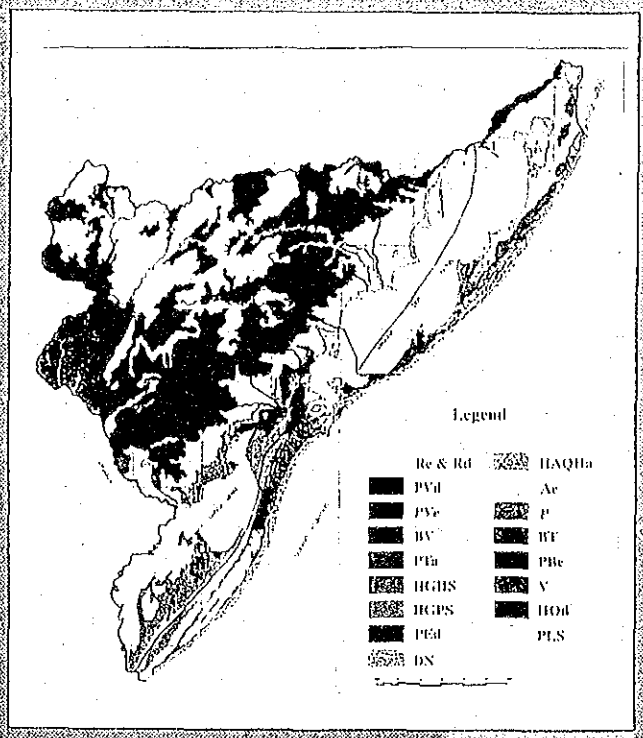
Fonte: Plano Diretor de Solos (SOUZA CRUZ)

GEOLOGIA



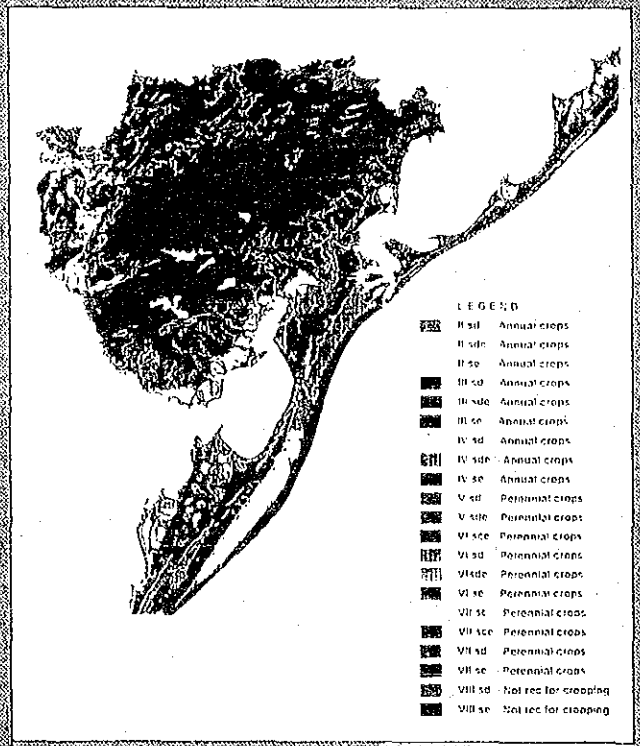
IBGE, 1986

SOLO



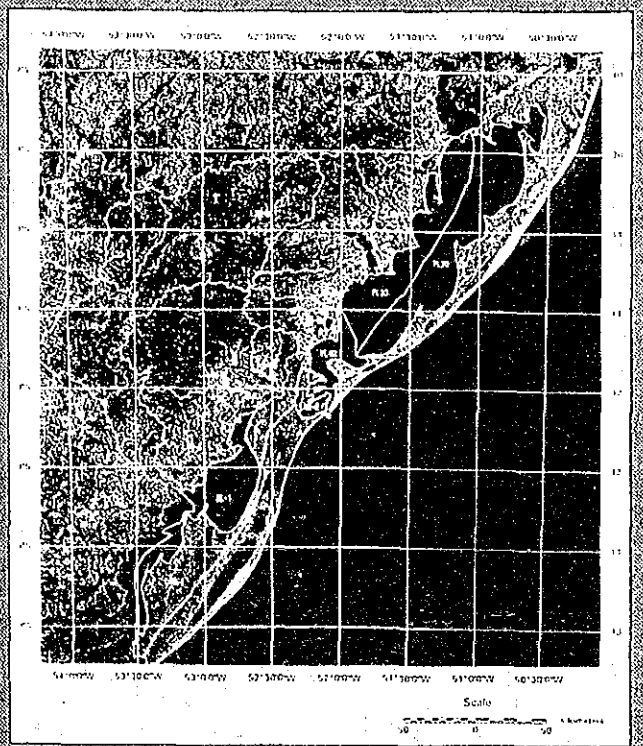
IBGE, 1986

CAPACIDADE DE USO DE SOLO



EMBRAPA, 1999

USO DO SOLO



JICA, 1999