

6.7 Environmental Study

6.7.1 General

The Environmental Study for "the Initial Environmental Examination (IEE) for the Study on integrated River Improvement of Orinoco River" includes the review, analysis and assessment of previous studies and field reconnaissance survey results, together with studies on the environmental administration systems in the Republic of Venezuela. This study will be followed by a detailed field survey of the Environmental Impact Assessment (EIA) for the Feasibility Study of the Project.

6.7.2 Environmental Administration in Venezuela

(1) Environmental Agency

Ministry of Environment and Renewable Natural Resources (Ministerio del Ambiente y de los Recursos Naturales Renovables: MARN) is in charge of environmental issues in Venezuela. Concerning Environmental Impact Assessment (EIA), the Department of Environmental Quality (Dirección General Sectorial de Calidad Ambiental: D.G.S.C.A.) conducts examination of the EIA report. It consists of 4 divisions as mentioned below.

- Division of Environmental Impact Study (División de Estudios de Impacto Ambiental)
- Division of Water Quality (Dirección de Calidad de Aires)
- Division of Air Quality (Dirección de Calidad de Aguas)
- Division of Waste Material Treatment (Dirección de Manejo de Residuos y Desechos)

(2) Environmental Policies in Venezuela

There are various efforts to address the environmental problems in Venezuela through policy, program and legislative framework. The National Environmental Plan was prepared by the Ministry of Environment and Renewable Natural Resources in 1996. The general purposes of the plan are outlined below;

- 1) To promote, to guide and to serve as a catalyst for the solution of environmental problems in the country.
- 2) To develop the guidelines of the environmental policies on land use of the territory and the policies on the use and preservation of renewable natural resources.

- 3) To incorporate environmental factors to the country's economic and social processes, the policies and regulations.
- 4) To improve the capacity for environmental preservation, supervision and control of Venezuela.
- 5) To improve the quality of life of the population.

(3) Procedures on Environmental Impact Assessment(EIA) in Venezuela

In Venezuela, the regulation on EIA was established in July 1991 under the decree No.1741. This regulation was amended in April 1992, but its contents and philosophy remained unchanged and it constitutes one of the technical standards of penal law of the environment (Ley Penal del Ambiente). Currently, this regulation is no longer effective, because it has been revised again and final approval was obtained in the cabinet on March 13, 1996 under the decree No.1257. The new regulation appeared in the official gazette No.35946 dated April 25, 1996.

The procedure of the EIA system in Venezuela is shown in Fig. 6-7-1.

(4) Laws on Environment in Venezuela

As mentioned above, EIA system in Venezuela is based on the Presidential Decree No.1257. There are other laws on environment as shown in Supporting Report Chapter 6.7.

(5) International Treaties on Environment

Venezuela Government has been adopting active policies on environmental protection. The international treaties on environmental protection signed by the government are described as below;

- CITES
(Convention on International Trade in Endangered Species of Wild Fauna and Flora)
signed in July 1976
- RAMSAR treaty
signed in December 1982

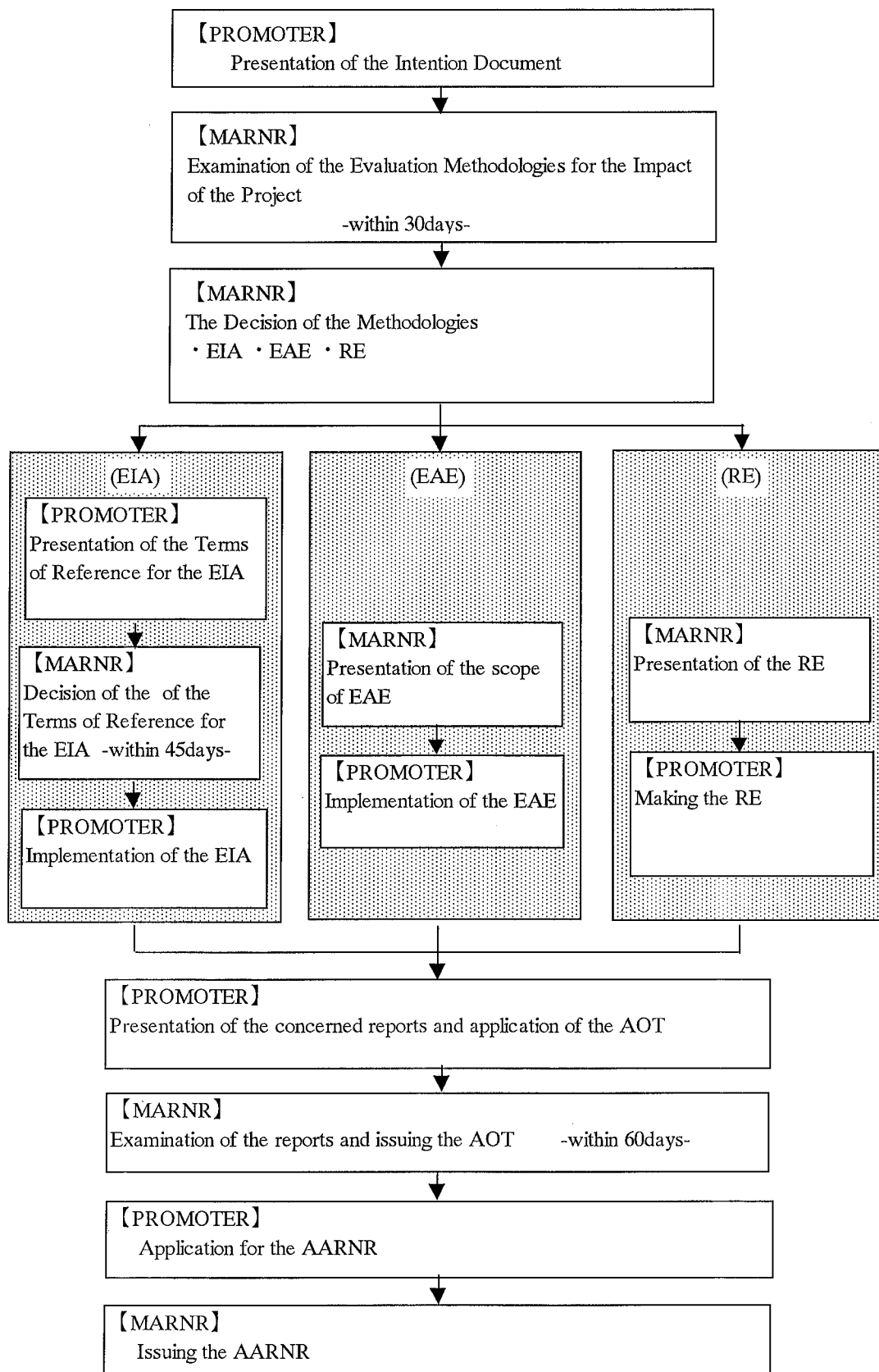


Fig. 6-7-1 Procedure of EIA in Venezuela

6.7.3 Present Condition of Environment of Study Area

The study area covers downstream of the Orinoco River from Guayana City, approximately being equal to State of the Amacuro Delta except the southern part of Rio Grande. Orinoco Delta is characterized by abundant nature. In this chapter, natural and social environment of Orinoco Delta will be described.

(1) Natural Environment

1) Climate

The Orinoco Delta presents a humid tropical climate with high temperatures and a short dry season in which there is still considerable precipitation. The weather in the area is characterized by very high temperatures throughout the year due to the low elevation above the sea level and the adjacency to the equator. And there is very small difference of temperatures in the area spatially and seasonally.

On the contrary, the precipitation presents clear difference depending on spatial conditions. There is a tendency of increasing precipitation from west to east. The yearly average precipitation in the area of Barrancas is something below 1,000 mm and it is higher than 2,500 mm in San Jose. This situation can be associated with trade winds which discharge humidity in the Atlantic.

2) Soils

The Orinoco Delta is a form of Holocenec accumulation originated by the rising of the sea level filled with marine clays. Over these clays, peat beds have developed in various thicknesses, which have been fossilized in the Upper Delta by the fluvial sediments deposited.

This plain is a dynamic body with a continuous deposit of marine and fluvial sediments with other recent accumulations of organic matters. This material is deposited during conditions of flooding. Therefore, there should be various types of soils developed in accordance with the parent materials of this plain.

3) Geology

The geology of the area of the Delta presents two major groups. One is rocks of the Precambrian in the borders of the Serrania de Imataca, in south of the Rio Grande. It is composed mainly of igneous rocks with high metamorphism. The other is the great delta plain covered by quaternary sediments during the Pleistocene.

4) Vegetation

The vegetation of the Delta is characterized by the marshy plains of the Orinoco Delta, where rain forest and palm groves are covering up to 50% of the lower and middle Delta. Savanna interspersed with palms cover extensive areas of flooded land in the Upper and Lower Delta. While, mangroves are confined to the Lower Delta and swamps along the coast. Rain forests are evergreen and canopy range from 20 to 30 m height. Characteristic species include *Symphonia globulifera*, *Virola surinamensis*, *Carapa guianensis*, *Mora excelsa*, and the palms *Mauritia flexuosa*, *Manicaria saccifera*, *Euterpe oleracea* and *Bactris spp.* Savanna presents a domination by herbaceous vegetation with scattered shrubs and palms. The herbaceous zone is dominant by the grasses *Leersia hexandra* and *Imperata contracta*, shrubs such as *Ludwigia spp* with some of *Mauritia flexuosa*. Furthermore, in these savanna a flooded vegetation characterized by the species *Montrichardia arborescens*, *Paspalum fasciculatum* and *Eichhornia crassipes* could be observed. Mangroves reach between 15 to 25 meters in height such as *Rhizophora mangle*, *Avicennia nitida*, *Laguncularia racemosa* and *Acrostichum aureum*.

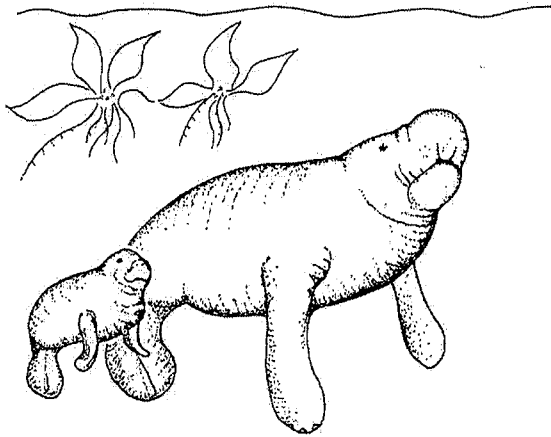
5) Wildlife & Endangered Species

It is said that Venezuela is one of the most important 10 regions in the world for biodiversity. It has various landscapes and tropical forests which provides habitat for many plants and wildlife. In order to preserve the ecosystem of the country, the government designated approximately half of the land as reserve area. 15,000~20,000 species of plants of the higher orders flora have been recorded in Venezuela, whose number is third largest after Brazil and Colombia in Central-South America.

Regarding fauna, 1,300 species of birds have been recorded. The number is equivalent to 15% of whole species identified in the world. 332 species of reptiles, 113 species of amphibians and 1,195 species of fishes have been also recorded. The number of invertebrate animal is comparatively abundant. However, several development activities and the expansion of residential area threat the existence of endangered species.

There are descriptions on endangered species of Venezuela in Red data book. Regarding endangered species the Presidential Decree (Decree No.1486 on 11, Sept. 1996) lists officially recognized species as shown in Supporting Report Chapter 6.7.

In the Orinoco Delta, due to the uniformity of the climatic condition derived from topographical characteristic of flat plain in the area, the fauna in the area has also evenly



distributed, that is, the mammals such as onina (*Inia geoffrensis*), Manatí (*Trichechus manatus*), Chiguire (*Hydrochaeris hydrochaeris*), the birds such as Garza (*Agamia spp.*), Corocoro (*Eudocimus ruber*), Martín pescado, Gavilán (*Accipiter spp.*), the reptiles such as anaconda caiman, fishes and amphibians. Shape of Manati is shown in Fig. 6-7-2.

Fig. 6-7-2 A Picture of Manati

6) National Parks and others

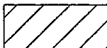
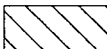
In Venezuela there are 39 national parks. Besides there are several natural monuments, wild animal refuges, bio-sphere reservations, forest reservations, and others.

The Mariusa National Park, 265,000 ha, is located in the State of Delta Amacuro between the Macareo canal and the Mariusa canal. It is representative of the physiographics unit of the Orinoco Delta occupied by marshes and swamps. The flora, fauna and the residents, mostly indigenous people in the area are affected by the hydrological and topographical characteristics. The Delta region of the Orinoco has exotic landscapes. It presents a great diversity of plant species and animals. The most extensive vegetation in the herbaceous swamp is the predominance of ferns, mosses, etc., upon deep peat layer or muddy layer reflecting the environmental conditions. There are also commercial forest species in the swamp such as carapo, cuajo, cachicamo, paramoncillo, currucayand mangrove.

Also there is Orinoco Delta biosphere reservation in the area of between Macareo canal and Rio Grande. The Reservation of Biosphere of Orinoco Delta is designated to protect and to preserve the tropical ecosystems of the Delta. The environment consists of invaluable biological resources such as great diversity of plants and animals. And the environments are conjugated with cultural resources as the indigenous communities of the Warao Indians practicing the way of most traditional and natural life.

The location map of the Mariusa National Park and Orinoco Biosphere reservation is shown in the Fig. 6-7-3.

STATE	UBICATION	Nº	SMALL COMMUNITIES
AMACURO	TUCUPITA	1	Barro de Macareo
		2	Boca de Guapoa
		3	Boca de Guapoa I
		4	Boca de Macareo
		5	Guapoa
		6	Isla Tucupita
		7	Jalaguano
		8	Juaneida
		9	Juaneida I
		10	La Cerca
		11	La Playita
		12	Las Guaguas
		13	Palo Maria
		14	Pueblo Blanco
		15	Punta Cochineria
		16	Temblador
		17	Tiritai
		18	Vuelta de los Indios

-  Orinoco Biosphere Reservation
 Amacuro Delta National Park

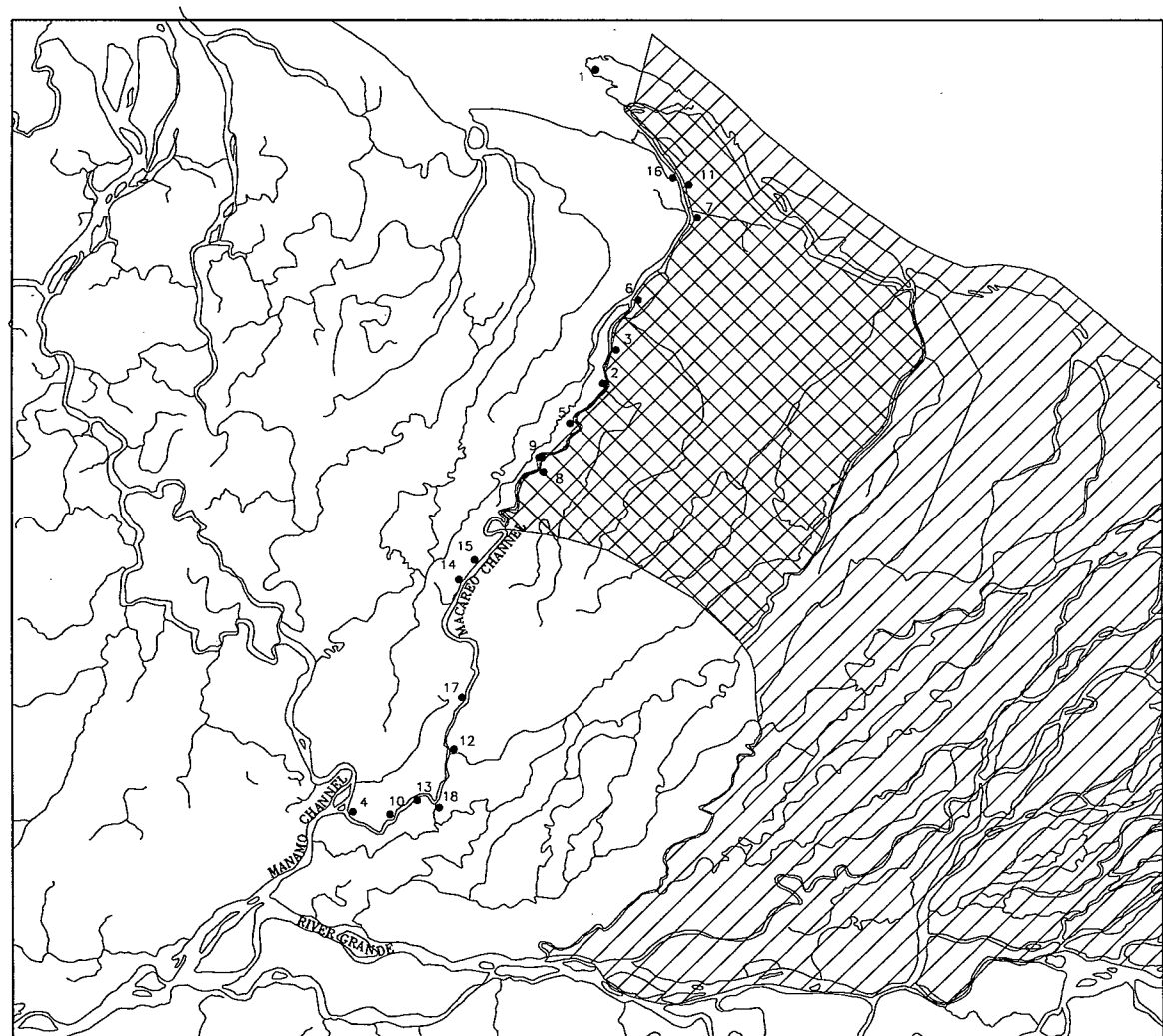


Fig. 6-7-3

Location Map of National Park and Biosphere Reserved Area

(2) Social Environment

1) Economic Aspects

The main economic activities of the state of Amacuro Delta are fishery, agriculture, forestry and mining, which are classified as the primary and secondary sector. The government activities (national, state and municipal) in tertiary sector, provide main employment in this area. The potential of tourism as a service industry is rather high. The development of tourism will contribute to the enhancement of state economy.

The fish products of the Delta vary between 40 and 50 thousand tons yearly. Fishery is dominated mainly in the upper Delta and in the marine waters.

With regards to the mining resources, there are petroleum and peat in the Delta and offshore. Furthermore, there are alluvial gold, quartz, bauxite, iron, mercury and sulfur. There are an extraordinary landscape shows the high potential for tourism and recreational development together with its extensive net of canals, abundant fauna, numerous islands, mountain areas, tropical forests of the Sierra Imataca, the natural monuments and cultural value of remains. However, up to now, little importance has been put to the tourism activity. As a result there is a lack of the basic infrastructure for the requirement.

2) Infrastructure of roads and communications

The transportation in the area is poorly developed due to its geographical location and its delta condition. There is a limited interrelation between the rural area and populated areas because of the lack of network of the fluvial, maritime land and air communication. There is only 559 km of transportation road network throughout the state, which extends throughout the Municipalities of Tucupita and Cosacoima. The other two municipalities do not have any land connection. Therefore, 161 public fleets contribute for the transportation of inter-community in the area. With regards to air transportation, the State has an airport in the capital city of Tucupita. Additionally, there is a private airport managed by a petroleum company.

In general, it is obvious that development of the infrastructure of various transportation; fluvial navigation, maritime, interconnected by land would promote other economic activities and improve the social situation of this important State.

3) Demographic aspects

According to the 1990 Census conducted by OCEI (refer to Supporting Report Chapter 6.7), the population of the state was 84,564. With regards to this aspect, it is important to point out the ratio of the indigenous population settled in the Delta is rather high (approximately 25% of the state population) With regards to the distribution of the population by age groups, according to the 1990 Census, followings are observed:

- The population in the state is dominated by young people. The population younger than 15 years accounts for 45 % of the whole population in the state which is higher than the average of the country (37 %) at the same year. The situation is more obvious in the Antonio Diaz and Pedernales Municipalities
- The 47.5 % of the total population is at the age of economically active, which is lower than the rest of the states and of the national ratio (55.6 %).
- There is a greater proportion of men than of women, masculine index being 105, tendency noted in all municipalities, which is higher than the other states of the country.

4) Indigenous People

The predominant ethnic group in the State of Delta Amacuro is the Warao, whose total population is estimated at some 29,000. The total population of the State in 1990 was 84,564(OCEI 1991). At the time of the 1992 indigenous census (OCEI 1992), 21,256 Warao were registered in the State of Delta Amacuro which is equivalent to 25% of its total population. There are also sizeable groups of Warao in the State of Monagas followed by the State of Sucre and the Essequibo Territory.

Traditionally, the Warao's habitat is the moriche grove or "morichal". Variations in the subsistence activities of the indigenous population in different areas of the Delta were determined by the characteristics of the ecological subsystems. Other than these environmental circumstances, today there are different forms of interaction with neighbors, as well as historical events that determines sometimes sizeable differences between the local groups that together make up the Warao. Nevertheless, the Warao are a rather homogeneous group culturally as well as linguistically.

Traditional subsistence activities among the Warao were based on fishing and some hunting associated with the gathering of fruits and other forest products according to the seasons, all of which portrayed a marked cycle during the course of the year.

Warao didn't adopt agriculture until recently. It was only lately with the introduction of the "*ocumo chino*" tuber (*Colocaisa antiquorum*), a kind of taro called *ure* by the Warao, cultivation was successfully adopted in the swampy soils of the Delta.

5) Public Health

The level of the services of public health in Amacuro Delta is rather low. The number of beds in this area are less than half of the standard of World Health Organization (WHO). The current status of the facilities and personnel concerned with public health in Amacuro Delta is shown in Supporting Report Chapter 6.7.

(3) Environmental Problems

Through the study carried out in Venezuela, some topics mentioned below were understood as environmental problems in the Amacuro Delta.

1) Salinization relating Manamo dam

- i) The situation of the area of in and around Tucupita city when the dam was constructed

One of the main objectives of the Dam was to control the flooding of Manamo River for agricultural development in and around Tucupita city.

In those days, the agriculture in Tucupita was not so popular. A few farmers cultivated meagerly rice, cacao, and banana and so on along Manamo River. The harvested crops were collected in Pt. Amador and carried with barge trains going through Manamo River. Because of this, the price increased by double. After construction of the dam, the transportation has been carried out by trucks.

The agriculture in Tucupita was severely hit by the flooding of Manamo River in 1943. Meanwhile stock farmers carried out pasture on the area of west part of Tucupita when the floodwater withdrew in dry season.

There used to be an oil well in Tucupita. The volume of the products was rather small but the quality of the oil was fine. The oil was carried to Pt. Hierrow through the Caribbean Sea along the Macareo River using barge transportation.

- ii) Impact on agriculture and fishery in around Tucupita city by the dam

No information on damages due to salinization on agriculture and fishery in and around Tucupita city was found through interviews to relating agency, i.e. CVG, Ministry of Production and Commercial and SARPA(Servicio Autonomo Recursos Pesca Aqui). However, the products of "Ocumo", a kind of tuberous plants, has been decreased largely in Isla Janacaguaja. "Ocoumo" is usually cultivated in fresh water of swampy area. Therefore, this decrease may be due to salinity increase in river.

In those days, CVG had an intention of developing the area of 18000 ha in Guara island. However, the plan was abandoned due to the illegal trespassing by farmers and not due to salinity increase.

2) The environmental impact caused by dredging activities

Every construction activities carried out at estuaries and rivers have the potential to damage estuary ecology. In general, dredging activities are conducted for the construction and the maintenance of waterways, navigation route, ports, marina and so on, as well as for the procurement of sand for land reclamation activities.

Dredging activities affect estuary ecology in various ways. They cause short-term and long-term changes in estuary ecology in terms of watercourse, water circulation, and salt concentration in the water as well as turbidity, siltation and the decrease of dissolved oxygen. Dredging activities will destroy the habitat of aquatic life directly. In addition to the direct damage to the habitat, plenty of silt and muddy sand generated by the activities of the removal, transportation and dumping of the dredged spoils is spread out on a riverbed. Minute particles of the muddy sand are conveyed long distance before being deposited. High turbid silt may cause harmful environmental impacts. Minute particles of muddy sand caused by dredging seals up the riverbed and might deteriorate the circulation of substance through crevices of in the riverbed. The increase of turbidity caused by silt may cause decrease of light penetration and consequently the action of photosynthesis is disturbed.

The deposit in brackish water area also works for catching hazardous substances and stabilization of a riverbed. Hazardous substance such as heavy metals and fertilizers are absorbed by the deposit. As a result, dredging activities will expose these materials which are harmful for aquatic life again.

In an ecological meaning, a deposition of silt by dredging activities in brackish water area may form inactive riverbeds. Recovery of vegetation in riverbeds which consists of migratory unstable deposition i.e. fluff with high void ratio proceeds very slowly. The larvae of benthic animals such as oysters, snails and crustaceans may not be able to establish themselves on affected riverbed.

With respect to the methodology of disposing of dredged spoils, to diffuse them into river is a very inadequate method to aquatic ecosystem. Because there is a high possibility to cause ecological disturbance at discharge mouth of a pipeline. Especially in the case of the dredging sand including plenty of organisms, hazardous materials and