Chapter 2 REGIONAL DEVELOPMENT RELATED TO THE PORT OF GUAYAQUIL

A. National Development Plan

1. It is necessary to refer to the National Development Plan of the Republic of Ecuador before explaining the Regional Development Plan, because the latter is based on the former.

2. As with many other countries in Latin America, the Presidential term of Ecuador is four years and reelection is prohibited. Therefore, it is difficult to make up a Long-term Development Plan of more than five years. Under the circumstances, in countries such as Ecuador, generally a four-year plan has been elaborated.

3. In Ecuador, the Government of Republican President Sixto A. Duran-Ballen C. approved the "Agenda para el Desarrollo" (Agenda for Development) on June 3, 1993, which is an Action Plan of the National Government for the years 1993-1996 equivalent to the present presidency. Thereafter, the Agenda was revised as the second edition on June 28, 1994 in accordance with a change of conditions and additional necessities.

4. There are five major objectives of the second edition of the Agenda:

(1) To improve social welfare
(2) To improve public service
(3) To modernize the State
(4) To increase productivity and production
(5) To obtain macro-economic stability and to dynamize the economy

5. There are problems which must be overcome, however, if each objective is to be realized. What follows is a summary of these problems.

(1) To improve social welfare
- High level of unemployment and semi-employment
- Insufficient attention to the basic necessities of baby
- Low coverage and quality of health services
- Deficient and inadequate system of social security
- Limited access to medication
- Deterioration of quality of education
- Poor quality of higher education
- Low standard of living of aboriginal groups
- Housing shortage
- Low level of cultural activity

(2) To improve public service
- Low level of water supply and inadequate waste disposal system
- Deterioration of electric sector
- Insufficient and inefficient public transportation
- Rising crime level
- Increase of narcotics trafficking and consumption of drugs
- Deterioration of environment and bad management of natural resources
- High vulnerability to natural disaster

(3) To modernize the State
- Interference of the State in the ambits where there is no competition
- Centralism and low capacity of works of the sectional governments

- Shortage of efficiency and efficacy in the system of justice

(4) To increase productivity and production
- Low productivity of agricultural sector
- Low productivity of manufacturing sector and insufficient promotion of exportation and investment
- Incipient development of tourism activity
- Insufficient infrastructure to support production
- Limited reserves of petroleum
- Institutional weakness for planning, proceeding and coordination of the activities of science and technology

(5) To obtain macro-economic stability and to dynamize the economy
- Inflation
- Insufficiency of internal savings utilized in the country and incipient financial markets
- Deficient tax collection system
- High level of external debts

6. CONADE (Consejo Nacional de Desarrollo, National Development Council) acts as an organization to promote the Agenda, and to hold an extraordinary power its status is higher than the Ministries; the Vice-President of the Republic is appointed as its President in the Governmental organization. CONADE not only promotes the socio-economic plan of the Nation, but also deals with foreign technical cooperation and financial assistance.

7. As to the theme "To modernize the State" in the Agenda, the operations proposed regarding "Interference of the State in the ambits where there is no competition" are as follows;

(1) To re-define the role of the public sector, within the frame of modernization of the State. (on-going)

(2) Review, analysis and modification of the Laws and Regulations which regulate the participation of the public sector in areas where there is no competition. (on-going)

(3) To review the organic-functional structure of the organizations of public sector to adapt them to its new role of the State. (on-going)

(4) Establishment of institutional frames in the ambits of control, normalization and regulation guaranteeing the efficiency and, avoiding duplication and superposition of functions.

(5) Simplification of procedures and proceedings in the public sector.

(6) Reduction in the number of public servants in accordance with the new role and functional structure. (on-going)

(7) To speed up the process of technical training of the public sector (on-going)

(8) To impel the process of decentralization in the public sector (on-going)

(9) To define a program of transfer to private sector of the state companies operating in areas where there is no competition. (on-going)

(10) To impel the process of dis-intervention of the public sector in priority areas. (on-going)

(11) Establishment of a coherent and solid legal regime which guarantees the management of private companies.

(12) Elimination of benefits and protection conceded by the State to some groups and sectors for the purpose of eliminating competition.

(13) To create the conditions for impelling the modernization of the production sectors through the strengthening of the market mechanism.

8. To advance strongly the process of modernization of the State, CONAM (Consejo Nacional de Modernizacion del Estado, or National Council of Modernization of the State) was established on October 17, 1992 under Effective Decree No. 143 of the Government.

9. According to the authorities, the modernization policy will not be modified even if a new government comes to power, because it is necessary for the development of the Republic of Ecuador.

10. The main concepts of the modernization of the State consist of the following six themes;

(1) Decentralization
(2) Deregulation
(3) Antimonopoly measures
(4) Non-intervention
(5) Dis-bureaucratization
(6) Privatization

11. The following programs of privatization are ongoing as of August 1994 under the administration of CONAM.

(1) Airports
(2) Customs
(3) Postal Service
(4) Telecommunications
(5) Water Supply <Sta. Elena and Playas>
(6) Electricity

12. To modernize the ports of Ecuador, UNCEMP (Unidad Coordinadora y Ejecutora de Modernizacion de Puertos, or Coordination and Effective Unit of Modernization of Ports) was organized in May 1993 under the Resolution of the National Council of Merchant Marine and Ports (Consejo Nacional de Marina Mercante y Puertos). The modernization project of the Port of Guayaquil (including The Port Authority of Guayaquil) is scheduled to be completed by the end of the year 1995, under the administration of UNCEMP with technical and financial assistance of the Inter-american Development Bank (Banco Interamericano de Desarrollo).

13. As to the theme "To increase productivity and production", the necessary operations have been proposed in the Agenda for each area of agriculture, manufacture, tourism, infrastructure of support to production, petroleum, and science and technology, after analyzing the problems (manifestations, causes and consequences).

14. Also, with regard to the theme "To obtain macro-economic stability and to dynamize the economy", the requisite operations have been proposed in the Agenda of inflation, internal savings and financial markets, tax collection system, and external debts, after analyzing the problems (manifestations, causes, and consequences).

B. New Institutional Scheme on Foreign Trade

1) Zona Franca (Export Processing Zone)

(a) Law and Regulations

15. Under the Decrees of February 18, 1991 and of September 11, 1991 the "Zona Franca Law" and its "Regulations" were enacted, respectively. The Zona Franca is defined therein as an area delimited and authorized by the President of the Republic under Effective Decree, according to the specific regime in this Law as to foreign trade, customs, tax, money exchange, finance, and treatment of capital and labor. The users properly authorized shall dedicate the production and commercialization of goods for export or re-export and provide the services linked with international trade.

(b) Objective

16. The objective of Zona Franca is to promote employment, generation of foreign currencies, foreign investment, technical transfer, increase of exportation of goods and services, and the development of depressed zones of the country.

(c) CONAZOFRA

17. CONAZOFRA is an acronym for the National Council of Zona Franca (Consejo Nacional de Zonas Francas), an organization ascribed to MICIP (Ministry of Industry, Commerce, Integration and Fishery), whose functions are as follows:

(1) To issue general policy for operation and supervision of Zona Franca

(2) To propose publication, modification or abolition of laws and regulations related with Zona Franca and its activities

(3) To review the application for establishment of Zona Franca and to give advice

(4) To approve the internal regulations of each Zona Franca presented by the administration companies

(5) To approve the application for installation presented by would-be users and for withdrawal or liquidation of it

(6) To resolve disputes which will arise from the application of Zona Franca Law

18. CONAZOFRA consists of the followings.

(1) Representative of the President of the Republic who will preside over this organization

(2) Representative of the Minister of Industry, Commerce, Integration and Fishery

(3) Representative of the Minister of Finance and Public Credit

(4) Representative of the Minister of Defence

(5) Representative of the Central Bank of Ecuador

(6) Representative of the administration companies of Zonas Francas

(7) Representative of the users of Zonas Francas

19. The subsecretary of Industry will act as Effective Secretary of CONAZOFRA and be in charge of executing and carrying out the resolutions of this organization

(d) Administration Company

20. The administration companies will be those who are public, private or mixed corporate bodies that obtain, under Executive Decree, a concession to administrate and operate the Zona Franca in the country.

(e) Users of a Zona Franca

21. Following three types of enterprise can be set up in a Zona Franca:

(1) Industry, destined to processing of goods for export or re-export.

(2) Commerce, destined to international commercialization of goods for import, export or re-export.

(3) Service, in charge of providing the services necessary for operation of Zona Franca.

(f) Customs Regime

22. The import and export of merchandise, inputs, machinery, raw materials, etc. through the Zona Franca will totally be free of tax, duty, and customs.

23. All goods produced in the industrial Zona Franca must be exported except those that CONAZOFRA approves for domestic use according to the law concerned.

24. The administration companies and the users of Zona Franca will have the benefit of exemption of 100% of income tax or any other similar one, and added value tax for a period of 20 years.

25. The users of Zona Franca will enjoy complete freedom in all currency exchange transactions among each other between Zonas Francas and abroad.

(g) Taxation Regime

26. The administration companies and the users of Zona Franca will have the benefits of exemption of 100% of income tax or any other similar one, added value tax (IVA), provincial tax, municipal tax, and any other new tax, for all actions and contracts which will be carried out within Zona Franca.

27. The users of Zona Franca, also, will totally be free of patent tax and of all taxes in force on production, use of patent and trade mark, technical transfer and repatriation of profits.

28. The administration companies and the users of Zona Franca will have the benefit of above-mentioned exemption for a period of 20 years from the day of the resolution which authorizes their settlement. The period can be prolonged under the criterion of CONAZOFRA.

(h) Labor Regime

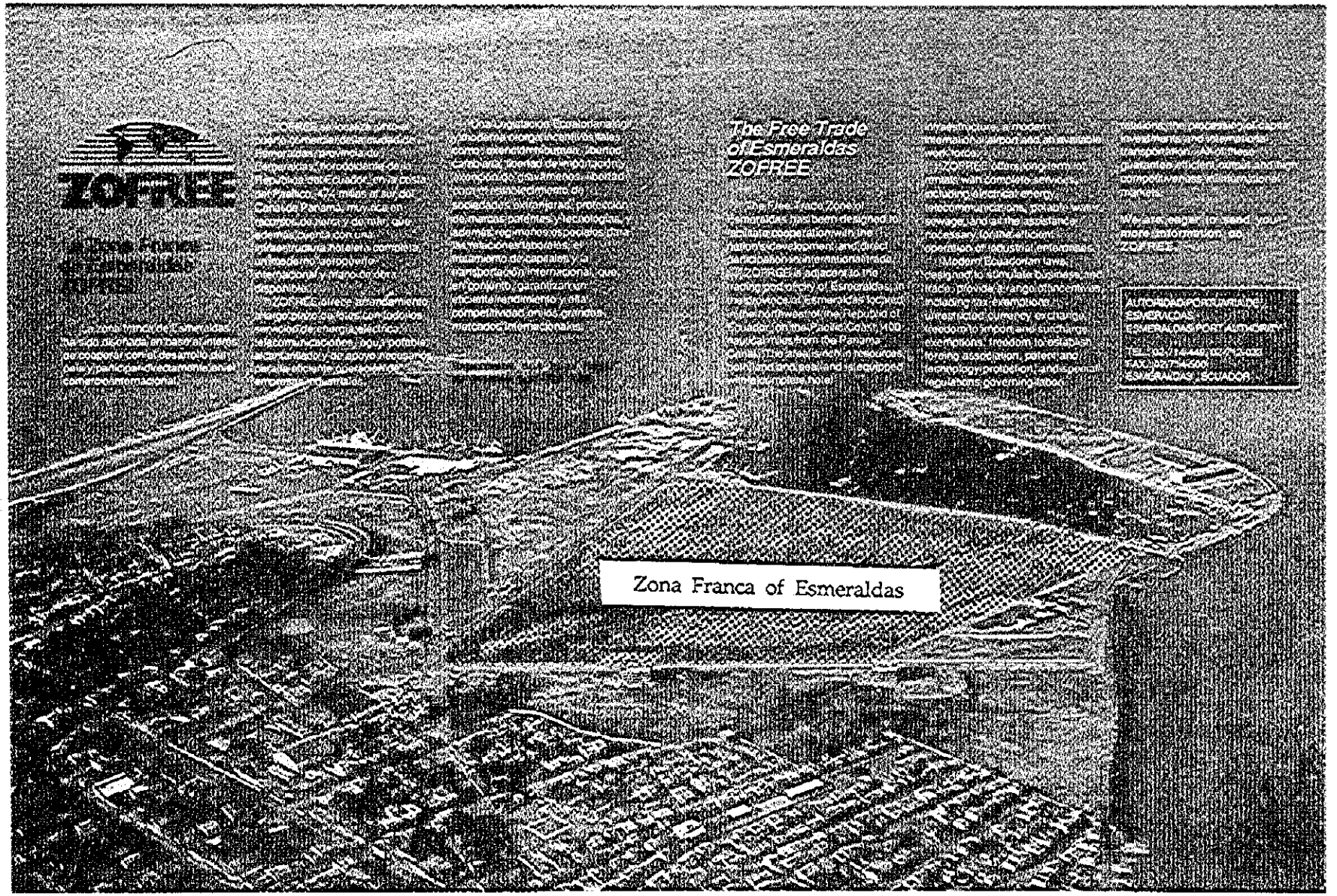
29. The relations between users of Zona Franca and the laborers are subject to Labor Law in force, with following modifications:

- By its nature, the labor contract in Zona Franca has a temporary character. Therefore, it is not subject to the Article 14 of Labor Law and can be renewed any time if necessary.
- The wages of workers must be at least 10% higher than the minimum wages which the workers of the same sector in the country will receive. The wages must be agreed upon in U.S. dollars and be paid in sucres at an exchange rate of free market in force at the day of payment.
- It is prohibited to make a labor contract with minors less than 15 years old within Zona Franca.

(i) Development of the Zonas Francas in Ecuador

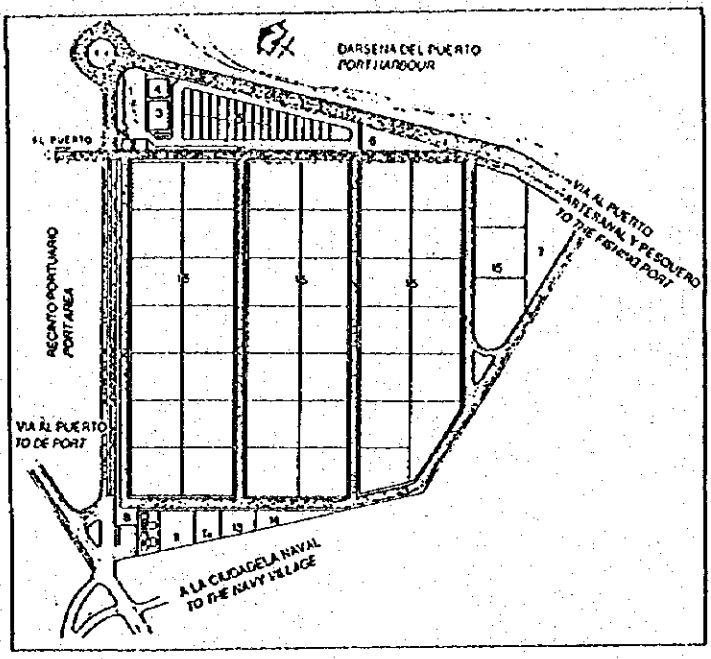
30. By the Effective Decree of October 31, 1985, the Zona Franca of the city of Esmeraldas was created under the Articles 108 to 111 of Customs Organic Law. With this antecedent, ZOFREE was established as a first administration company of Zona Franca in Ecuador in 1986 to manage the Zona Franca of Esmeraldas, where a chip manufacturing industry is now operating. The main stock-holder of ZOFREE is the Port Authority of Esmeraldas. The perspective of the Port of Esmeraldas where Zona Franca of Esmeraldas (Total area: 22 ha.) is located and the plan of this Zona are shown in Figures I-2-1 and I-2-2.

31. According to the Decree of February 18, 1991 by which Zona Franca Law was issued, various territorial districts of the country have shown their interest in realizing specific projects. Among them, that of the city of Riobamba, through the company called ZOFRACENE-Zona Franca Centro Ecuatoriana C.A. which was established in May 1992, is ready to be carried out very soon for which the authorization of CONAZOFRA was already given. The import, export or re-export of goods through this Zona Franca will be executed via the Port of Guayaquil because of its location.



Source: Port Authority of Esmeraldas

Figure I-2-1 Perspective of the Port of Esmeraldas



Implantación general
General Implantation

1. Estacionamiento / Parking lot
2. Inspección / Inspection
3. Administración / Administration
4. Entrenamiento y capacitación / Training area
5. Locales para servicios generales / General purpose area
6. Restaurantes y cafetería / Restaurant and food area
7. Talleres y equipos pesados / Slops and heavy equipment
8. Ingreso de obreros / Worker's enirance
9. Recursos humanos / Human resources
10. Servicios médicos / Medical services
11. Energía eléctrica / Power plant
12. Planta agua servidas / Sewage treatment plant
13. Planta de agua potable / Potable water plant
14. Central telefónica / Central telephone office
15. Lotes industriales de 3.500 m2 / Industrial lots (3500 m2)

Datos Generales de ZOFREE

Area Total: 22 Hs
Area Util: 16 Hs
Cantidad de Lotes:
45 de 3.500 m2
Captación de mano de Obra concluido el proyecto:
3.000 obreros
Mano de obra disponible:
Textiles, confecciones
Madera, carpintería
Cueros y plásticos
Electrotécnica
Costo total :
U$S 14'000.000
Costo de infraestructura y administración:
U$S 3'000.000
Capacidad de exportación máxima :
U$S 54'000.000
Generación de divisas:
U$S 13'500.000. por
U$S. 284.000 por empresa.

Costos de operación industrial en ZOFREE

La empresa de zona ofrece los siguientes costos aproximados de tarifas industriales
Agua potable : U$S0.10 por m3
Kilowatio: U$S 0.07
Alquiler de lote con servicio:
U$S 0.80 mes
Costo promedio de mano de obra:
U$S 0.50 por hora
Jornada semanal de trabajo:
40 horas

General ZOFREE information

Total area: 22 hec.
Use area : 16 hec
Number of lots:
45- 3.500 m2 lots
Labor force available at completion of project:
3.000 workers

Available labor specialties:
Textile and garment workers
Lumber workers and carpenters
Leather and plastic wokers
Electro-technicians
Total cost: 14 million dollars
Administrative and infraestructure costs: 3 million dollars
Maximun export capacity: 54 million dollars
Income generated per business: 13.5 million dollars per 284.000 dollars

Industrial operation costs in ZOFREE

The free trade zone offers the following estimated insdustrial tariff costs:
Potable water: U$S 0.10 per m3
Kilowatt/hour : U$S 0.07
Lot rental with services:
U$S 0.80 m2/month
Average labor cost:
U$S 0.50 per hour
Work week: 40 hours

Source: Port Authority of Esmeraldas

Figure I-2-2 Plan of the Zona Franca of Esmeraldas

2) Maquila

(a) Law and Regulations

32. The Maquila Regime Law and its Regulations were issued on August 3, 1990 and on October 31, 1991 respectively. Maquila is an industrial or service processing for elaboration, perfection, transformation or reparation of goods imported from abroad under the Special Temporary Admission Regime provided for in the Law for posterior re-export, with incorporation of national products as the case may be.

(b) Main objectives

33. Major objectives are as follows:

(1) Modernization and technical improvement of the industrial sectors

(2) Investment in sectors of advanced technology

(3) Securing of man-power and training

(4) To promote high incorporation of national products in the processing of Maquila

(5) To stimulate direct foreign investment in the country

(c) Maquilador

34. Any natural or juridical person, consortium or other economic body who is qualified to operate in the form provided for in the Maquila Law can be a Maquilador.

(d) Customs Regime

35. The goods whose import may be authorized to a maquilador shall be subject to the Special Temporary Admission Regime, under which the obligation of payment of tax and duties concerned for introduction of the goods will be suspended till their final re-export.

36. For introduction of the authorized goods into the country, the maquilador shall present a Customs declaration attached with the following documents:

- Certified copy of the Resolution of Maquila Program which is treated
- Original bill of lading, air B/L or carrier's note, as the case may be, with respective approval of the transportation company
- Dispatch note of the authorized goods which will be imported by a maquilador and be sent by a foreign contractor, in which the characteristics, quality, weight and value of the goods must be detailed

37. Maquilador shall tender special guarantee sufficient for an amount equivalent to 100% of the tax which is payable and is in force at the moment of acceptance of the import declaration.

38. In case the goods whose import has been authorized under the Special Temporary Admission Regime are in bad condition, they have to be destroyed or re-exported for substitution. In case these goods can be repaired, they may be repaired in the country or be re-exported for refinement. In any case the authorization of the Ministry of Finance and Public Credit will be necessary.

(e) Labor Relation

39. The labor contract of maquilado intends to provide an employer with quick and efficient mechanism for the development of maquilador enterprise in the country.

40. The prominent mechanism is as follows:

(1) The Ministry of Labor and Human Resources will execute the labor policy on maquila operation in accordance with Labor Law and Maquila Law.

(2) The labor contract of maquilado is an agreement by which a person undertakes to provide his licit services and personnel within a period of duration of the contract of maquilado for a remuneration fixed by agreement, custom or Law, under the orders and dependence of a maquilador who is qualified and authorized to make use of the Regime provided for in this Law.

(3) The individual labor contracts of maquila may be executed according to the various forms in Labor Law. These contracts will not enjoy the stability contemplated in the first sub-paragraph of the Art. 14 of Labor Law.

(f) Other Special Disposition

41. The import which may be carried out under Maquila Law does not require permission of the Central Bank of Ecuador. It is approved by MICIP.

42. For re-export of the goods imported under the Special Temporary Admission Regime and of the national components incorporated, it is only necessary to present the export declaration to the Administration of respective District Customs.

43. The remittance of the verified net annual profits of foreign investors which are generated in authorized operations of maquila in accordance with the Law will not be subject to any restriction.

(g) Development of Maquila in Ecuador

44. Since the Maquila Regime Law and its Regulations were issued in August 1990 and in October 1991, respectively, Maquila companies have been established in many regions of the country.

45. The number of maquiladoras (Maquila companies) authorized by MICIP as of June 1992 and November 1994 is as follows:

City	Number of Maquiladoras	
	June 1992	November 1994
(1) Quito	14	15
(2) Guayaquil	11	24
(3) Manta	4	5
(4) Cuenca	1	1
(5) Latacunga	1	1
(6) Sangolqui	1	1
(7) Calceta	1	1
(8) Azogues	1	1
(9) Ambato	0	1
(10) Sta.Elena	0	1
(11) Quevedo	0	1
(12) Daule	0	1
Total	34 maquiladoras	53 maquiladoras

See Table I-2-1.

46. The import and re-export of goods through the Maquilas which are located in Guayaquil, Cuenca, Latacunga, Azogues, Ambato, Sta.Elena, Quebedo and Daule will mainly be carried out via the Port of Guayaquil because of their location.

47. Moreover, it is likely that the other maquilas may also import or re-export their goods via the Port of Guayaquil, because this is the principal port where liner vessels call from all over the world.

Table I-2-1 Empresas Maquiladoras (Enero 1990 a Novembre 1994)

RAZÓN SOCIAL	ACTIVIDAD AUTORIZADA	LOCALIDAD	TEL.	FAX.	REPRESENTANTE	DIRECCIÓN
PABLO LARREA LOOR	Desembalaje y clasificación de materia prima (chatarra)	Manta			Pablo Larrea Loor	
MERCEDES FASHONS C.A.	Confección de prendas de vestir	Manta			Mercedes Fashions C.A.	
CLASICORP S.A.	Confección de vestidos para niñas Colón/Guayaquil	Guayaquil	795303		Mercedes Morán Mantuano	General Vernaza E.
INT. DE CONFECC. EXPORCONSA S.A.	Confección de adornos y prendas de vestir	Guayaquil	427541		Allan Klinger	Ave. Domingo Comín #200
GIOBRE MANUFACTURAS (GIOBRE C.A.)	Confección de prendas de vestir	Guayaquil	880081	00.593.4.880312	Giorgio Breglia	Urdenor Mz. 213 Lotes 18-28
CONF. RITA MARYOLU	Confección de prendas de vestir	Calceta				
GIOMAR AVILÉS DE FERRETI CÍA. LTDA.	Confección de prendas de vestir	Guayaquil	281364		Giomar Avilés de Ferreti	Ave. de las Américas 277
E Y C PRENDAS Y TEJIDOS.	Confección de prendas de vestir	Quito				
GUIDO PALACIOS	Confección de prendas de vestir	Ambato			Guido Palacios	
LUVIC Y ASOCIADOS CÍA. LTDA.	Confección de prendas de vestir	Latacunga				
MANUFACTURAS HILTON	Confección de prendas de vestir	Quito				
VOLUMEN EXPORT	Confección de prendas de vestir	Quito				
JOKKO S.A.	Confección de prendas de vestir	Guayaquil	252535	251351	Teresa Collazo	Km. 16,5 Vía Daule
SEAFMAN C.A. (SOC. ECUA/ALL FRÍO)	Procesamiento de atún y elaborados	Manta			Wolf Harten	
PESQUERA FERNÁNDEZ S.A.	Procesamiento de atún	Guayaquil	441220	442352	Pedro M. Fernández	Robles 117 y Chambers
EMPESEC S.A. (EMP. PESQ. ECUAT.)	Procesamiento de atún	Guayaquil	250077	2512823	Gilberto Momsanto	Km. 12,5 Vía Daule
PEVISCAYA S.A. (PESQ. VISCAYA)	Procesamiento de atún	Manta	624961	625661	Carlos Calero Calderón	Los Esteros Ave. 103
INPECA C.A. (IND. PESQ. MONTE VER)	Procesamiento de atún	Santa Elena	445661	251745 Télex 43268	Alberto Maspons Guzmán	Dom. Comín y P. J. Boloña

RAZÓN SOCIAL	ACTIVIDAD AUTORIZADA	LOCALIDAD	TEL.	FAX.	REPRESENTANTE	DIRECCIÓN
PESCA ECUATORIANA C. LTDA.	Procesamiento de camarón	Manta				
CONTROLEC S.A.	Bobinas semielaboradas y terminados para contactores	Guayaquil	353432	353842	Aquiles Guerrero M. S/N.	Mapasingue Este Calle tercera
TEXTILES CONTINENTAL	Elaboración de tejidos de lana	Guayaquil	800044	800963	Joseph Kronfle Akel	Vía Durán Tambo Km. 4
CREACIONES HERPINVILL	Confección de fundas de tela	Guayaquil	310932	326278	Manuel Pinos Villa	C. S. Ana 1er. C #146 y Rocafuerte
FCA. Ma. BELLE C. LTDA.	Confección de maletas, mochilas, bolsos de nylon			202852	Young Min Yun	Cdla. Ferroviaria Av. 4ta. #513 y calle 10ma.
MOLINOS DEL ECUADOR	Producción de harina para panificadoras, galletas, fideos, etc.	Guayaquil	445988	445058	Joel G. Stuart	Ave. D. Comín #511
POLYRESEN CORPORATION	Fca. ortoftalato/dicodilo aceite epoxidado de soja	Guayaquil	251232	Télex 40054	Alexandra de Spivak	Km. 10 Vía Daule
OAHAV S.A.	Fca. de resinas poliéster, alquílicas y tintes	Guayaquil	251232	Télex 40054	Alexandra de Spivak	Km. 10 Vía Daule
MOLINOS CHAMPION S.A.	Alimentos balanceados para animales	Guayaquil	202214	251251	Peter Pickett P.	Km. 7,7 Vía Daule
MASSARENTI S.A.	Procesamiento de frutas tropicales	Guayaquil			David Paredes M.	Sto. Domingo de los Colorados
ANGELA BAQUERIZO	Camisetas y otros tejidos de punto	Quito				
ARTE PRÁCTICO	Producción de muebles de madera y otros	Cuenca				
CONFECCIONES NATURALES	Confección de ropa desechable	Quito				
DIEGO DARQUEA	Apliques, murales y muñecas cerámicas	Quito				
ENKADOR	Fabricación de hielo sintético	Sangolquí				
GIANA PALETTE	Maletas y bolsos de cuero	Quito				
INDUSTRIA DATAPRIN S.A.	Cintas para máquinas de escribir	Quito				
LUIS BUCHELI MANTILLA	Figuras decorativas de resina poliéster	Quito				
LUIS CARPIO AMOROSO	Confección de joyas de oro-plata, prendas de vestir y artes gráficas	Azogues				
MARQUILLAS TEJIDAS ECUA. C. LTDA.	Marquillas, etiquetas, encajes	Quito				
MACROCOLOR ECUADOR S.A.	Rayotes, acuarelas, masterbatch	Quito				

RAZÓN SOCIAL	ACTIVIDAD AUTORIZADA	LOCALIDAD	TEL.	FAX.	REPRESENTANTE	DIRECCIÓN
MAPRIPLASTEC DEL ECUADOR	Manufacturas flexibles de PVC	Quito				
MANUAL MURILLO	Confección de casacas y abrigos	Quito				
APORTEX S.C.C.	Elaboración de joyas de oro	Quito				
TECNOLOGÍA FLORAL TECFLOR	Flores y follajes eternizados	Quito				
JOSÉ LYNCH ÁLVAREZ	Procesado y empacado de camarón	Guayaquil	328472		José Lynch Álvarez	Km. 10,5 Vía Daule
FUROCA S.A.	Saco de papel	Guayaquil	351900 35-34-82		Gunter Link	Km. 18 Vía a la Costa (C. R. Blanco)
INCACAO	Cacao en grano	Guayaquil	445900 443452		Fernando Guzmán	Ave. Domingo Comín S/N. P. J. Boloña
MI CHONG OH LEE	Camisetas y pantalones	Guayaquil			Mi Chong Oh Lee	Luque 521 y Boyacá
FIDEO CHINO WILYURI C. LTDA.	Fideos en general	Quevedo			Wilson León Lee	Cdla. José C. 16 y Malecón
MAQUILAT S.A.	Confecciones de trajes de vestir	Daule			Oswaldo Lematr	10 de Agosto y Véliz Río Daule
GIORGIOS ATHANAPOULOS	Producción de figuritas de animales cerámicos	Guayaquil	884245		Giorgios Athanapoulos	V. E. Estrada 1242, Urdesa
SOLUBLES ECUATORIANOS SOLUBEL S.A.	Elaborado de café soluble tipo spray dried	Guayaquil	270882 Télex 23145		Marco Ontaneda Ludeña	Km. 28,5 Vía Durán - Boliche
CALDARELA S.A.	Confección de prendas de vestir	Guayaquil			Sonia Benalcázar Flores	
PACHMOR S.A.	Fac. de maletas y mochilas de nylón y pantalones tipo blue jean	Guayaquil			Luis Maingoy Pacheco	Mapasingue Km. 8 Vía Daule

Elaborado por el Dept. de Estadísticas y Cómputo
Dirección Regional de Industrias en el Litoral

Nota: Datos actualizados al 6 de febrero de 1995

Table I-2-2 Comparison between Zona Franca and Maquila

Items	Zona Franca	Maquila
Law and Regulations	Zona Franca Law (Feb. 18, 1991) Regulations (Sept. 11, 1991)	Maquila Regime Law (Aug. 3, 1990) Regulations (Oct. 31, 1991)
Definition	An area delimited and authorized by the President of the Republic as an Export Processing Zone.	Industrial or service processing of the goods imported from abroad for posterior re-export.
Objectives	To promote employment, generation of foreign currencies, foreign investment, technical transfer, increase of export of goods and services, and the development of depressed zones of the country.	1. Modernization and technical improvement of the industrial sectors. 2. Investment in advanced technology sectors. 3. Man-power securing and its training. 4. To promote high incorporation of national products in the processing. 5. To stimulate the direct foreign investment in the country.
Operations	1. Administration Company A company to administrate and operate the zone. 2. Users of the zone (1)Industrial company (2)Commercial company (3)Service company	Maquilador Any natural or juridical person, consortium or other economic body who is qualified to operate the Maquila.
Obligation	All goods produced in the industrial zone must be exported except those that CONAZOFRA approves for domestic use.	All goods imported from abroad for elaboration, perfection, transformation or reparation must be re-exported.
Customs and Taxation Regimes	1. The import and export of goods through the Zone are totally free of tax, duty and customs. 2. Administration company and users have the benefits of exemption of 100% of income tax, value-added tax (IVA), provincial tax, municipal tax, and any other new tax for a period of 20 years. 3. Users are totally free of patent tax and of all taxes in force on production, use of patent and trademark, technical transfer and repatriation of profits for a period of 20 years. 4. Users will enjoy complete freedom in all currency exchange transactions among each other between zones and abroad.	1. The goods whose import may be authorized to a maquilador shall be subject to the Special Temporary Admission Regime of the Law, under which the payment of tax and duties will be suspended till final re-export. 2. Maquilador shall tender special guarantee sufficient for an amount equivalent to 100% of the tax which is payable and is in force at the moment of acceptance of the import declaration.

Item	Zona Franca	Maquila
Labor Regime and Relations	The relations between users and the laborers are subject to Labor Law in force with following modifications: (1) The labor contract in the zone, by its nature of temporary character, is not subject to the Article 14 of Labor Law and can be renewed any time if necessary. (2) The wages of workers must be at least 10% higher than the minimum wages that the workers of the same sector in the country will receive. (3) The wages must be agreed upon in U.S.$ and be paid in sucres at an exchange rate of free market in force at the day of payment. (4) It is prohibited to make a labor contract with minors less than 15 years old in the zone.	1. Maquila operation is subject to Labor Law and Maquila Regime Law. 2. The labor contract of maquilado is an agreement by which a person provides his licit services and personnel within a period of duration of the maquilado contract. 3. The individual labor contracts of maquila may be executed according to the various forms in Labor Law. These contracts will not enjoy the stability contemplated in the Art. 14 of Labor Law. Therefore, maquilador will be able to make a labor contract for a period required for operation.
Other special disposition	Users will enjoy free remittance abroad of the net annual profits generated in the zone.	1. The import does not require permission of the Central Bank. (Approval of MICIP) 2. For re-export of the imported goods and of the incorporated national components, an export declaration only is required. 3. The remittance of the net annual profits of foreign investors is not subject to any restriction.

C. Regional Development Plan Related to the Development of Port Activites

1) Road Development Plan

48. The most important road in Ecuador is the route from Quito (Capital of the Republic) to Guayaquil (the biggest commercial city of Ecuador). There are many industrial factories and agricultural farms such as banana plantations along this road. This road is the most frequently used for transportation of the commodities to/from the Port of Guayaquil.

49. However, the city of Babahoyo, Capital of the Province of Los Rios, is situated along this route. Since it is necessary for vehicles to pass through the center of the city, traffic congestion has become a problem.

50. Under the circumstances, the Ministry of Public Works has a plan to construct a new road from Baba to Salitre (22 km + 4 km of bypass = 26 km) which will be completed in two years. It will not be necessary for traffic to pass through Babahoyo after construction of the above road is completed. New route from Quito to Guayaquil will be as follows;

Quito - Quevedo - Baba - Salitre - Daule- Perimetral - Guayaquil Port

51. The plan and its budget (US$12 million) have already been approved, but financing is a pending question.

52. According to the Sub-secretariat of Guayaquil, Ministry of Public Works, there are no existing problems with other roads to/from the Port of Guayaquil.

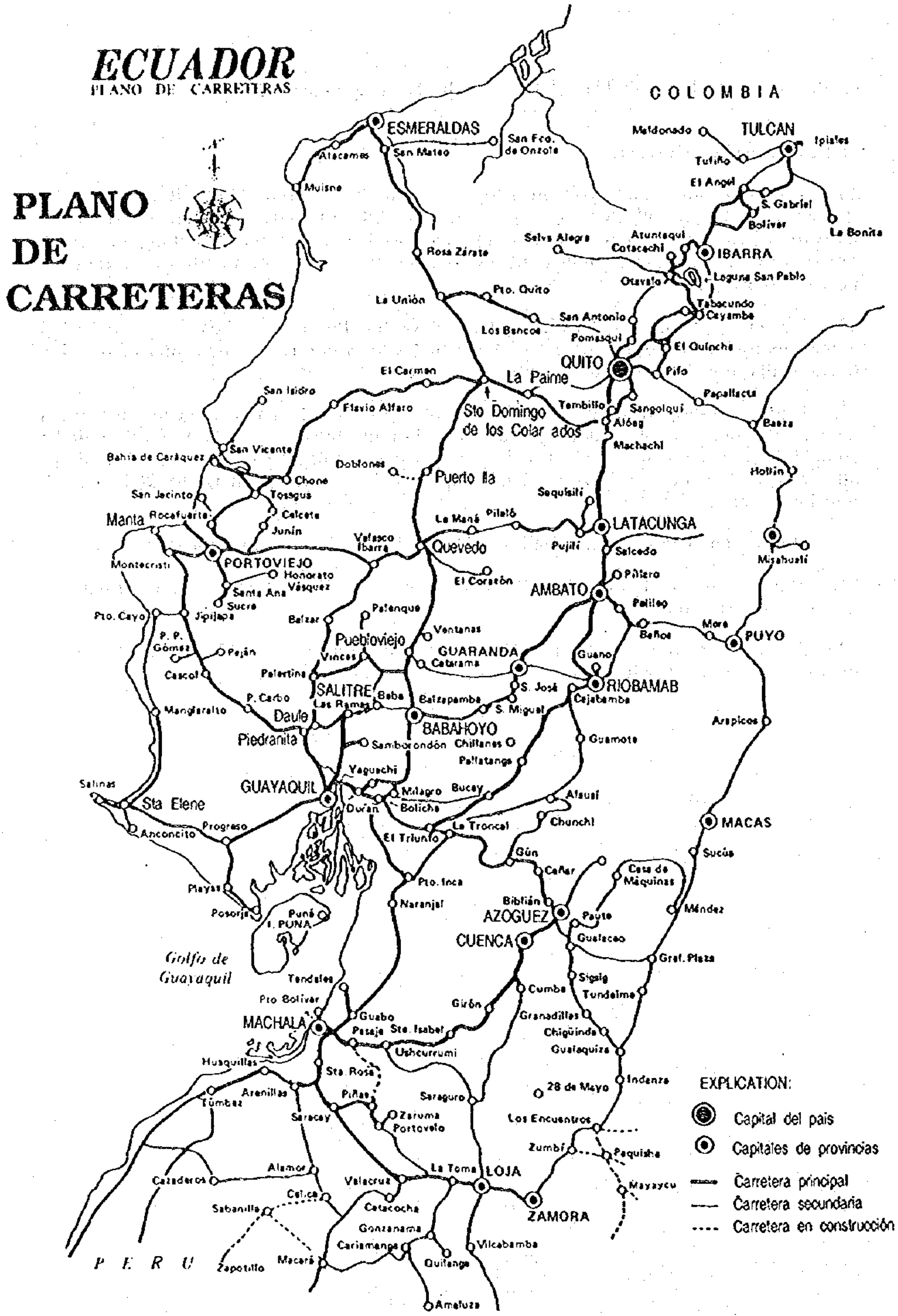


Figure I-2-3 Road Network in Ecuador and the New Road Plan

2) CEDEGE Plan

53. CEDEGE (Comision de Estudios para el Desarrollo de la cuenca del Rio Guayas, or Study Commission for Development of Rio Guayas Valley) is an organization attached to the President of the Republic.

54. The objective of the CEDEGE is to promote agricultural development in Cuenca de Guayas and Peninsula de Santa Elena. Figures I-2-4 shows the active areas and the plan of CEDEGE.

55. According to the explanation of CEDEGE, the following projects are in progress.

(1) Babahoyo Project (Irrigation area 9,000 ha.) is for the cultivation of rice (not for export because of the low production volume).

(2) Valle del Daule Margen - Derecha (Irrigation area 17,000 ha.) is for cultivation of rice (not for exportation because of the low production volume).

(3) Valle del Daule Margen - Izquierda (Irrigation area 33,000 ha.) is a future plan.

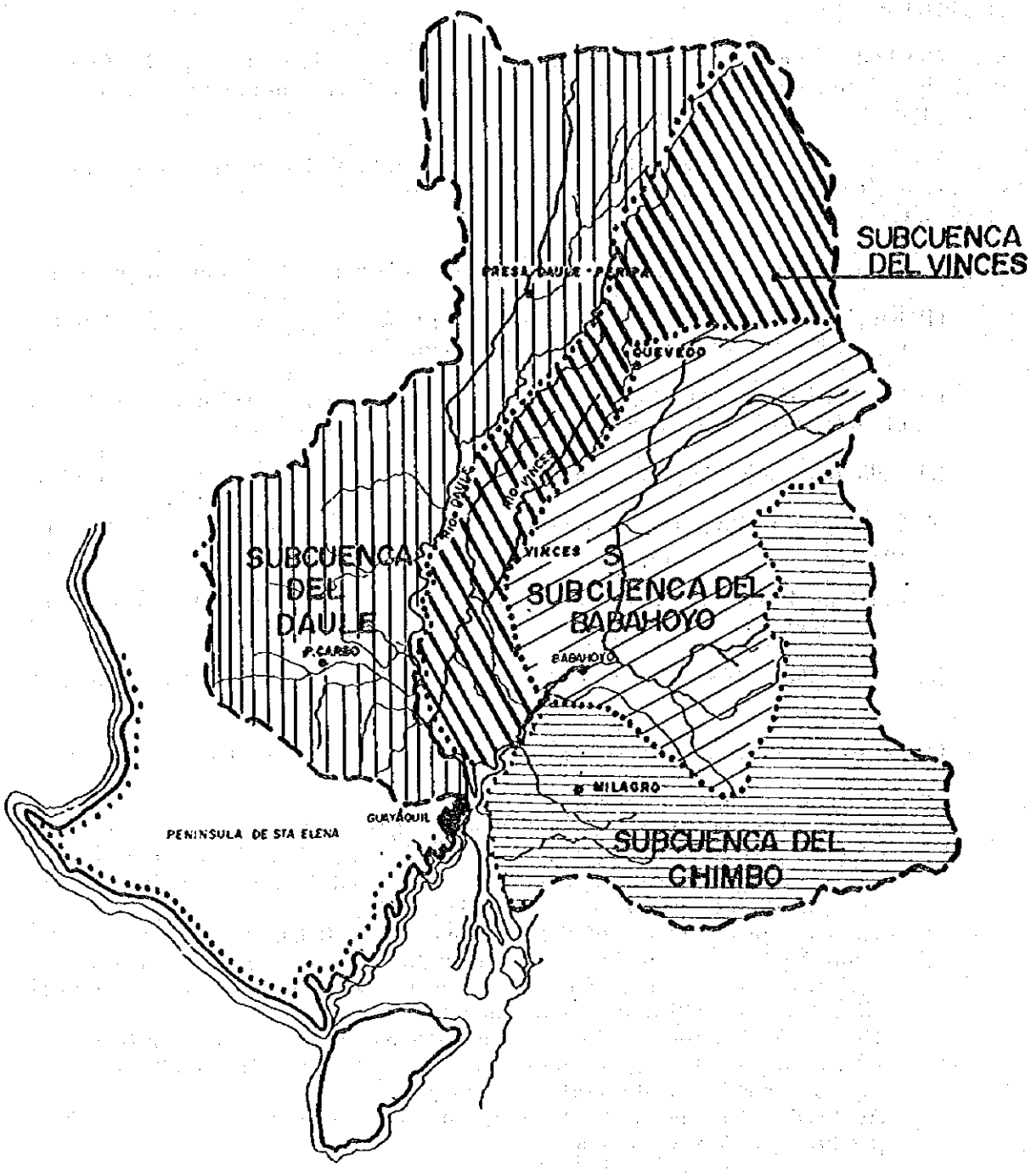
(4) Samborondon Project (Irrigation area 9,000 ha.) is scheduled for cultivation of rice.

(5) Catarama Project (Irrigation area 5,600 ha.) is planned for cultivation of soybean, rice, banana etc.

(6) Cuenca Baja del Guayas Project (170,000 ha.) is to protect against flooding of the area.

(7) Pedro Carbo Project (Irrigation area 7,500 ha.) is a future plan.

(8) Peninsula de Santa Elena Project
- The construction works of the 1st. phase (4,387 ha.) were already completed in 1991. As of 1994, 2,000 ha. of the total area have been cultivated for mango, melon, and passion fruit. The rest (about 2,300 ha.) will be available for cultivation in late 1995 or early 1996.
- The construction works of the 2nd. phase (15,000 ha.) are scheduled to be completed in 1995, and will be available for production in 1998. As this is a big project, foreign export of the products should be considered. Products other than rice will also be cultivated therein.
- The production forecast in the year 2,000 is 380,550 mt. of which around 250,000 mt. will be for exportation mainly to the E.C. The products will be exported mainly via the Port of Guayaquil.
- As to the remaining 20,000 ha. in the Sta. Elena Project, financing is a pending question at present.



ZONAS DE PLANIFICACION DEL
PLAN HIDRAULICO

Figure I-2-4 (1) CEDEGE Project

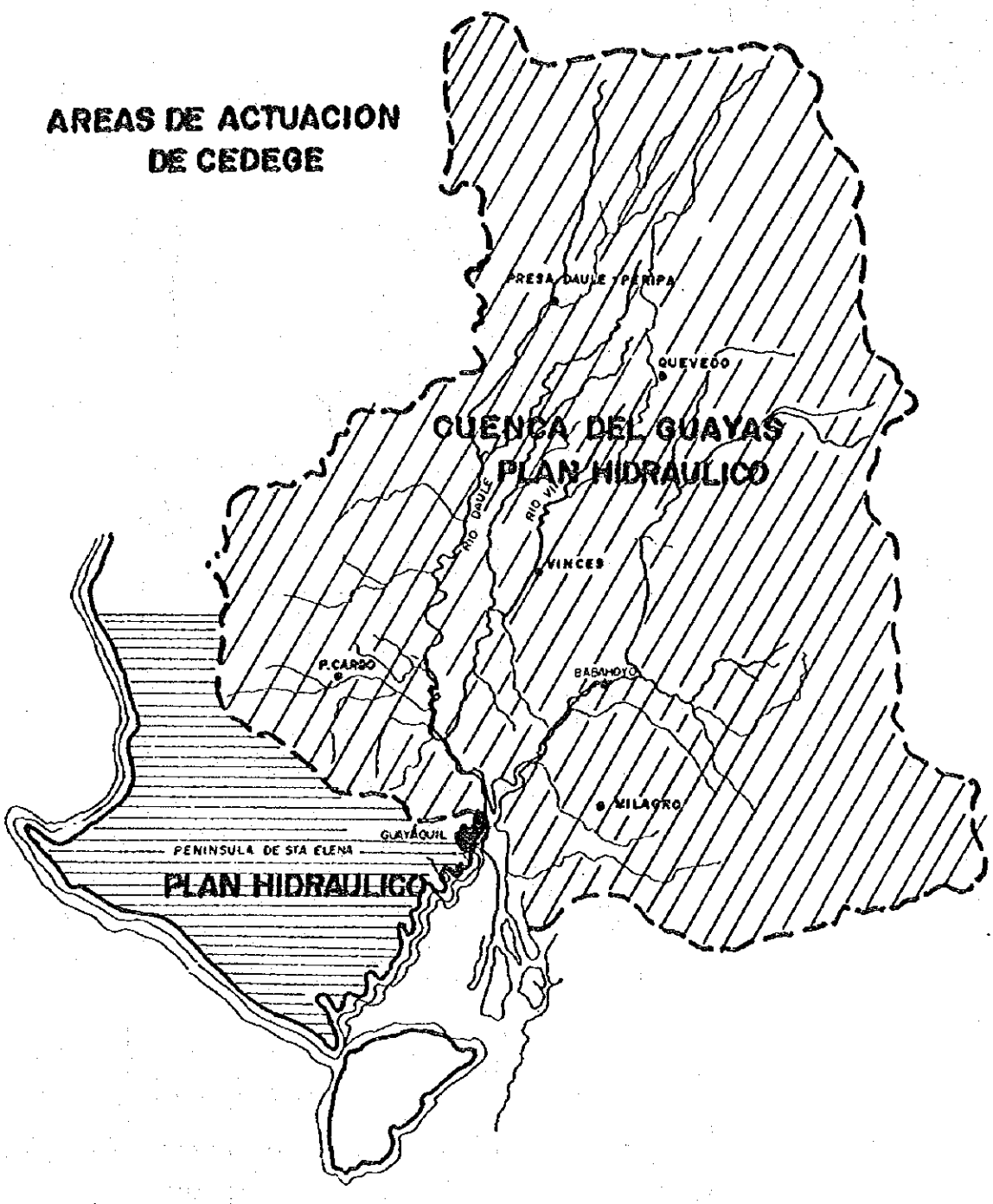
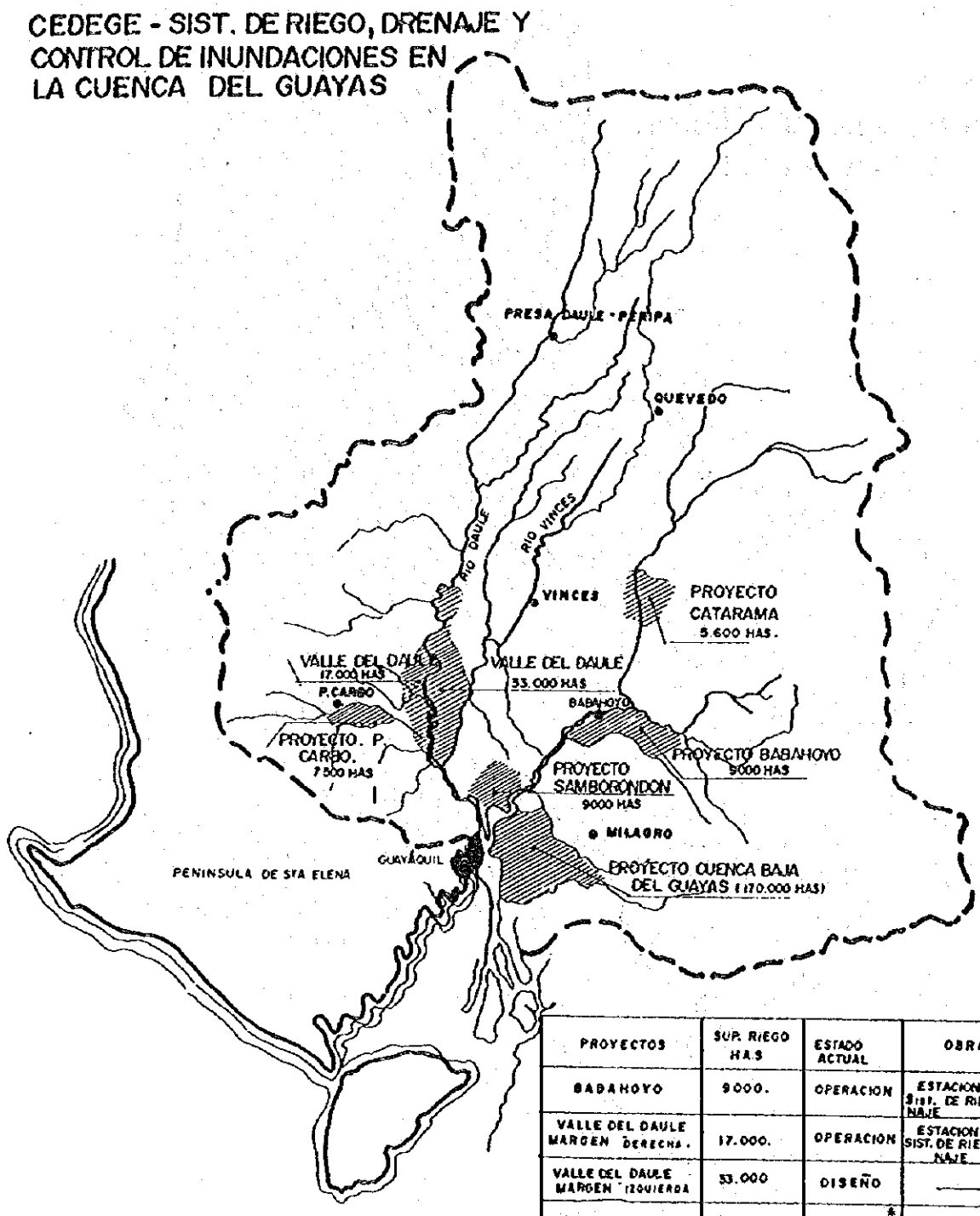


Figure I-2-4 (2) CEDEGE Project



PROYECTOS	SUP. RIEGO HAS	ESTADO ACTUAL	OBRAS
BABAHOYO	9000.	OPERACION	ESTACION BOMBEO SIST. DE RIEGO Y DRENAJE
VALLE DEL DAULE MARGEN DERECHA.	17.000.	OPERACION	ESTACION BOMBEO SIST. DE RIEGO Y DRENAJE
VALLE DEL DAULE MARGEN IZQUIERDA	33.000	DISEÑO	———
SAMBORONDON	9.000.	EN CONSTRU.*	DIQUES PROTECCION BOCATOMAS
CATARAMA	5.600.	LICITACION	SIST. DE RIEGO Y DRENAJE
CUENCA BAJA	170.000	CONSTRUCC.	CAUCE DE ALIVIO DRENAJES
P. CARBO	7.500.	PREFACTIBILIDAD.	SIST. DE RIEGO Y DRENAJE

* PARALIZADA CONSTRUCCION

ELABORACION: D. DE PLANIFICACION - ORDENADO: EC. M. NARANJO.

Figure I-2-4 (3) CEDEGE Project

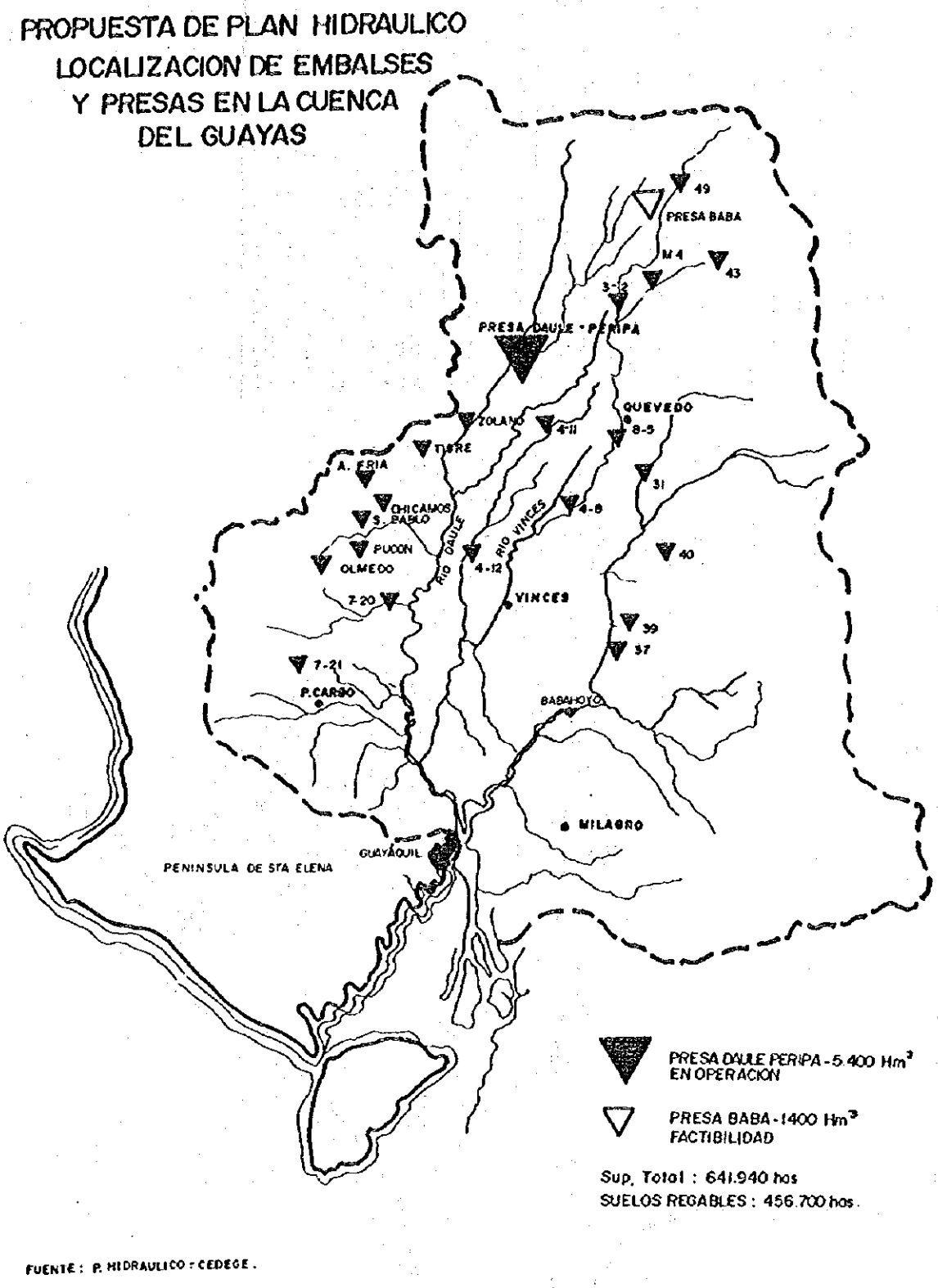
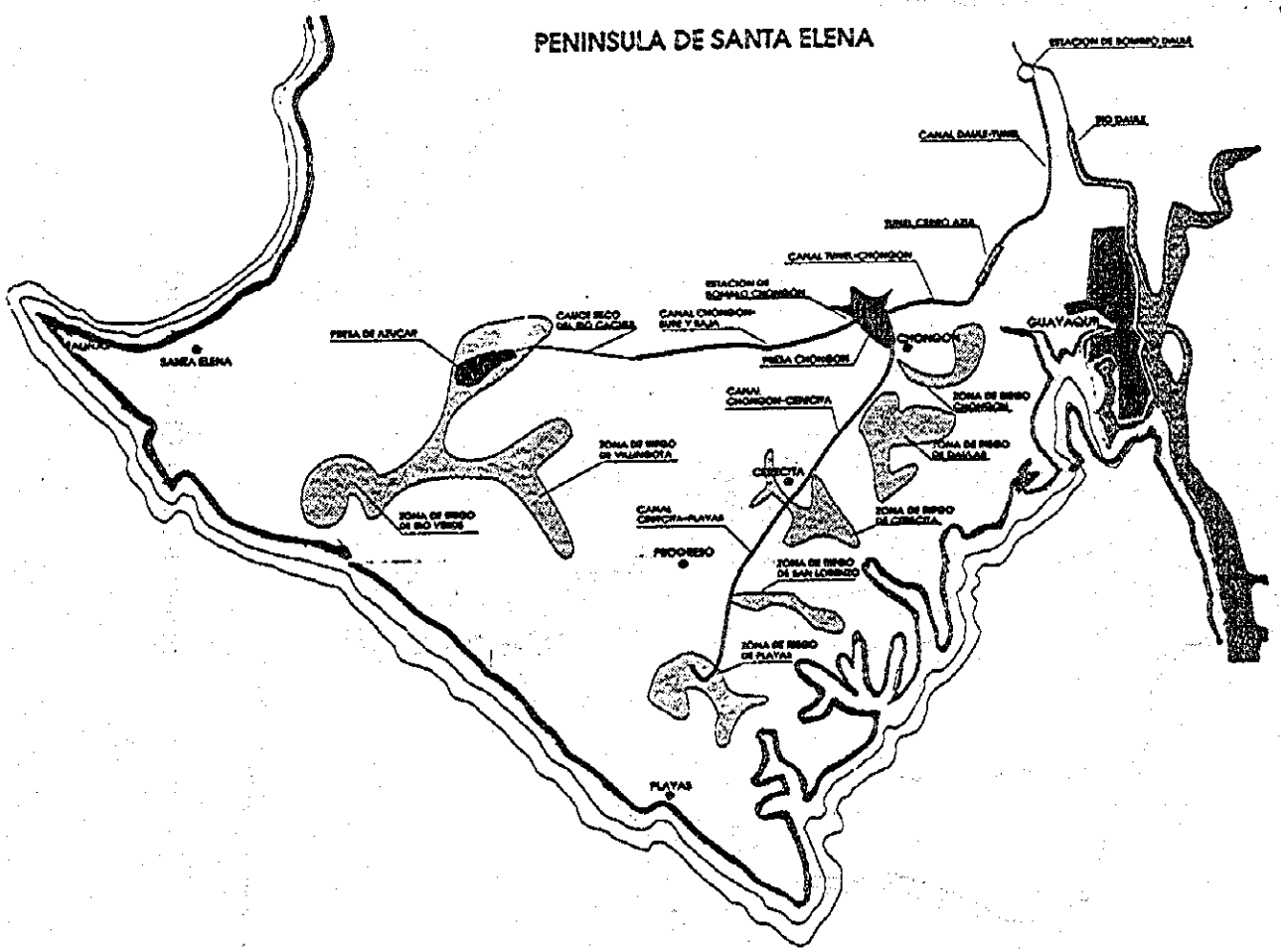


Figure I-2-4 (4) CEDEGE Project

PLAN HIDRAULICO Y AREAS DE RIEGO TRASVASE DAULE STA ELENA



OBRAS		1991	1995	PROXIMA ETAPA	PROYECTO COMPLETO
IMPULSION DAULE	L		1.06	1.06	2.10
	C		22.00	22.00	44.00
CANAL DAULE-TUNEL	L		24.75		26.75
	C		22.00	22.00	44.00
TUNEL DE CERRO AZUL	L		6.76		6.76
	C		22.00	22.00	44.00
CANAL TUNEL-CHONGON	L		4.10		4.10
	C		22.00	22.00	44.00
PRESA DE CHONGON	V				280,000,000
CANAL CHONGON-CERECITA	L	34.50			34.50
	C	12.50			12.50
CANAL CERECITA-PLAYAS	L		31.00		31.00
	C		9.00		9.00
IMPULSION CHONGON	L		3.00	3.00	6.00
	C		4.60	4.60	9.20
TRAMO CHONGON-SUBE Y BAJA	L		20.00		20.00
	C		9.20		9.20
TRAMO SUBE Y BAJA-AFAYE	L			12.00	12.00
	C			8.50	8.50
TRAMO AFAYE-RIO HONDO (JAVITA)	L			24.00	24.00
	C			7.00	7.00
TRAMO AZUCAR-RIO VERDE	L			20.00	20.00
	C			5.50	5.50

L = Longitud en km. C = Caudal en m³/seg. V = Volúmen del embalse en m³

ZONAS DE RIEGO	1991 ha	1995 ha	PROXIMA ETAPA
CHONGON	1,056		
DAULAR	1,509		
CERECITA	1,822		
SAN LORENZO		2,526	
PLAYAS		5,780	
SUBE Y BAJA		2,106	
VILLINGOTA		3,772	
RIO VERDE		3,448	
AZUCAR-ZAPOTAL			3,280
ATAHUALPA			7,081
JAVITA			8,424
SUB TOTAL	4,387	19,632	18,785
TOTAL ACUMULADO	4,387	24,019	42,804

Figure I-2-4 (5) CEDEGE Project

Chapter 3 OVERVIEW OF THE PORTS IN ECUADOR

A. Ports in Ecuador

1) General

1. The coast-line of Ecuador stretches about 700 km along the Pacific Ocean between Colombia and Peru. Along the coast-line there are four commercial ports and two oil terminals.

2. The ports of Esmeraldas, Manta, Guayaquil and Bolivar are commercial ports while Balao and La Libertad are the ports for oil loading and unloading. The location of these ports is shown in Figure I-3-1.

3. There are other ports in the estuaries and along the rivers but export/import cargo is not handled at these ports. In that sense, the six ports above are the main ports of Ecuador.

4. It is said that the cargo volume through the main ports, commercial ports and oil terminals, accounts for about 95 % for total foreign trade cargo volume in Ecuador. This figure shows that the ports have a very important role for the economic activity in Ecuador.

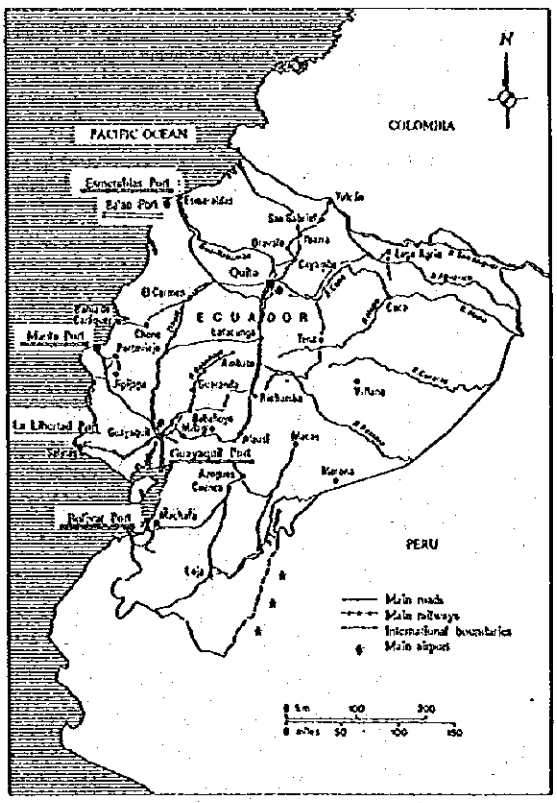


Figure I-3-1 Location of Main Ports in Ecuador

2) Port Facilities of Main Ports

(a) The Port of Esmeraldas

5. The Port of Esmeraldas is situated at Latitude 00° 59' 40" N and Longitude 79° 38' 48" W.

6. The port is located in the Province of Esmeraldas, in the northern part of Ecuador. The capital city of the province is Esmeraldas city which has about 120 thousand inhabitants.

7. The construction of the port began in 1971 and was completed in 1979.

8. The port directly faces the Pacific Ocean and the water area is protected by a breakwater. The depth in front of the port is more than 30 m and the Esmeraldas River mouth is positioned east-west from the port. The layout of the port is shown in Figure I-3-2.

9. There is a 350 m marginal wharf with 11.5 m depth and at the end of the wharf a platform for RO/RO ship is constructed. The wharf, warehouse and open shed in the port are listed in Table I-3-1.

10. According to DIGMER, maintenance dredging is required at the mouth of the port because of the material sedimentation from the Esmeraldas River. One more problem of the port is the lack of the equipment with sufficient capacity for handling the machinery of the petroleum industry.

11. In 1991 an area of 22 ha in the port was designated as the Free Zone and a chip making factory is under operation. The chip produced at the free zone is loaded to the vessel and exported. The study on the Free Zone in Esmeraldas was conducted by JICA.

12. Next to the port there is a fishery port, where many fishery boats are staying.

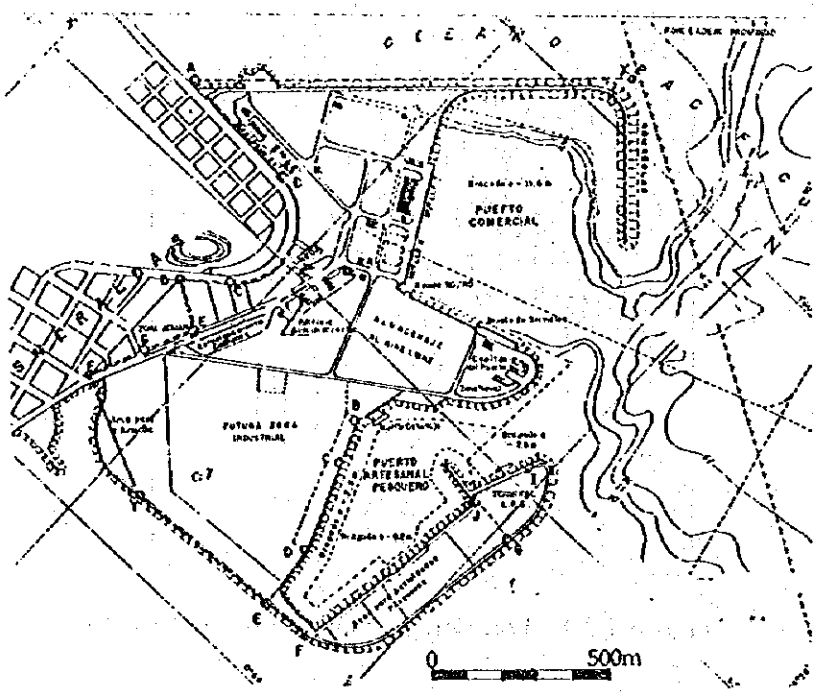


Figure I-3-2 Layout of The Port of Esmeraldas

Table I-3-1 Port Facilities at The Port of Esmeraldas

Berth

Type	Number	Length (m)	Depth (m)	Apron (m)
Marginal	2	350.00	11.50	26.00
(Ro-Ro Platform)	1	-	-	-

Storage Facilities

Type	Number	Area (m^2)
Warehouse (Transit)	1	7,200
Warehouse (Banana)	1	-
Warehouse (Dangerous Cargo)	1	-
Open Shed	2	176,000

Equipment

Type	Capacity (ton)	Number	Remarks
Crane	60.0	1	-
Crane	35.0	2	-
Forklift	3.0 - 10.0	9	-
Hauling Tractor	-	1	-
Header	40.0	2	-
Platform	5.0 - 40.0	18	-
Tug Boat	325.0 - 1,200.0	3	Unit;HP

(b) The Port of Manta

13. The Port of Manta is situated at Latitude 00° 55' 35" S and Longitude 80° 43' 02" W.

14. The port is located in the Province of Manabi between the Province of Esmeraldas and Guayas. The capital city of the province, Portoviejo city is about 4 km from the port.

15. The port facilities including the basin are protected by the jetty in the Pacific Ocean. The water depth in front of the port is about 11.0 m. The Manta River mouth is east from the port. The plan of the port is shown in Figure I-3-3.

16. There are finger jetty piers and marginal wharves and the maximum depth is 10 m. The platforms for RO/RO ship are attached to one of the finger jetty piers. The port facilities are listed in Table I-3-2.

17. According to DIGMER, the installment of new fender is strongly requested in this port. The fender installed before is covered with the concrete and rubber tires are attached at present. One of the piers is not fully used by ocean-going vessels under the coordination with other users. There is a problem with the security of the cargo transported to the port because the area for the ocean-going cargo handling is not well divided from the fishery activity.

18. Next to the port there is a fishery port. The study on the new fishery port development was conducted by JICA in 1991 but the project has not yet commenced.

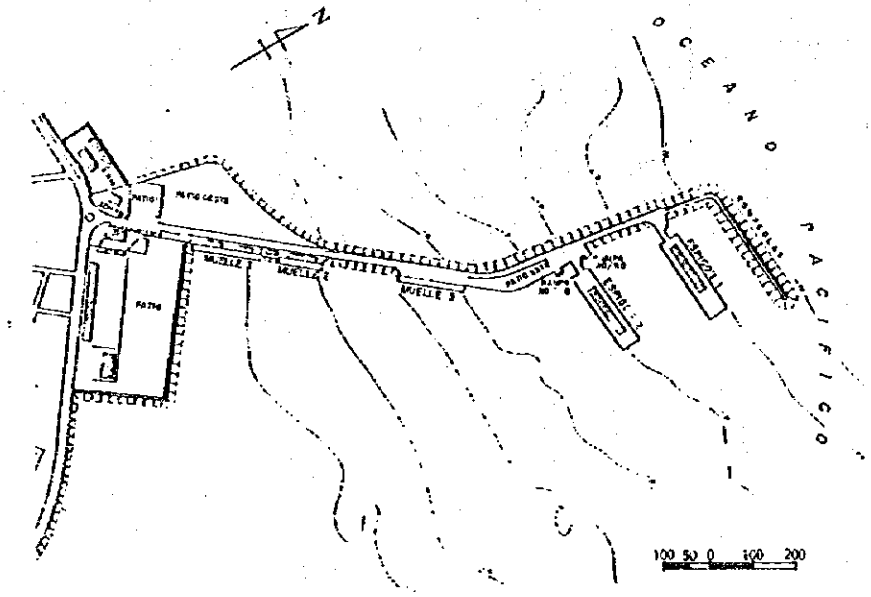


Figure I-3-3 Layout The Port of Manta

Table I-3-2 Port Facilities at The Port of Manta

Berth

Type	Number	Length (m)	Depth (m)
Pier (No. 1)	1	200.00	9.60
Pier (No.1)	1	200.00	9.00
Pier (No.2)	1	200.00	8.40
(Ro-Ro Platform)	1	-	-
Pier (No.2)	1	200.00	7.80
(Ro-Ro Platform)	1	-	-
Marginal (No.3)	1	150.00	7.00
Marginal (No.2)	1	150.00	5.00
Marginal (No.1)	1	100.00	5.00

Storage Facilities

Type	Number	Area (m^2)
Warehouse (Pier No.1)	1	2,232
Warehouse (Pier No. 2)	1	2,232
Warehouse (Marg. No. 2)	1	745
Warehouse (Danger/C)	1	450
Warehouse	1	1,400
Warehouse (Interior)	1	3,353
Open Shed	1	145,348

Equipment

Type	Capacity (ton)	Number	Remarks
Crane	10.0	1	-
Crane	35.0	2	-
Forklift	1.5 - 40.0	31	-
Hauling Tractor	2.0 - 5.0	7	-
Header	25.0	10	-
Platform	50.0 - 60.0	4	-
Tug Boat	1326.0 - 1,800.0	2	Unit;HP
Pilot Boat	-	1	-

(c) The Port of Guayaquil

19. The Port of Guayaquil is situated at Latitude 02° 16' 51" S and Longitude 79° 54' 49" W.

20. The port is located in the Province of Guayas. The capital city, Guayaquil city, has the biggest population in Ecuador with about 2 million inhabitants.

21. The port was originally located at an inner part of the Guayas River but was transferred to the present site in 1958. The expansion project was executed in 1980 at which time the present facilities were constructed.

22. The port has a 50 mile access channel with design depth of 9.45 m and the ship with draft depth enters the port on benefit of high tide. The layout of the port is shown in Figure I-3-4.

23. The port consists of a conventional port, container terminal and bulk terminal. There are about 925 m wharf with depth of 10.0 m, 555 m container berth and 155 m bulk berth. The wharves and storage facilities at the port are listed in Table I-3-3.

24. DIGMER points out the necessity of the maintenance dredging of the channel, the pavement work in the container yard and the improvement of the fender at the container berth. The shortage of capacity for container handling in various fields is also pointed out. The port also has the problem of security on cargo.

25. Along the channel, there is a mangrove forest and many pools for shrimp breeding are found.

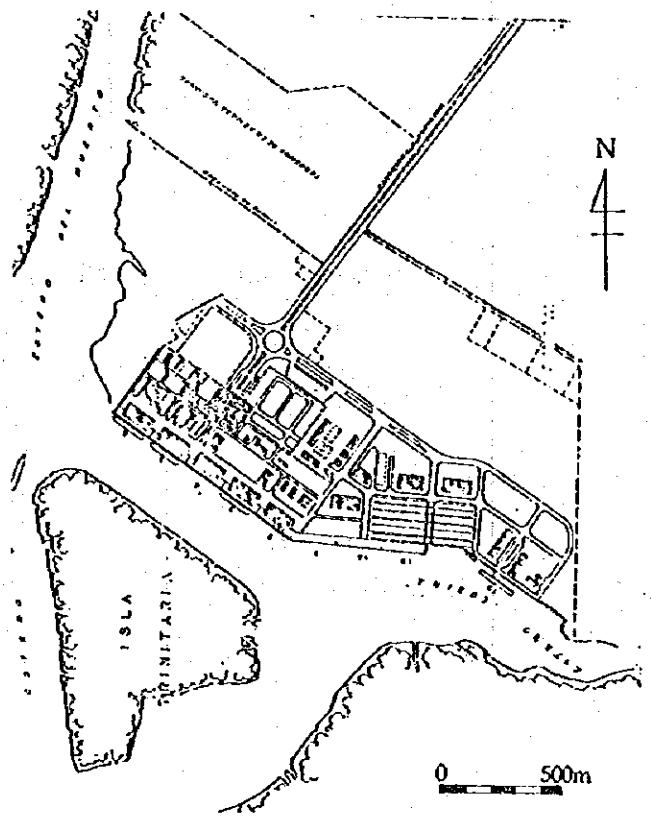


Figure I-3-4 Layout of The Port of Guayaquil

Table I-3-3 Port Facilities at The Port of Guayaquil

Berth

Type	Number	Length (m)	Depth (m)	Apron (m)
Marginal	5	925.25	10.00	12.20
Marginal	3	555.00	10.00	30.20
Dolphin (Bulk)	1	155.00	10.00	15.00

Storage Facilities

Type	Number	Area (m^2)	Capacity	
			(ton)	(m^3)
Warehouse	24	58,458	-	-
Warehouse (General/C)	1	7,200	-	-
Warehouse (Sugar)	1	-	30,000	-
CFS	2	14,400	-	-
Silo	1	-	2,000	-
Liquid Silo Tank	3	-	-	4,000
Vegetable Oil Tank	3	-	240	-
Open Shed	-	361,800	-	-

Equipment

Type	Capacity	Number	Remarks
Railed Crane	30.5	1	-
Rubber Wheeled Crane	40.0	2	-
Crane	50.0 - 70.0	7	-
Forklift	2.0 - 40.0	183	-
Hauling Tractor	70.0	20	-
Container Chassis	-	57	-
Platform	-	28	-
Tug Boat	400.0 - 1,350.0	8	Unit;HP
Launch	250.0	3	-

(d) The Port of Bolivar

26. The port of Bolivar is situated at Latitude 03° 15'55" S and Longitude 80° 00'01" W.

27. The port is located in the Province of El Oro in the southern part of the costal area of Ecuador. The capital city, Machala, is positioned about 5 km from the port.

28. The port is at the inner part of Estero Santa Rosa, approximately 7 km from the Pacific Ocean. The layout of the port is shown in Figure I-3-5.

29. There are 378 m marginal wharves with 10.0 m depth and a finger pier along Estero Santa Rosa. The facilities at the port are listed in Table I-3-4.

30. Almost all cargo through the port is banana and the shortage of berth for banana handling is pointed out by DIGMER.

31. According to DIGMER the expansion of a wharf is planned by the Port Authority of Bolivar. The new berth is designed as a banana handling berth and the installment of a crane is also under consideration.

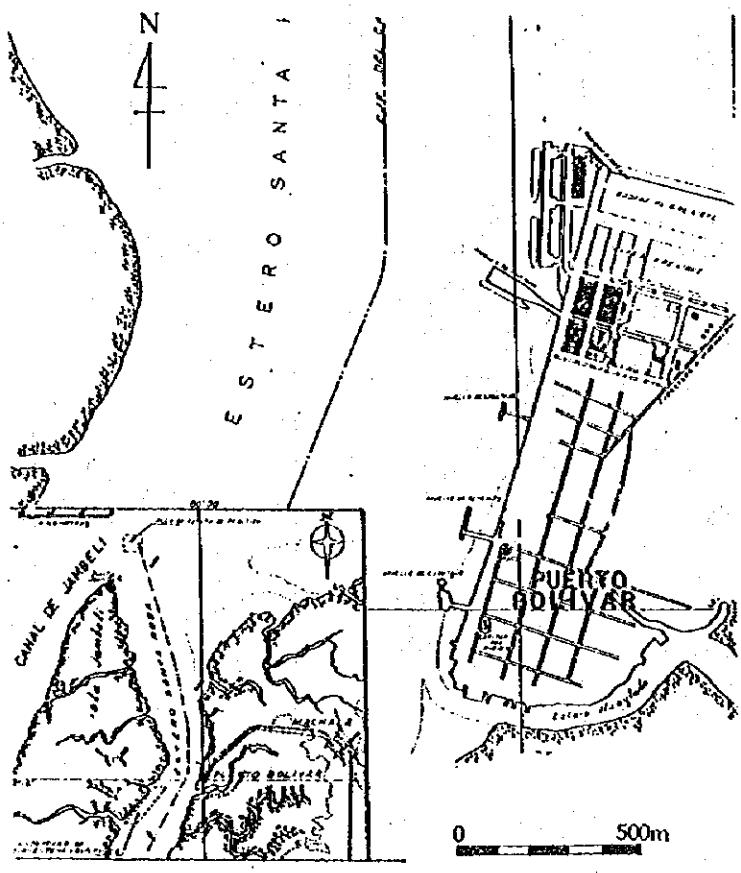


Figure I-3-5 Layout The Port of Bolivar

Table I-3-4 Port Facilities at The Port of Bolivar

Berth

Type	Number	Length (m)	Depth (m)	Apron (m)
Pier	2	120.00	8.00	30.00
Marginal	1	378.00	10.00	-

Storage Facilities

Type	Number	Area (m^2)
Warehouse	3	12,768
Warehouse (Banana)	1	
Open Shed	2	16,926

Equipment

Type	Capacity (ton)	Number	Remarks
Crane	17.0	1	-
Crane	35.0	1	-
Forklift	4.0	17	-
Hauling Tractor	3.5	4	-
platform	30.0	10	-
Tug Boat	480.0 - 1,200.00	3	Unit;HP
Pilot Boat	-	1	-

(e) Oil Terminal

32. The Balao Oil Terminal is located 4 km west from Esmeraldas City. Two mooring buoys are installed at the Terminal for crude oil loading.

33. The buoys are designed to serve oil tankers up to 100,000 DWT and are situated 3.3 miles off coast with no draft limitations. The buoy delivery capacity is 38,000 barrels/hour. A buoy has designed capacity of 80,000 barrels/hour and another buoy has designed capacity of 50,000 barrel/hour.

34. TEPRE (Esmeraldas Oil Refinery Provisional Terminal) is located between the commercial port and the Balao Oil Terminal and it is used to evacuate the refinery products. TEPRE maritime installations and facilities are a conventional mooring buoys system composed of four mooring buoys designed for ships up to 30,000 DWT and 15 m maximum draft at buoy field.

35. La Libertad Oil Terminal is located in the Santa Elena Peninsula, 140 km west of Guayaquil City

36. The Terminal is equipped with the buoy system designed for an approximate pumping capacity of 550 ton per hour and located 2.5 miles off La Libertad beach. This mooring buoy may serve ships up to 40,000 DWT and 11 m draft.

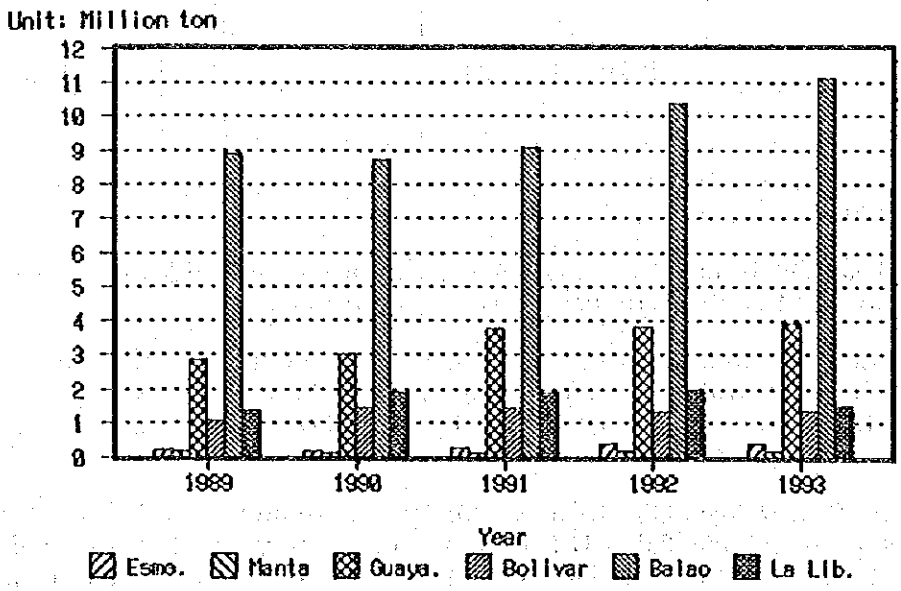
B. Port Activities in Major Ports

37. This chapter indicates ports activities in six major ports. Four ports are managed by Port Authority; the ports of Esmeraldas, Manta, Guayaquil and Bolivar. The other two ports are special oil terminals; the ports of Balao and La Libertad. The port of Balao is only exporting crud oil in international trade and the port of La Libertad is unloading petroleum product within domestic transport.

1) Cargo volume handled in Ecuador

38. Figure I-3-6 shows the cargo trend movement in six ports. Cargo volume handled at Balao port is the largest, followed by that handled at Guayaquil port. La libertad and Bolivar port rank third and fourth. The volume of cargo handled at the ports of Esmeraldas and Manta port is small compared to the other ports.

39. Table I-3-5 shows that total cargo volume handled in five major ports from international trade (except the port of La Libertad) by is 17 million tons in 1993, on the other hand cargo volume of La Libertad (domestic) is 1.4 million tons. The cargo volume of the five ports has increased by 32% during the last 5 years and the growth rate is 7% per year from 1989 to 1993. The oil terminal, in the port of Balao, handled 11.1 million tons of liquid cargo (only export) in 1993. The other four commercial ports handled 58.8 million tons in 1993. In international trade Balao handled 65%, the four commercial ports handled cargo 35% in 1993.



Source: DIGMER

Figure I-3-6 Trend of Cargo Movement Major Six Port

Table I-3-5 Total Cargo Volume of Major Ports in Ecuador

Year / Port	1989	1990	1991	1992	1993	Share '93 (%)	'93 PA (%)
Esmeraldas							
Import (ton)	158,459	113,195	195,296	264,424	292,920	11.08	11.08
Export (ton)	47,963	50,583	71,705	144,556	102,316	0.71	3.16
Total (ton)	206,422	163,778	267,001	408,980	395,236	2.32	6.71
Ship Call	169	180	198	215	239	8.39	8.96
Manta							
Import (ton)	99,780	50,378	63,782	132,044	114,103	4.32	4.32
Export (ton)	58,391	64,125	53,493	49,009	55,921	0.39	1.72
Total (ton)	158,171	114,503	117,275	181,053	170,024	1.00	2.89
Ship Call	147	173	190	296	301	10.57	11.29
Guayaquil							
Import (ton)	1,735,696	1,683,432	2,030,579	2,153,102	2,142,959	81.05	81.05
Export (ton)	1,099,892	1,319,287	1,737,169	1,657,068	1,793,038	12.48	55.31
Total (ton)	2,835,588	3,002,719	3,767,748	3,810,170	3,935,997	23.13	66.87
Ship Call	1,173	1,325	1,513	1,531	1,570	55.13	58.87
Bolivar							
Import (ton)	58,976	95,753	72,845	70,994	94,130	3.56	3.56
Export (ton)	1,009,518	1,359,007	1,405,709	1,261,826	1,290,664	8.98	39.81
Total (ton)	1,068,494	1,454,760	1,478,554	1,332,820	1,384,794	8.14	23.53
Ship Call	471	559	610	528	557	19.56	20.88
Sub-Total							
Import (ton)	2,052,911	1,942,758	2,362,502	2,620,564	2,644,112	100.00	100.00
Export (ton)	2,215,764	2,793,002	3,268,076	3,112,459	3,241,939	22.56	100.00
Total (ton)	4,268,675	4,735,760	5,630,578	5,733,023	5,886,051	34.59	100.00
Ship Call	1,960	2,237	2,511	2,570	2,667	93.64	100.00
Balao							
Import (ton)	0	0	0	0	0	0.00	
Export (ton)	8,914,279	8,718,053	9,075,293	10,360,646	11,129,832	77.44	
Total (ton)	8,914,279	8,718,053	9,075,293	10,360,646	11,129,832	65.41	
Ship Call	185	179	157	171	181	6.36	
Total							
Import (ton)	2,052,911	1,942,758	2,362,502	2,620,564	2,644,112	100.00	
Export (ton)	11,130,043	11,511,055	12,343,369	13,473,105	14,371,771	100.00	
Total (ton)	13,182,954	13,453,813	14,705,871	16,093,669	17,015,883	100.00	
Ship Call	2,145	2,416	2,668	2,741	2,848	100.00	
La Libertad							
Unload (ton)	1,379,958	1,922,931	1,908,184	1,990,334	1,493,903		
Load (ton)	0	0	0	0	0		
Total (ton)	1,379,958	1,922,931	1,908,184	1,990,334	1,493,903		
Ship Call	125	138	126	142	142		
Ground Total							
Import (ton)	3,432,869	3,865,689	4,270,686	4,610,898	4,138,015		
Export (ton)	11,130,043	11,511,055	12,343,369	13,473,105	14,371,771		
Total (ton)	14,562,912	15,376,744	16,614,055	18,084,003	18,509,786		
Ship Call	2,270	2,554	2,794	2,883	2,990		

Source: DIGMER, 'Estadistica Portuaria Ecuador'
Remarks: PA, Port Authority

2) Port of Esmeraldas

40. Total cargo volume is 395 thousand tons, the share in international trade is only 2% and the share of commercial port is 6% in 1993. Annual growth rate is 18% from 1989 to 1993 (Refer to Table I-3-5).

41. Major commodities of import are iron & steel, vehicles and metal product. The share of these in this port are 61%, 18% and 13%. Compared 1986 and 1993, new imported commodities are cotton and metal production. The share of two are 13% in 1993. (Refer to Table I-3-6)

42. On the other hand, major commodities of export are banana (84%) and wood (12%) (Refer to Table I-3-7).

43. Table I-3-8 shows major import countries: are the USA (57%), Brazil (11%) and Japan (9%). Major export countries are Japan (28%), Turkey (20%), and the USA (13%).

44. Almost all cargo (99%) is transported from Esmeraldas port to the Pichincha province, it shares about 99%. Secondary province is Guayas with a share of only 0.4%. Figure I-3-7 shows that the shares of Pichincha and Sin Datos province increased in 1993.

45. Vessel size trends are shown in Figure I-3-8. Length of major vessel ranges from 140-149 m and draft is more than 11 m in 1993. Esmeraldas port is located, the Pacific Ocean and its depth is the deepest among the other commercial ports, so vessels draft vessels is also deeper than at the other ports.

3) Port of Manta

46. Total cargo volume is 170 thousand tons, the share in international trade is 1%. With a share of only 3%, Manta port handled the least amount of cargo for international trade in 1990. Annual growth rate was 2% from 1989 to 1993 (Refer to Table I-3-5).

47. Major commodities of import are vehicles & machinery, chemical product and paper & paper product. The share of these in this port are 16%, 11% and 6%. Others of Products is large accounting for 62%. Between 1986 and 1993, vehicles & machinery increased by 6 times and import of chemical product by 3 times (Table I-3-6).

48. On the other hand, major commodities of export are fish (31%), coffee (14%) and wood (9%) (Refer to Table I-3-7).

49. Table I-3-8 shows that major countries of import are the USA (27%), Argentina (11%) and England (6%). Major countries of export are the USA (48%), Japan (12%) and Spain (12%).

50. Total container volume was 10,282 No (full container is 6,698 No, empty container is 3,584 No) in 1993. Weight was 95,991 tons. Full container of import is 4,502 No and that of export is 2,491 No. Container has increased rapidly since 1991; before this year total container was between 3,000 No and 4,000 No.

51. The cargo is mainly transported from Manta port to Manabi(41%), Pichincha (29%) and Guayas province(25%). Total share of three provinces is more than 90%. Figure I-3-7 shows that the shares of Manabi, Cotopaxi, Azuay provinces increased between 1986 and 1993.

Table I-3-6 Main Commodity of Import at Four Commercial Ports

Import — Esmeraldas — Manta — Unit: ton

	1986	1990	1993	'93 Share(%)	'93/86	1986	1990	1993	'93 Share(%)	'93/86
Fertilizers								267	0.23	
Oil										
Cement and construction	2	402	98	0.03	45.00	63	98	890	0.78	14.13
Fuel and derivative	7	127	28	0.01	4.00					
Paper and paper products	1,382	8	784	0.27	0.57	9,651	8,033	7,361	6.45	0.75
Wheat										
Animal Oil						616				
Vegetable Oil						4,734	11,229	986	0.86	0.21
Cotton		1,970	1,109	0.38						
Metal products		18,565	39,542	13.50		15,618	3,059	1,573	1.38	0.10
Vehicles and machinery	30,982	21,863	54,090	18.47	1.75	3,503	2,550	18,537	16.25	5.29
Chemical products	2,631	3,456	4,688	1.60	1.78	4,390	4,722	12,047	10.56	2.74
Iron, steel and other ma	82,886	61,926	178,712	61.01	2.16	9,688	16,361	1,779	1.56	0.19
Cereals and Pulses							303	293	0.26	
Other products	6,648	4,876	13,885	4.74	2.09	15,769	4,024	70,370	61.67	4.46
Total	123,738	113,195	292,928	100.00	2.37	64,151	50,378	114,103	100.00	1.78

Import — Guayaquil — Bolivar

	1986	1990	1993	'93 Share(%)	'93/86	1986	1990	1993	'93 Share(%)	'93/86
Fertilizers	137,734	214,412	285,798	9.61	1.49	21,670	10,438		0.00	0.00
Oil	32,829	28,896	34,515	1.61	1.05					
Cement and construction	44,340	3,981	5,312	0.25	0.12	13		5	0.01	
Fuel and derivative	340,251	3,657	4,459	0.21	0.01					
Paper and paper products	168,884	185,920	285,236	9.59	1.22	23,758	29,772	40,581	43.03	1.71
Wheat	384,697	417,956	444,164	20.74	1.15					
Animal Oil	1	14,822	5,382	0.25						
Vegetable Oil	15,457	23,437	5,928	0.28	0.38					
Cotton										
Metal products								41,324	43.80	
Vehicles and machinery	89,885	61,498	114,625	5.35	1.28	752	691	1,778	1.88	2.35
Chemical products	291,440	235,973	388,486	18.14	1.33	188	738	3,617	3.84	33.49
Iron, steel and other ma	261,757	199,149	263,778	12.32	0.94	1,872	6,148	3,995	4.23	3.72
Cereals and Pulses										
Other products	296,819	283,881	463,478	21.65	1.57	11,442	3,984	2,947	3.13	0.26
Total	2,003,474	1,683,432	2,141,185	100.00	1.03	59,807	95,753	94,138	100.00	1.60

Import — Total

	1986	1990	1993	'93 Share(%)	'93/86
Fertilizers	159,686	224,850	286,857	7.88	1.29
Oil	32,829	28,896	34,515	1.31	1.05
Cement and construction	44,418	4,481	5,297	0.24	0.14
Fuel and derivative	348,258	3,794	4,487	0.17	0.01
Paper and paper products	203,867	267,733	253,882	9.61	1.25
Wheat	384,697	417,956	444,164	16.81	1.15
Animal Oil	616	14,822	5,382	0.20	8.74
Vegetable Oil	20,191	34,665	6,894	0.26	0.34
Cotton	0	1,970	1,102	0.04	
Metal products	15,618	21,624	82,419	3.12	5.28
Vehicles and machinery	125,122	86,592	189,022	7.15	1.51
Chemical products	298,569	244,881	408,838	15.47	1.37
Iron, steel and other ma	374,523	283,584	449,255	16.96	1.20
Cereals and Pulses	0	303	293	0.01	
Other products	329,670	306,687	550,572	20.84	1.67
Total	2,330,362	1,942,758	2,642,258	100.00	1.13

Source: DIGMER

Table I-3-7 Main Commodity of Export at Four Commercial Ports

Export	Esmeraldas					Manta				
	1986	1990	1993	'93 Share(%)	'93/86	1986	1990	1993	'93 Share(%)	'93/86
Sugar										
Banana	6.649	46.657	86.050	84.88	13.06					
Cacao						35		946	1.69	27.03
Coffee						29.188	23.122	7.562	13.52	0.26
Fishmeal										
Sesame							757	4.349	7.78	
Fish, crustacea and moll						32.204	25.939	17.532	31.35	0.54
Wood and balsa wood	1.846	3.515	12.637	12.35	6.85	387		5.039	9.01	13.02
Green banana	754							3.638	6.51	
Other products	3.148	411	2.829	2.76	0.90	4.183	14.407	16.856	30.14	4.03
Total	12.397	50.583	102.316	100.00	8.25	65.917	64.125	55.921	100.00	0.85

Export	Guayaquil					Bolivar				
	1986	1990	1993	'93 Share(%)	'93/86	1986	1990	1993	'93 Share(%)	'93/86
Sugar	16.641	16.838	12.212	0.69	0.73					
Banana	436.310	885.239	1.339.493	74.71	2.70	896.778	1.347.564	1.282.966	99.40	1.43
Cacao	37.957	74.628	57.730	3.22	1.52					
Coffee	78.421	74.371	81.613	4.55	1.04					
Fishmeal	144.731	4.157		0.00	0.00					
Sesame			10	0.00						
Fish, crustacea and moll	55.461	71.416	102.918	5.63	2.84	653	1.868	1.645	0.13	2.52
Wood and balsa wood	15.599	11.127	11.187	0.62	0.73					
Green banana	28.758	48.949	34.065	1.90	1.18	4.368	5.697			
Other products	73.605	132.571	156.911	8.69	1.95	506	3.878	6.053	0.47	11.96
Total	933.495	1.319.287	1.793.039	122.00	1.92	902.237	1.359.027	1.292.664	100.00	1.43

Export	Total				
	1986	1990	1993	'93 Share(%)	'93/86
Sugar	16.641	16.838	12.212	0.38	0.73
Banana	1.399.729	2.279.460	2.709.309	83.57	1.94
Cacao	37.992	74.628	58.676	1.81	1.54
Coffee	107.609	97.493	89.175	2.75	0.83
Fishmeal	144.731	4.157	0		0.00
Sesame	0	757	4.359	0.13	
Fish, crustacea and moll	88.338	99.123	120.095	3.70	1.76
Wood and balsa wood	17.632	14.642	28.865	0.89	1.64
Green banana	33.872	54.645	37.703	1.16	1.11
Other products	87.642	151.267	181.546	5.60	2.07
Total	1.914.186	2.793.032	3.241.940	182.22	1.69

Source: DIGNER

Table I-3-8 Cargo Volume of O/D in Four Commercial Ports in 1993

Import — Unit: ton

	ESM	MANT	GUAY	BOLI	Total
USA	166,489	30,887	922,252	53,408	1,172,816
Argentina	15,279	12,896			28,175
Australia			71,038		71,038
Belgium			52,370	4,513	56,883
Brazil	32,599	2,188	129,257		164,032
Canada		2,581	156,772		159,353
Chile	16,207	5,889	77,410		99,426
Colombia			69,384		69,384
England		6,981			6,981
Germany			54,287	976	55,263
Iran	3,928				3,928
Italy		3,007		8,424	11,431
Japan	25,286	5,249			30,535
Korea	3,304				3,304
Mexico	5,278		109,358	1,184	115,840
New Zealand				565	565
Peru				3,299	3,299
Portugal				56	56
Spain		2,600			2,600
Turkey				3,886	3,886
Venezuela	14,258				14,258
Others	10,302	42,127	500,793	17,839	571,061
Total	292,920	114,103	2,142,959	94,130	2,644,112

Export — Unit: ton

	ESM	MANT	GUAY	BOLI	Total
USA	13,238	26,994	703,997	355,646	1,098,863
Argentina			133,869	42,677	176,545
Belgium	5,314		278,718	59,973	336,025
Chile		757	153,585		154,342
Germany		804	142,947	191,013	334,764
Holland		1,470	37,180		38,650
Iran	11,443				11,443
Italy	455		88,443	322,523	403,431
Japan	29,125	8,691	61,377	72,479	169,872
Korea	6,421	1,557			7,978
Mexico	1,134	1,187		19,003	21,324
New Zealand				45,073	45,073
Puerto Rico		2,466		21,070	23,536
Spain		6,832	28,468		35,301
Turkey	28,469				28,469
Venezuela	4,470				4,470
Others	18,239	6,972	183,454	161,207	351,872
Total	102,316	55,921	1,793,038	1,290,664	3,241,939

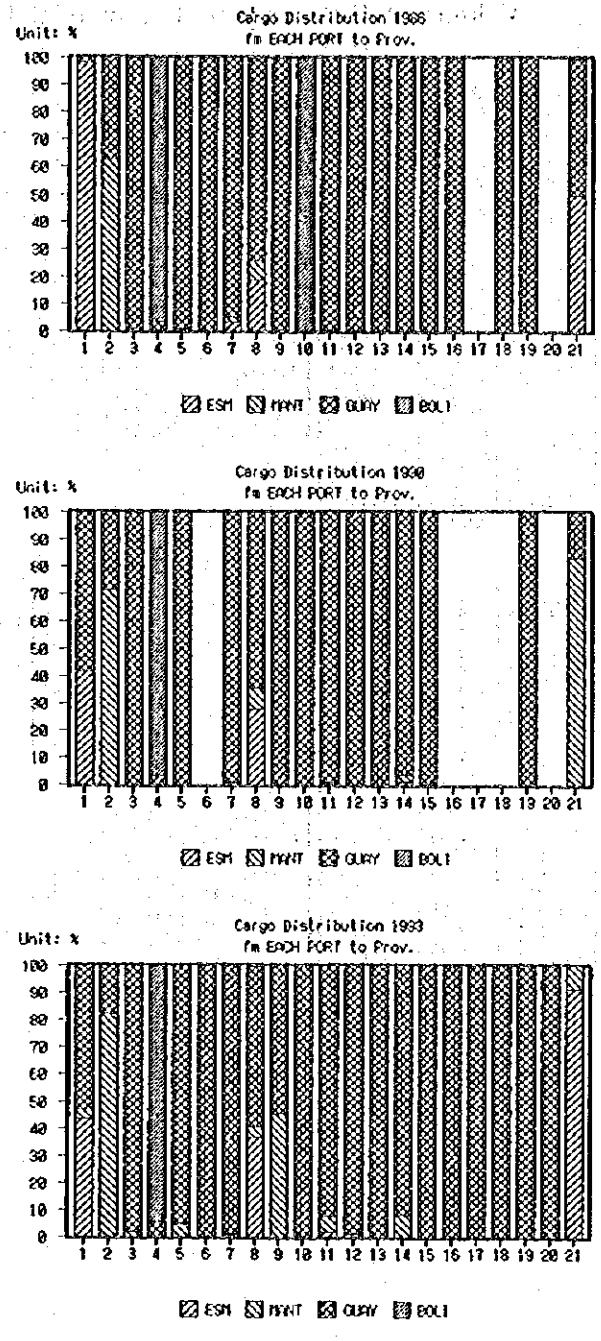
Share of Cargo — Unit: %

	ESM	MANT	GUAY	BOLI	Total
USA	56.84	26.88	43.04	56.74	44.36
Argentina	5.22	11.30	0.00	0.00	1.07
Australia	0.00	0.00	3.31	0.00	2.69
Belgium	0.00	0.00	2.44	4.79	2.15
Brazil	11.13	1.92	6.03	0.00	6.20
Canada	0.00	2.26	7.32	0.00	6.03
Chile	5.53	5.00	3.61	0.00	3.76
Colombia	0.00	0.00	3.24	0.00	2.62
England	0.00	6.12	0.00	0.00	0.26
Germany	0.00	0.00	2.53	1.04	2.09
Iran	1.34	0.00	0.00	0.00	0.15
Italy	0.00	2.64	0.00	8.95	0.43
Japan	8.63	4.60	0.00	0.00	1.15
Korea	1.13	0.00	0.00	0.00	0.12
Mexico	1.80	0.00	5.10	1.26	4.38
New Zealand	0.00	0.00	0.00	0.60	0.02
Peru	0.00	0.00	0.00	3.50	0.12
Portugal	0.00	0.00	0.00	0.06	0.00
Spain	0.00	2.28	0.00	0.00	0.10
Turkey	0.00	0.00	0.00	4.13	0.15
Venezuela	4.87	0.00	0.00	0.00	0.54
Others	3.52	36.92	23.37	18.95	21.60
Total	100.00	100.00	100.00	100.00	100.00

Source: DIGMER

Export — Unit: %

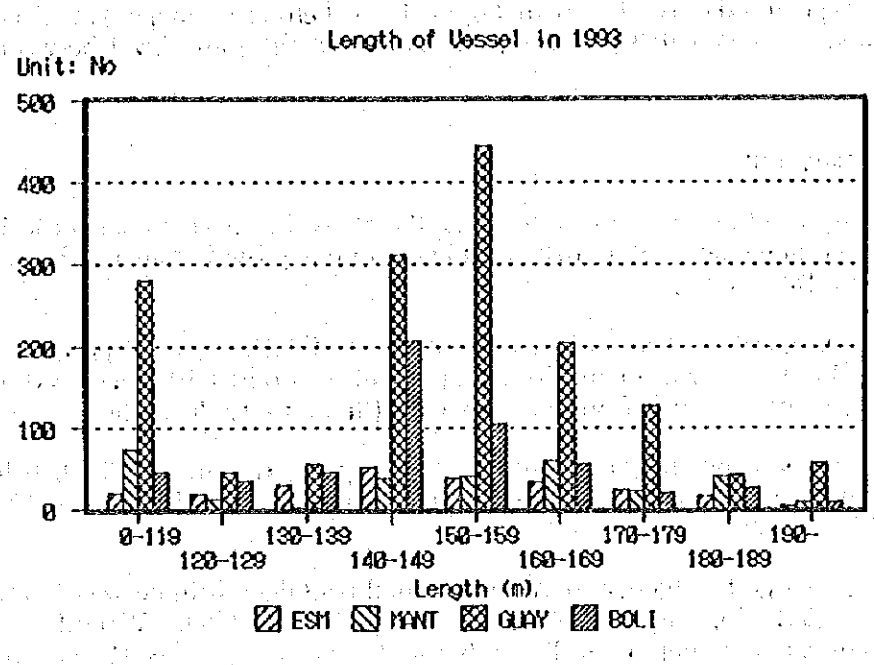
	ESM	MANT	GUAY	BOLI	Total
USA	12.94	48.25	39.10	27.56	33.83
Argentina	0.00	0.00	7.47	3.31	5.45
Belgium	5.19	0.00	15.10	4.65	10.36
Chile	0.00	1.35	8.57	0.00	4.76
Germany	0.00	1.44	7.97	14.80	10.33
Holland	0.00	2.63	2.07	0.00	1.19
Iran	11.18	0.00	0.00	0.00	0.35
Italy	0.45	0.00	4.49	24.99	12.44
Japan	28.47	12.32	3.42	5.62	5.24
Korea	6.28	2.78	0.00	0.00	0.25
Mexico	1.11	2.12	0.00	1.47	0.66
New Zealand	0.00	0.00	0.00	3.49	1.33
Puerto Rico	0.00	4.41	0.00	1.63	0.73
Spain	0.00	12.22	1.59	0.00	1.09
Turkey	28.01	0.00	0.00	0.00	0.63
Venezuela	4.37	0.00	0.00	0.00	0.14
Others	18.01	12.47	10.23	12.49	11.16
Total	100.00	100.00	100.00	100.00	100.00

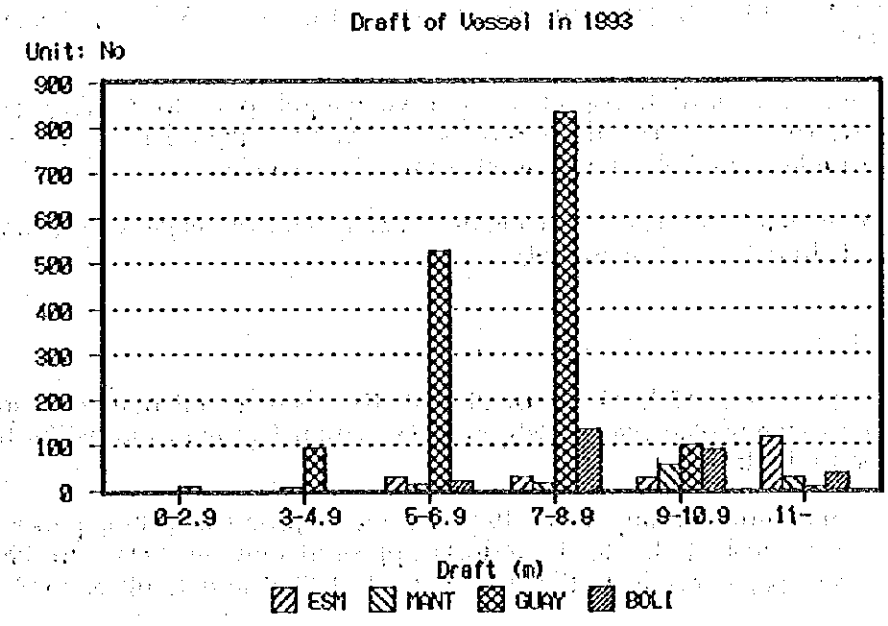


No	Province	No	Province	No	Province
1	Esmeraldas	8	Pichincha	15	Loja
2	Manabi	9	Cotopaxi	16	Napo
3	Guayas	10	Bolivar	17	Pastaza
4	El Oro	11	Tungurahua	18	Morona Santiago
5	Los Rios	12	Chimborazo	19	Zamora Chinchipe
6	Carchi	13	Canar	20	Galapagos
7	Imbabura	14	Azuay	21	Sin Datos

Source: DIGMER

Figure I-3-7 Cargo Distribution from Each Port to Province





Source: DIGMER

Figure I-3-8 Size of Vessel at Four Commercial Ports in 1993

52. Vessel type trends are shown in Figure I-3-8. Length of major vessel is 0-119 and 160-169 m and draft is 9-10.9 m. This trend is almost the same level between 1986 and 1993.

4) Port of Guayaquil

53. Total cargo volume is 3.9 million tons, the share in international tarde is 23% and the share of commercial port is 67% in 1993. Annual growth rate is 8% from 1989 to 1993 (Refer to Table I-3-5).

54. Major commodities of import in 1993 are wheat (21%), chemical products (18%) and iron & steel (12%). Growth of fertilizer and chemical product has increased at a greater rate than other commodities from 1986 to 1993 (Refer to Table I-3-6).

55. On the other hand, major commodities of export are banana (75%), fish (6%) and coffee (3%) in 1993. The three commodities maintain same trend between 1986 and 1993 (Refer to Table I-3-7).

56. Container cargo has increased annually. Total container volume was 126,627 No (full container is 78,551 No, empty container is 48,076 No) in 1993. Weight was 1,207,688 tons. Full container of import is 37,208 No and that of export is 41,343 No.

57. Table I-3-8 shows that major countries of import are the USA (43%), Canada (7%) and Brazil (6%) in 1993. Major countries of export are the USA (39%), Belgium (15%) and Chile (9%).

58. The cargo is mainly transported from Guayaquil port to Guayas (74%) and Pichincha province (22%). The third province is Azuay. Figure I-3-7 shows that the share of Esmeraldas and Bolivar increased from 1986 to 1993.

59. Vessel size trends are shown in Figure I-3-8. Length of major vessel ranges from 150-159 m and draft is 7-8.9 m in 1993.

5) Port of Bolivar

60. Total cargo volume is 1,384 thousand tons, the share in international tarde is 8% and the share of commercial port is 24% in 1993. Annual growth rate is 7% from 1989 to 1993 (Refer to Table I-3-5).

61. Major commodities of import in 1993 are metal products (44%), paper products (43%) and iron & steel (4%). Metal products appeared only in 1993. In 1992, major commodities were paper products (79%), Iron & steel (8%) and fertilizer (5%) (Refer to Table I-3-6).

62. On the other hand, major commodity of export is banana (99%). This port is a special port for banana (Refer to Table I-3-7).

63. Table I-3-8 shows that major countries of import are the USA (57%), Italy (10%) and Belgium (5%). Meanwhile, major countries of export are the USA (28%), Italy (25%) and Germany (15%).

64. The cargoes are only transported from Manta port to El Oro province (100%). But Figure I-3-7 shows the share of El Oro province slightly decreased in 1993.

65. Vessel size trends are shown in Figure I-3-8. Length of major vessel ranges from 140-149 m and draft is 7-8.9 m in 1993.

6) Port of Balao

66. Total cargo volume is 11,129 thousand tons, the share in international tarde was 65% in 1993. This port is only for exporting. The annual growth rate is 5.5% from 1989 to 1993 (Refer to Table I-3-5).

67. Major commodity of export is crude oil. Ship call in 1993 is 181. Length of major vessel is more than 220 m, draft is more than 11 m and dead weight tonnage is more than 600,000 tons in 1993.

68. Major countries of export are the USA (43%), Korea (23%), Panama (8%) and Peru (8%) in 1993.

7) Port of La Libertad

69. Total cargo volume is 1,493.9 million tons; this port is only for domestic unloading of oil product in domestic. Annual growth rate is 2% from 1989 to 1993 (Refer to Table I-3-5).

70. Ship call in 1992 and 1993 is also 142. Length of major vessel is 170-179 m, draft is 9-10.9 m and dead weight tonnage is 30,001-32,000 tons in 1993.

C. Administration and Operation

1) Outline of Ecuador Port

71. In Ecuador, there are four main commercial ports and two main oil terminals as shown below.

- Commercial Ports
  - Esmeraldas
  - Manta
  - Guayaquil
  - Port Bolivar
- Oil Terminals
  - Salitral
  - Balao

In addition, private international traffic terminals and fishing ports are incorporated in the national port system.

72. The main laws concerning Ecuador port are Port General Laws (Ley General de Puertos) which stipulate administration of all port installations, maritime waters in Ecuador, and National Port Administrative Regime Law (Ley de Regimen Administrativo Portuario Nacional) which outlines the Port Authority and its purpose.

73. According to Article 2 of the Port General Laws, policy-making, planning, management, coordination and control of the port policy are carried out by Marine Merchant and Port National Council (Consejo Nacional de Marina Mercante y Puertos, CNMMP), through General Direction of Merchant Marine and the Littoral (Direccion de la Marina Mercante y del Litoral, DIGMER) and Port Entities.

74. Figure I-3-9 shows the system of port control in Ecuador.

2) CNMMP

75. CNMMP, the highest organ of government related to the navy and port, is comprised of the following members.

- Minister of National Defense (Ministro de Defensa Nacional): President of Council
- General Marine Commander (Comandante Genelaciones Marina)
- Minister or undersecretary of Foreign Relation (Relaciones Exteriores)
- Minister or undersecretary of Public Works and Communications (Obras Publicas y Comunicaciones)
- Minister or undersecretary of Finances and Public Credits (Finanzas y Credito Publico)
- Minister or undersecretary of Industry, Commerce, Integration and Fishery (Industrias, Comercio e Integracion y Pesca)
- National Development Council (Consejo Nacional de Desarrollo, CONADE)
- First Zone Director of Navy (Jefe de la Primera Zona Naval)
- Navy Maritime Development Director (Director de Desarrollo Maritimo de la Armada)

The General Director of DIGMER takes part in the Directors' meeting of CNMMP in the capacity of an assistant.

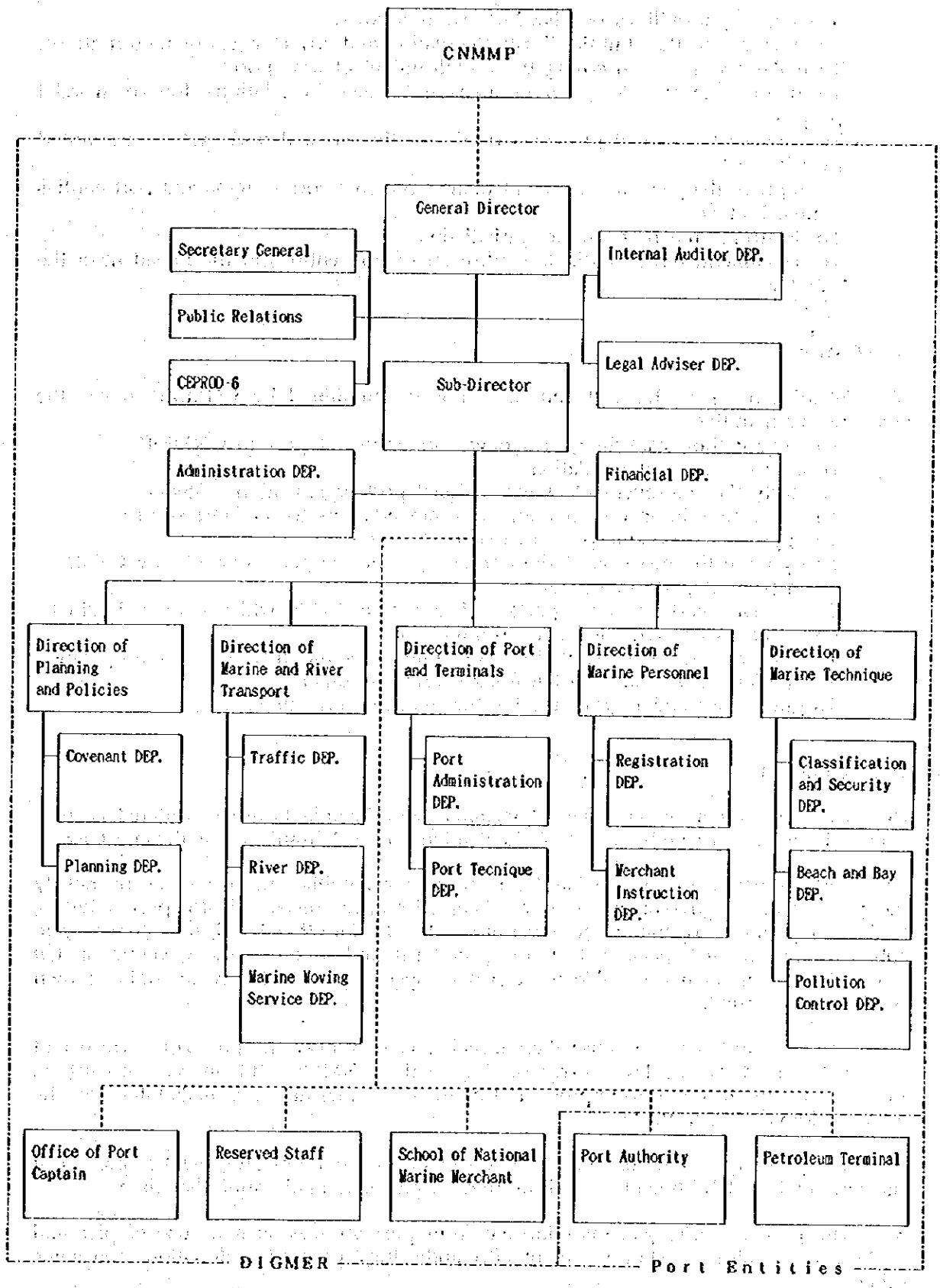


Figure I-3-9 System of Port Control in Ecuador

76. The main responsibilities of CNMMP are as follows.
- To approve the Port Entities Tariff Regulation and any changes or modifications.
- To make decisions concerning the establishment of new ports.
- To permit the use of ports or maritime water installations for commercial purposes.
- To approve the annual plan of activities of the national port systems submitted by DIGMER.
- To approve the general investment plan of national port systems and port entities annual budget.
- To determine the port entities' jurisdiction.
- To recommend three candidate of director of port entities to the President of the country.

3) DIGMER

77. DIGMER oversees the port and navy policy determined by CNMMP. It has the following main duties.
- To suggest the establishing of a new port or use of port to CNMMP.
- To approve the port regulations.
- To study the improvement of the national port organization systems.
- To make periodic inspections, and recommendations to the port entities.
- To approve the organic personnel of port entities
- To over see the progress of the annual operation targets approved by CNMMP.
- To inspect all ports in Ecuador.
- To evaluate workers in the ports of Ecuador to decide which people should be promoted, which require further training etc..
- To study documents submitted by port authorities; monthly statistics of operation and performance, annual balance sheet and any others.
- To grant titles and register list for the maritime personnel.

4) Port Entities

78. The port authorities and the oil terminal superintendents are considered as port entities in accordance with clauses of the National Port Administrative Regime Law.

79. Port Authority is on one hand an autonomous public institution, or financially independent of the government. They own capital and resources used for port activities, facilities, equipment, operation, administration etc. On the other hand, it is necessary to submit annual budget, personnel affairs, port tariff and so on to the government. Oil terminal superintendents are able to regard as special port authority by right of own patrimony and funds.

80. The port authorities exercise their jurisdiction only over the port zone which had been determined by the law, corresponding to the CNMMP. Planning, construction, investment, administration to improve and maintain the maritime terminals fall under the administrations of CNMMP.

81. The property of the port authority consist of all properties and facilities present at the time of its establishment as well as they acquisitions made after that time.

82. The port authority generates income from port services such as use of pier and anchorage, technical assistance, rent of port authorities' properties, donations and some others.

83. The responsibilities of port authorities in their jurisdiction are as follows
- To use and assign port services and facilities.
- To classify and regulate services and facilities.
- To establish the administrative rule and port service control.
- To apply the port laws and regulation to the facilities and services.
- To collect the port charge according to tariff regulation approved by CNMMP.

Chapter 4 NATURAL CONDITION

A. Meteorological Condition

1) Climate and Weather

1. The climate of the project site is classified into semitropical arid one which is under the influence of the cold ocean current, so called the Peru Humboldt current. Remarkable characteristics of the climate are:

(1) There are two seasons, i.e. rainy season (December to May) and dry season (June to November).

(2) Cloudy weather is dominant throughout the year, number of fine days is few, which counts about 25% of the year.

Table I-4-1 Weather Condition

1. Year 1988

Month	WEATHER (number of days)		
	Fine	Fine To Cloudy	Cloudy -Rain
January	3	6	22 *(22)
February		1	27 (25)
March	3	4	24 (20)
April	1	6	23 (19)
May	8	8	15 (12)
June	5	9	16 (6)
July	9	11	11 (2)
August	8	9	14 (0)
September	6	9	15 (5)
October	3	8	20 (5)
November	4	4	22 (7)
December	1	2	28 (28)

*Note: (22) means rainy days

2. Year 1983 (Year of Niño)

January		1	30 (28)
February		2	27 (26)
March		2	29 (29)
April		1	29 (29)
May		4	27 (27)
June		7	23 (23)
July		9	22 (22)
August	6	12	13 (5)
September	2	8	20 (9)
October		9	22 (9)
November	4	9	18 (8)
December	2	5	24 (13)

2) Temperature

2. Temperature of the site is summarised as below.

(1) Maximum temperature of the month ranges from 31° to 35°, average temperature ranges from 23°C to 27°C and minimum temperature ranges from 16°C to 24°C.

(2) The highest temperature in the past was 35.9°C in January 1988, on the other hand the lowest was 15.8°C in February 1971.

(3) There is a tendency that the temperature in rainy season are about 2 to 3°C higher than those in dry season.

(4) Although location is near the equator (tropical region), minimum temperature becomes below 20°C due to the influence of the Peru Humboldt Current (cold ocean current).

Table I-4-2 Temperature

(Latitude : 02°09'30" Longitude : 79°53'20" Altitude 7 m.)

MAXIMUM TEMPERATURE

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	ANNUAL
1959	33.2	32.3	35.1	33.7	32.3	31.5	32.4	31.9	32.4	33.1	33.7	33.8	35.1
1960													
1961	33.2	32.9	33.6	33.0	32.0	31.4	30.6	32.0	31.8	32.6	33.1	34.6	34.6
1962	33.3	33.5	33.2	34.4	33.2	31.0	32.4	32.5	(33.7	33.6	34.5	35.3	33.3
1963	34.2	32.8	32.8	32.8	33.4	33.5	30.5	32.2	32.5	33.0	32.7	34.2	34.2
1964	33.2	32.3	32.5	32.0	32.4	31.7	30.7	32.0	31.0	32.4	32.7	33.9	33.9
1965	33.4	32.6	32.2	32.9	31.9	32.9	33.2	31.0	34.0	33.0	32.6	33.8	34.0
1966	32.9	32.0	33.6	33.4	33.0	31.8	32.4	32.8	33.4	33.0	34.0	34.1	34.2
1967	33.8	32.0	33.0	35.5	34.1	33.8	31.8	33.3	33.8	33.6	33.0	33.2	35.5
1968	33.8	35.3	34.4	35.0	33.6	32.2	31.9	31.0	31.3	34.1	33.2	35.4	35.4
1969	35.0	35.3	34.4	33.8	33.4	33.0	31.2	32.2	32.9	32.8	33.1	35.2	35.3
1970	35.1	35.4	34.6	33.6	32.6	32.3	31.0	31.2	32.4	32.3	32.7	34.4	35.4
1971	35.5	32.7	33.4	34.0	33.5	31.6	30.8	31.9	33.5	32.0	34.1	35.2	35.2
1972	35.8	33.7	34.9	35.0	33.9	34.1	32.2	33.6	34.0	34.0	35.2	35.0	35.8
1973	33.5	33.8	35.1	34.6	33.2	33.5	31.6	32.2	32.9	33.7	34.1	33.8	35.1
1974	34.7	33.2	34.5	33.8	33.2	33.5	30.9	32.6	32.8	33.2	33.8	33.4	34.7
1975	33.9	33.9	33.0	32.9	32.6	33.2	30.0	31.8	31.8	32.8	33.0	34.8	34.8
1976	32.8	32.7	33.1	33.9	32.8	32.4	32.8	31.9	32.4	33.1	33.6	35.2	35.2
1977	33.8	33.3	33.8	34.2	33.6	33.6	33.0	33.6		33.2	34.3	35.2	35.6
1978	33.4	34.0	34.1	34.0	33.6	31.5	32.8	32.7	34.0	33.8	34.1	34.9	34.9
1983	34.5	34.8	34.9	34.3	34.6	34.0	33.8	33.5	32.0	32.7	33.8	34.8	34.8
1988	35.9	35.2	34.0	34.0	32.0	32.9	33.8	32.3	34.0	32.3	34.5	35.0	35.0

(a) Maximum

MEAN TEMPERATURE IN °C

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	ANNUAL
1959	26.6	26.3	26.5	26.9	26.1	23.7	23.6	23.8	24.3	24.2	24.6	25.6	25.2
1960													
1961	26.1	26.1	26.2	26.1	25.6	24.0	22.8	22.3	23.5	24.2	23.5	26.2	24.8
1962	25.9	26.2	26.0	26.4	25.3	23.4	23.2	23.2	23.8	23.9	24.8	25.9	24.9
1963	26.3	25.7	26.0	26.1	25.2	23.7	23.3	23.8	23.7	24.5	23.9	24.9	24.8
1964	25.5	25.8	26.0	26.0	24.8	23.5	23.6	23.3	23.4	23.8	24.4	25.0	24.5
1965	25.9	25.9	26.0	25.9	25.9	25.7	24.4	24.0	24.3	24.6	24.4	25.7	25.2
1966	26.2	26.1	26.2	26.3	25.6	23.8	23.2	24.0	24.1	24.4	24.3	25.5	25.0
1967	25.3	25.7	26.1	27.1	26.5	24.1	23.2	23.8	23.7	24.2	23.6	24.8	24.8
1968	26.0	26.7	26.6	27.1	24.8	23.7	23.9	23.6	24.2	23.8	24.8	25.9	25.2
1969	26.0	27.6	27.2	27.3	27.1	26.3	23.9	23.9	24.6	24.7	25.2	26.6	25.8
1970	26.8	26.9	27.0	26.9	25.7	24.6	23.5	23.1	23.8	24.3	24.3	25.8	25.2
1971	26.0	25.6	25.7	26.0	24.6	24.2	23.3	23.3	23.9	23.6	24.0	25.8	24.7
1972	26.2	25.9	26.2	27.0	26.7	25.9	25.9	25.4	25.1	25.6	25.5	27.0	26.0
1973	26.4	26.4	27.0	26.8	25.9	24.6	22.9	23.1	23.9	23.7	24.2	24.4	24.9
1974	25.9	25.7	26.4	26.8	26.0	25.0	23.4	23.3	23.4	23.5	24.6	25.5	25.0
1975	25.8	26.3	26.4	26.4	25.2	24.4	23.5	22.8	23.4	23.8	23.6	24.5	24.6
1976	24.9	25.2	26.0	26.4	26.2	25.8	25.3	24.6	24.8	24.1	25.8	26.3	25.4
1977	26.1	26.3	27.2	26.7	26.2	25.2	24.1	23.6		24.3	24.8	26.7	25.5
1978	26.6	26.8	26.6	26.5		25.1	24.7	24.3	24.9	24.9	26.3	26.9	25.8
1983	27.1	27.6	27.8	27.6	27.6	27.5	23.1	26.0	25.5	25.0	25.0	24.6	26.5
1988	26.7	27.0	27.6	27.1	27.0	24.5	23.9	23.6	24.5	24.5	24.7	25.8	25.5

(b) Mean

MINIMUM TEMPERATURE IN °C

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	ANNUAL
1961	21.9	21.7	21.2	20.1	20.5	18.1	19.0	19.3	17.2	19.9	19.8	19.9	17.2
1962	21.0	21.0	21.3	21.0	19.8	17.6	17.2	17.4	18.2	18.6	19.4	20.0	17.2
1963	20.3	20.4	21.2	19.4	19.3	18.0	19.0	18.1	17.8	18.8	17.0	20.7	17.0
1964	20.3	20.9	22.0	21.0	18.8	19.0	17.1	16.2	17.9	18.0	19.3	19.4	17.1
1965	20.8	21.4	21.5	21.6	20.7	20.3	18.1	19.0	19.0	20.6	20.3	20.6	18.1
1966	20.6	20.9	21.4	21.1	20.4	18.8	18.0	19.0	18.8	19.3	19.0	19.0	18.0
1967	20.3	21.0	20.9	21.1	20.2	19.0	18.0	18.0	17.9	17.8	18.3	18.8	17.6
1968	20.2	20.8	21.0	19.3	18.5	19.8	19.2	19.3	19.6	19.3	19.5	19.6	19.5
1969	20.0	21.0	21.8	22.4	21.8	22.0	18.4	19.4	19.8	19.5	20.4	21.4	18.4
1970	22.1	21.9	21.6	22.0	19.6	19.8	18.0	18.6	19.0	19.8	19.0	22.4	18.0
1971	21.0	19.8	21.4	21.2	19.0	18.9	18.4	19.2	19.2	19.6	19.3	19.9	18.8
1973	20.9	21.0	21.4	22.0	21.0	21.4	20.4	19.8	21.0	21.3	21.0	22.4	19.8
1973	21.6	23.0	21.8	22.4	20.5	20.2	17.2	17.8	19.4	19.1	19.2	18.3	17.2
1974	20.6	20.3	19.9	20.6	19.2	19.6	18.7	19.0	18.7	18.3	19.8	20.8	18.9
1975	22.0	21.7	22.4	22.1	20.8	19.7	17.0	17.2	18.8	18.6	19.2	18.0	17.0
1976	20.8	21.0	22.3	22.0	21.0	21.3	19.8	19.7	19.2	18.5	20.8	21.4	18.6
1977	21.0	22.1	23.0	22.0	20.8	20.2	19.2	18.6	-	19.4	19.4	23.8	-
1978	21.2	22.6	22.8	22.4	-	20.1	19.1	18.0	19.4	18.8	20.8	23.5	-
1983	22.0	23.5	23.8	23.4	24.7	23.8	24.2	20.6	20.6	20.7	21.2	20.7	24
1988	21.9	22.9	23.2	22.3	21.7	19.5	18.3	19.0	19.5	20.4	20.8	20.3	18.5

(c) Minimum

3) Rainfall

3. Annual rainfall from 1915 to 1988 is summarised in the graph as shown in Figure I-4-1.

(1) The maximum annual rainfall in the past was 4,230 mm in 1983 which was the year of El Niño. Daily rainfall is recorded every 6 hours interval in the meteorological station and most of heavy rainfall occurs with 2 to 6 hours in a day of the rainy season. According to Table I-4-1, the maximum rainfall in the past was 196.4 mm per 6 hours in March 1983 (year of El Niño).

(2) Except for the year of El Niño, annual average rainfall is 1,120 mm, maximum one was 2,500 mm in 1924 and minimum one was 360 mm in 1985.

(3) It is concluded that heavy strong rainfall is concentrated at a certain day of the rainy season.

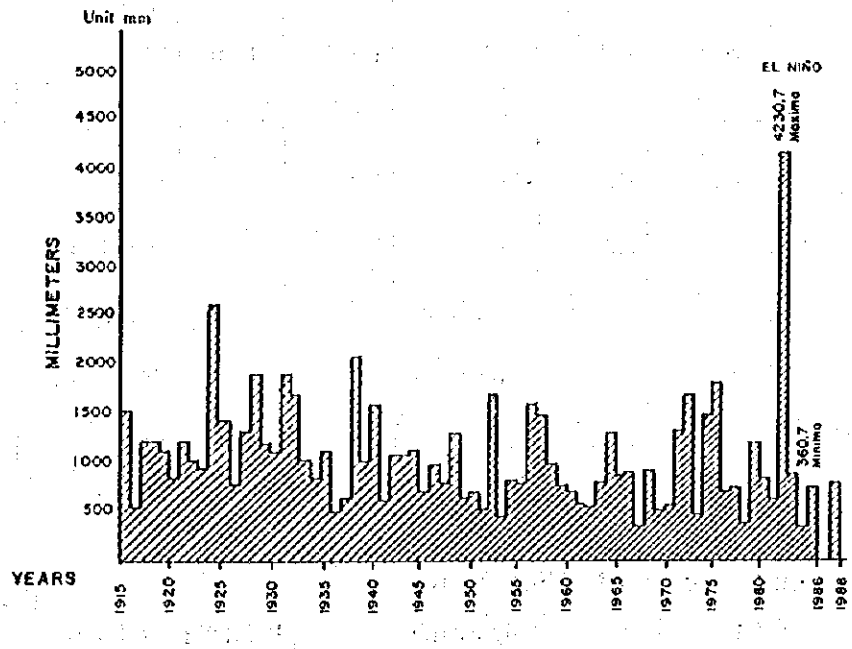


Figure I-4-1 Record of Annual Rainfall

Table I-4-3 Characteristics of Rainfall

1983 (Year of EL NIÑO) (Unit: mm)

Month	Rainfall of the Month	Daily Rainfall			6 hours		
		MAX.	MEAN	MIN.	MAX.	MEAN	MIN.
January	601.7	43.4	20.4	2.5	43.4	21.1	1.7
February	539.4	126.0	31.7	0.7	126.0	54.0	0.7
March	830.5	445.1	35.9	0.8	196.4	35.6	0.8
April	606.4	156.2	35.3	1.0	109.0	26.7	0.8
May	621.7	164.4	30.1	2.5	96.6	21.5	0.4
June	629.9	111.6	25.6	1.3	110.0	25.8	0.2
July	292.5	31.3	31.2	0.6	52.5	11.1	0.1
August	18.2	12.2	4.0	2.0	Negligible		
September	18.9	6.2	207	1.5	Negligible		
October	4.0	Negligible			Negligible		
November	1.1	Negligible			Negligible		
December	86.4	28.4	7.7	0.4	26.6	1.8	0.2

1988 (Example except EL Niño Year) (Unit: mm)

Month	Total Rainfall of the Month	Daily Rainfall			Rainfall per 6 hours		
		MAX.	MEDIAN	MIN.	MAX.	MEDIAN	MIN.
January	287.8	117.1	28.5	1.2	63	12	1.0
February	217.6	53.3	24.4	1.0	36	16.8	1.0
March	7.0	3.6	3.0	0.1	3.6	3.0	0.1
April	261.9	77.3	26.3	1.5	76.8	25.8	1.0
May	25.7	21.9	13.4	1.7	13.2	7.8	1.0
June	MINUS 1	NEGLIGIBLE			NEGLIGIBLE		
July	MINUS 1	NEGLIGIBLE			NEGLIGIBLE		
August	MINUS 1	NEGLIGIBLE			NEGLIGIBLE		
September	MINUS 1	NEGLIGIBLE			NEGLIGIBLE		
October	MINUS 1	NEGLIGIBLE			NEGLIGIBLE		
November	1.1	NEGLIGIBLE			NEGLIGIBLE		
December	45.1	18.0	3.0	1.1	18.0	3.0	0.3

4) Humidity

4. Monthly humidity of regular year (the years nor affected by El Niño) ranges from 87% to 97% maximum, 69% to 77% (average) and from 39% to 49% (minimum). On the other hand in the El Niño year (1983), those values range from 91% to 98% (maximum), 74% to 86% (average) and from 43% to 59% (minimum).

Table I-4-4 Humidity

unit (%)

Year 1983	MAX	Ave	MIN
January	98	86	55
February	95	84	54
March	98	84	57
April	97	85	59
May	97	83	54
June	98	82	54
July	97	81	53
August	96	78	50
September	96	77	49
October	95	76	50
November	91	74	44
December	96	74	43

unit (%)

Year 1983	MAX	Ave	MIN
January	97	75	43
February	97	77	45
March	91	67	36
April	97	72	44
May	96	69	47
June	92	74	48
July	93	74	49
August	91	73	46
September	87	71	42
October	88	73	47
November	90	72	43
December	95	69	39

5) Wind Condition

5. Wind velocity in this area shows 7.4m/s as maximum and 3.2m/s as average. The major value ranges between 2m/s and 4m/s, consequently wind condition in this area is regarded as a low intensity, which corresponds to grade 1 to 3 (light breeze) in the Beaufort Wind Scale.

6. Whilst with regards to the wind direction, it is reported that south-western winds are predominant throughout the year (Final Report on investigations on causes of sedimentation and recommendation on remedial measures on Access Channel, June 1985).

Table I-4-5 Wind Velocity

Latitude : 02° 09'30" Longitude : 79°53'20" Altitude 7 m

	Jan	Feb.	Mar	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	AVERAGE
1962	1.3	1.0	1.3	1.5	1.7	2.4	2.8	3.0	2.8	2.9	2.8	2.5	2.2
1963	2.1	1.5	16.	1.7	1.8	2.2	2.9	2.9	2.2	3.1	2.7	2.5	2.3
1964	2.2	1.4	2.7	1.4	4.4	2.5	2.6	5.4	5.8	5.3	3.0	5.1	3.5
1965	1.9	1.6		1.3	1.4	1.8	2.8	5.7	3.3	4.0	4.3	3.9	
1966	2.6	2.1	2.1	2.1	2.6	3.1	3.4	3.8	4.3	4.3	4.1	4.0	3.2
1967	2.6	2.4	2.0	2.6	2.7	3.4	4.2	4.4	4.3	4.7	4.4	3.8	3.5
1968	3.0	2.8	2.8	6.0	3.3	3.7	3.9	4.4	4.2	4.3	3.9	3.8	3.8
1969	3.2	2.9	2.7	2.4	2.5	2.5	3.9	3.4	4.3	3.9	3.6	3.5	3.3
1970	2.6	2.7	2.8	2.5	2.7	3.0	4.1	3.8	4.1	4.4	4.0	3.6	3.3
1971	3.1	2.6	3.1	2.8	3.3	3.3	3.7	3.6	4.1	4.3	3.9	3.5	3.4
1972	2.9	2.9	3.0	2.9	2.7	2.7	3.0	3.3	3.7	3.7	3.8	3.2	3.2
1973	2.7	2.9	2.7	3.1	2.7	2.9	3.2	3.8	3.6	3.8	3.8	3.2	3.2
1974	3.0	2.7	3.0	3.0	2.9	2.2	2.2	2.7	4.4	4.5	4.5	3.3	3.2
1975	3.0	2.2	2.3	2.7	3.2	3.3	3.7	4.8	4.7	2.7	2.7	3.5	3.6
1976	2.3	3.2	2.7	3.6	0.5	3.3	3.9	3.5	-	4.2	4.2	5.0	-
1977	2.8	3.4	2.7	3.0	3.4	4.5	3.7	4.6	-	-	-	-	-
1978	-	-	-	-	-	4.3	3.6	3.9	7.4	5.4	5.4	4.0	-

Max. 7.4 m/sec Average 3.2 m/sec Min. 1.0 m/sec

B. Geographical Condition

7. Project site is located far inside of the Guayaquil Gulf. The gulf shows a U-shaped morphology with a mouth opened toward South to the Pacific Ocean (Refer to Figure I-4-2).

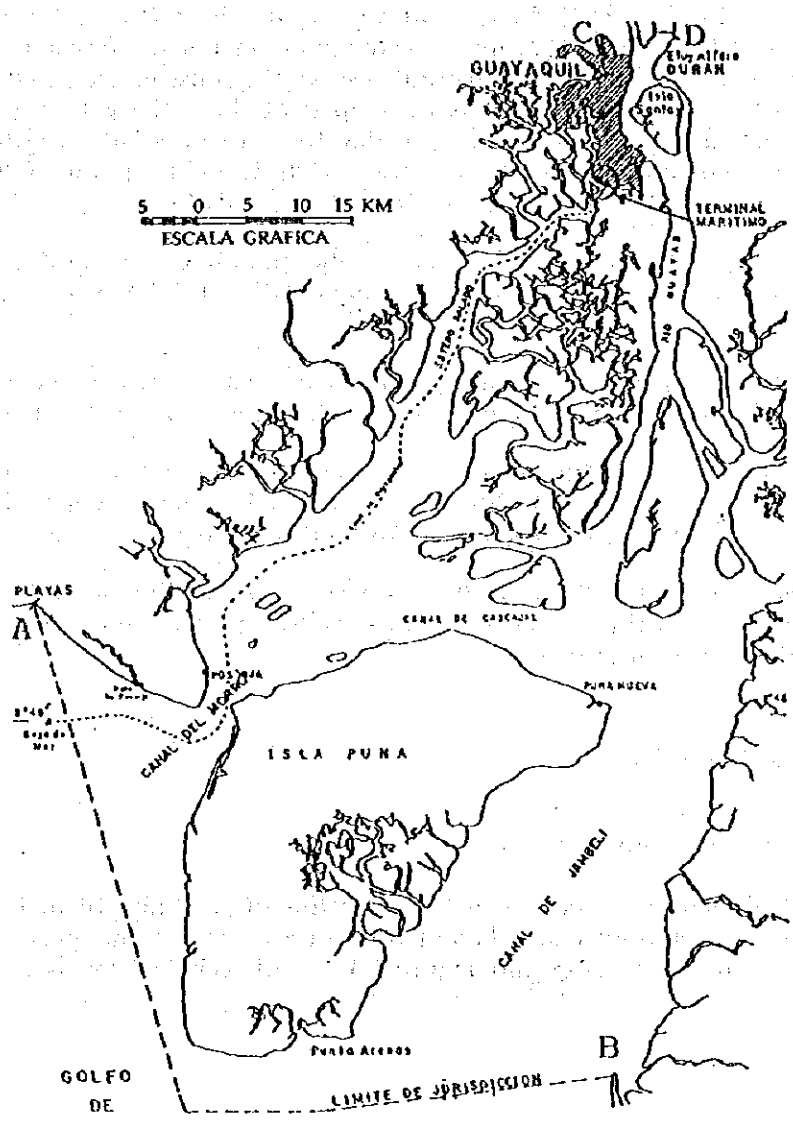


Figure I-4-2 Gulf of Guayaquil

Total area of the Gulf is about 1,000 km^2 and the length is approximately 70 km. A major river (Guayas River) which combines two rivers (Daule, 13,800 km^2 in basin area and Babahoyo, 17,900 m^2 flows into the gulf. Confluence point of the River Daule and the Babahoyo is situated about 70 km upstream from the mouth of the gulf where Guayaquil city is developed.

8. Inside the gulf, especially in the western side of the Guayas River, many islands, shoals and marshes of wild mangrove forest are spread and many estuaries from drain system irregularly. Cobina, Del Muerto and Salado are the name of the main estuary which extend inside the gulf. The area covered with mangrove forest is estimated at about 400 km^2 which function as both natural reservoir against erosion and resources of marine fauna. The Port of Guayaquil is developed at the estuary Cobina, and access channel of the Guayaquil port is extended through the estuary Salado leading the Pacific Ocean. The access channel (about 90 km long) starts from the point of Boya de Mar and connects with the basin of the port at the estuary Salado.

9. There is a large island (named Puna) at the mouth of the gulf in which two channels are formed in the west and east side, named Canal del Morro and De Jambeli, respectively.

10. Besides, there is an artificial channel, with sluice gate between the Guayas River and the Estuary Cobina, which is located about 5 km north-east of the Guayaquil port.

11. In the hinterland of the gulf, there are gentle hills with 100 to 200 m in elevation composed of sedimentary rocks. Mudstone is the major liothology which dominates the soil type of the river bottom, consequently clay and silt are dominantly transported.

12. Main geological composition in the estuary area is alluvial soil (Holocene in geo-age, clay and silt fraction is mostly) which is transported and sedimented by the river and tide flow to a large extend.

C. Oceanographic Condition

1) Field Survey by JICA Study Team

13. Oceanographic surveys were carried out by the JICA Study Team including tide, current and wave observations and bathmetric survey around the port. Location of surveys are shown in Table I-4-6 and Figure I-4-3, and technical terms of each survey are as follows:

Table I-4-6 Oceanographic Survey

		Station	Period	Interval	Instrument	Remarks
Tide		1	15 days	Every 2 hours	Tide Gauge	
Current		3	30 days	Continuously	Current meter (Direction and Velocity)	2.5m under water surface
Wave		1	30 days	2 times a day	Visual	
Bathmetic						
	Basin Area	175 ha (30 km)	—	50m pitch	Echo Sounding	
	Access Channel	90 km	—	—	Echo Sounding	along Navigation Route

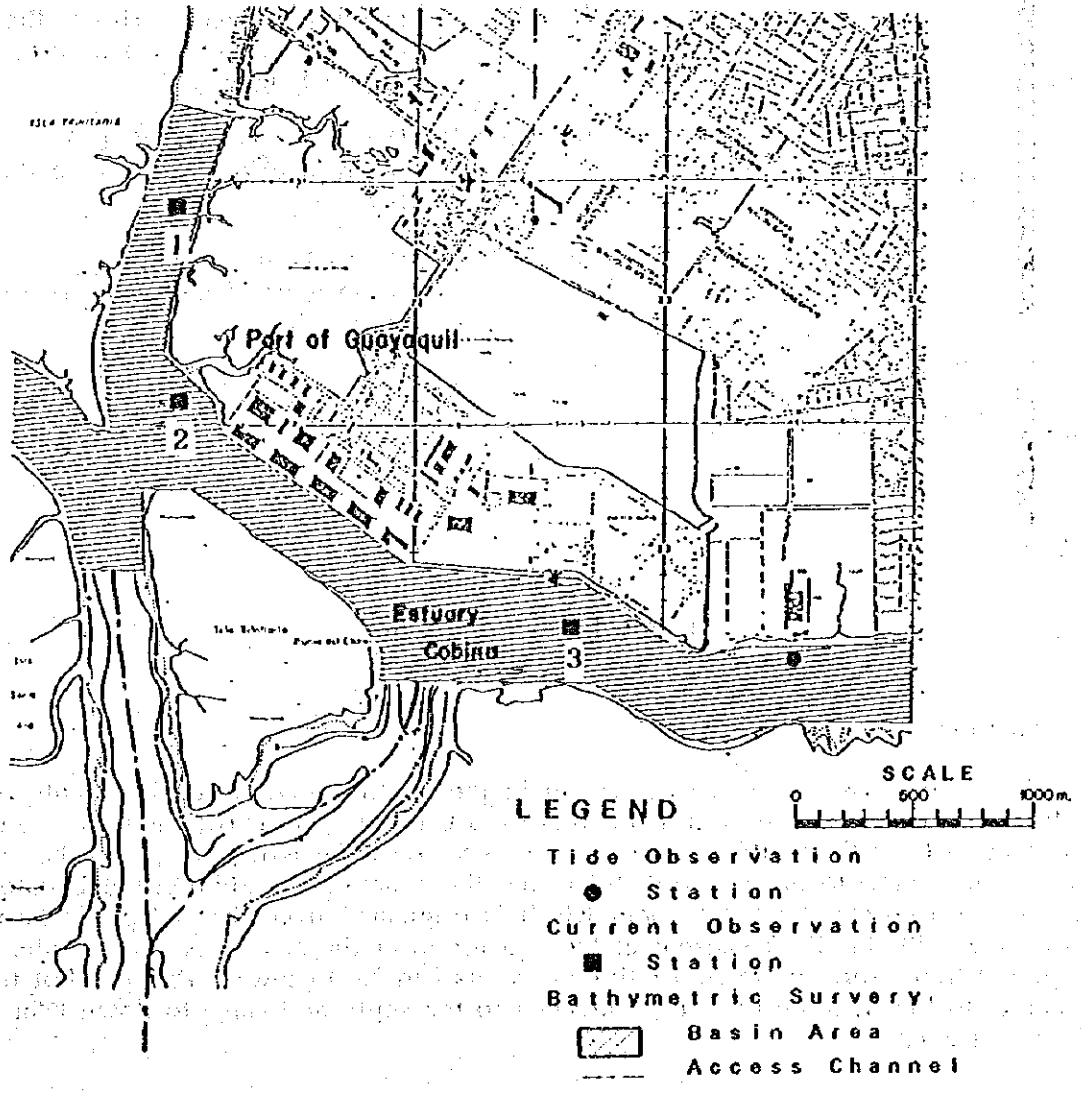
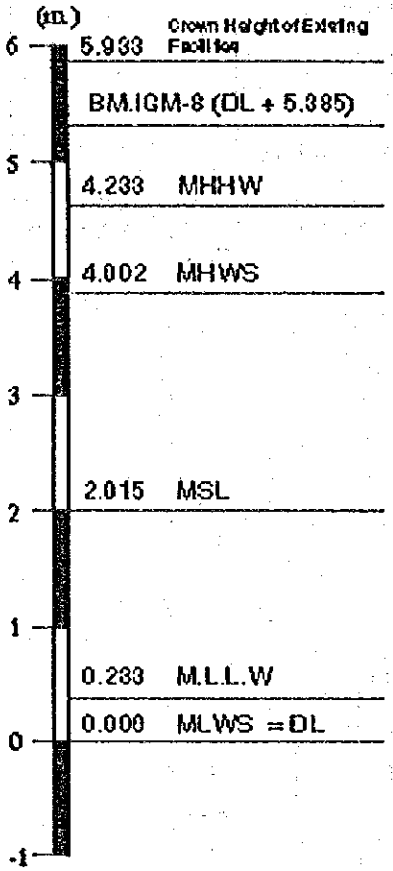


Figure I-4-3 Location of Field Surveys

All survey works were done by INOCAR (Instituto Oceanografico de la Armada) in August, 1994.

2) Tidal Record

14. As a result of the observation, particular tidal elevations at the Guayaquil port are summarised as follows (Refer to Figure I-4-4).



Note:

(a) MHHW (Mean Higher High Water) Mean level of the higher of the two daily high waters.

(b) MHWS (Mean High Water Spring). Mean Level of high water of the spring time.

(c) MSL (Mean Sea Level). This is the average level of the sea surface over a long period.

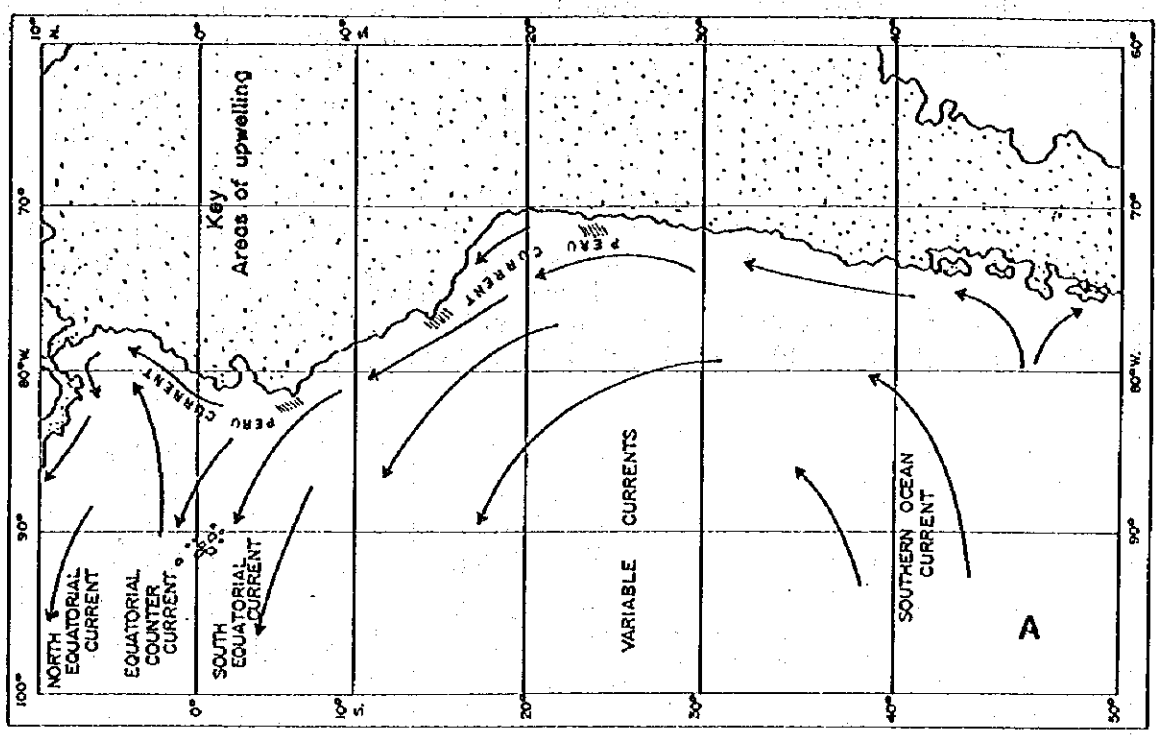
(d) M.L.L.W. (Mean Lower Low Water) Mean level of the lower of the two daily low waters.

(e) MLWS (Mean Low water spring). Mean level of low water of the spring time

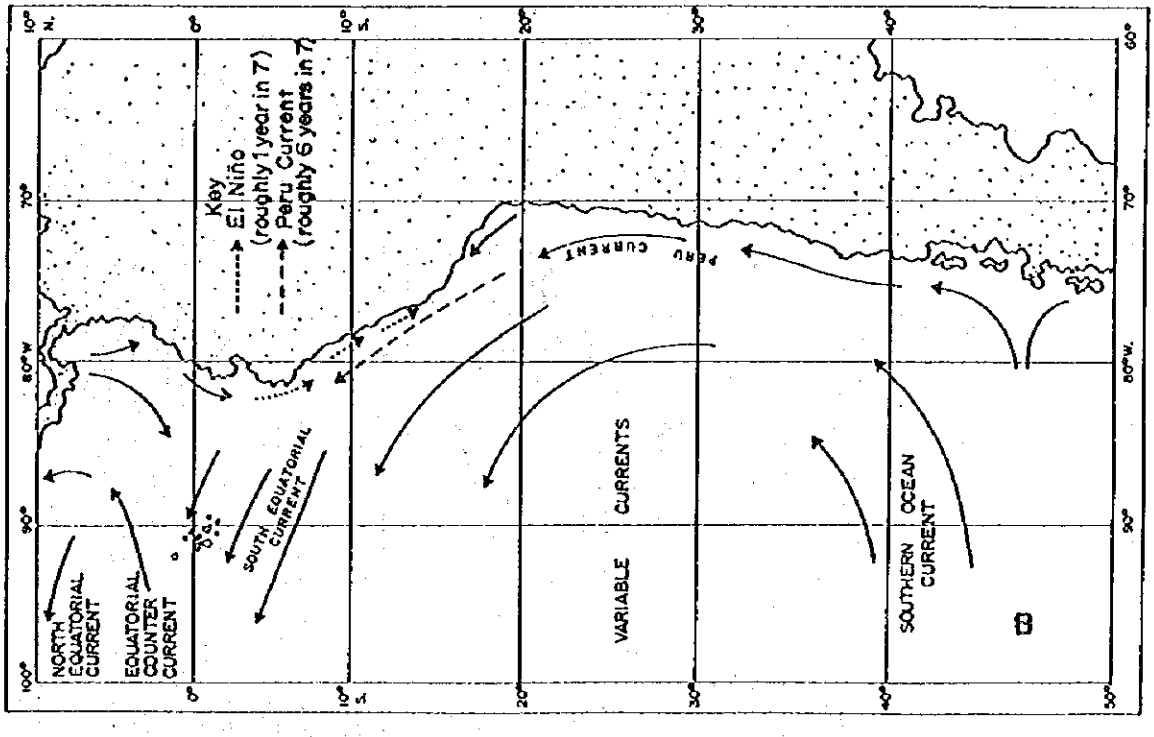
Figure I-4-4 Tidal Range

3) Tidal Current

15. Along the coast of the Pacific Ocean in the South American, cold currents runs northward, which is named Perú, Humboldt Cold Current. This current is split into two parts around the latitude 10° S, flows westward to the Galapagos Islands and the other advances its course to further north traversing the equator. In addition the Equatorial counter ocean current (also cold one) which is originated from the Galapagos Islands which joins with the Perú Current at the equator to at the area 5° N in Latitude. In the period from April to December those currents run North toward Panama, but from December to March those turn their direction to the south and come to down near the offshore of Perú.



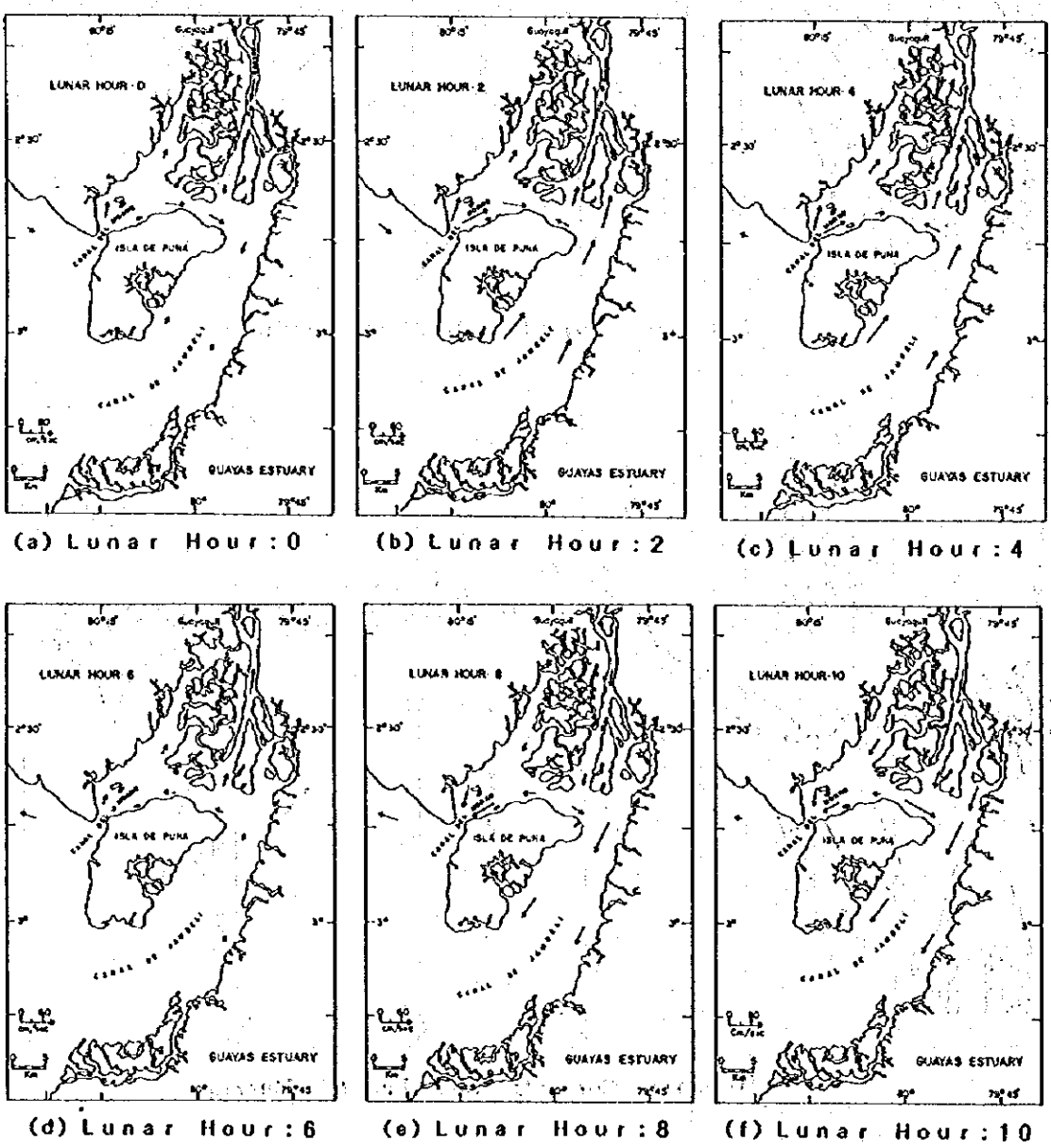
A · Ocean Currents - April to December



B · Ocean Currents - Dec./Jan. to Mar./Apr.

Figure I-4-5 Ocean Currents in South America (Pacific Ocean)
(American Pilot 1968)

16. The dominant factor of the current in the access channel is the one of the estuary Salado and gulf of Guayaquil. As above mentioned macrographic origin of the current in this area is the Peru Ocean Current, however from the local view point, tidal current of the gulf of Guayaquil is major factor regarding the channel because the gulf has sufficiently wide area and direction of the gulf is west to east (perpendicular to the direction of the Peru Current). The current in the gulf and the estuary is principally controlled by the ebb and flow. In the year of 1981 it was studied in relation to the dredging work for the channel. Movement of the current is shown Figure 4.7. According to those, in the time of Lunar hour 2 and 4, up tide flow occurs from the mouth toward the inside of the gulf, that is, velocity and direction of the current are 0.6 to 2.0 m and NE. On the other hand in the time of Lunar hour 8 and 10 it turns to the ebb, 0.6 to 2.0 m and SW in velocity and direction.



(a) Lunar Hour : 0 (b) Lunar Hour : 2 (c) Lunar Hour : 4

(d) Lunar Hour : 6 (e) Lunar Hour : 8 (f) Lunar Hour : 10

Figure I-4-6 Tidal Current in Gulf of Guayaquil

17. As concerns the basin of the port, tidal current was measured at 3 points as shown in Table mentioned above. The result is modified in Figure I-4-7 and summarized as follows. Generally, slack water occurs 30 to 45 minutes after local high water with the maximum velocity of 50 cm/s and an average velocity of 10 cm/s in general and main direction of the current is N, EE and ESE of azimuth which nearly coincide with the direction of the estuary flow.

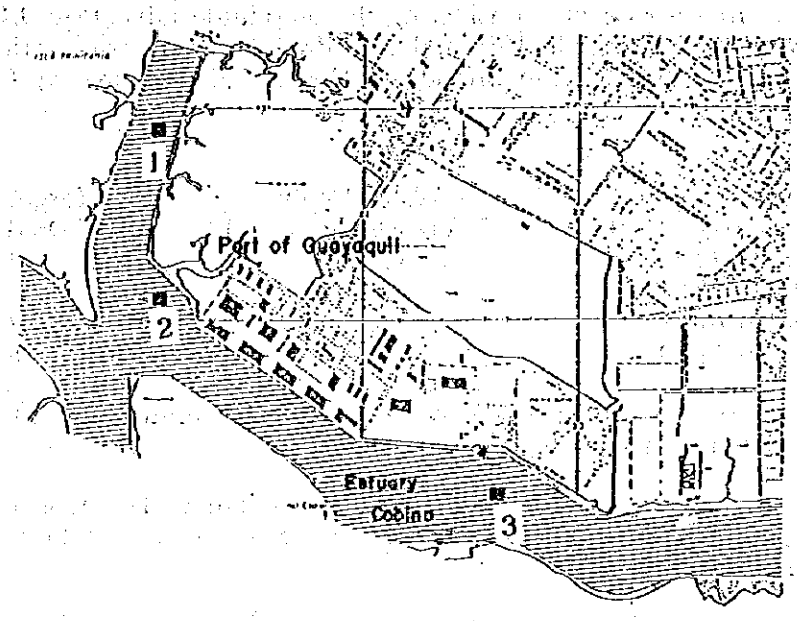


Figure I-4-7 Stations of Tidal Current Survey

Table I-4-7 Current Velocity in Basin of Port

(from Aug. 16~Sep16, 1994)

Station	Direction	Velosity(cm/s)	
		Max	Ave
1	N	34	15
	ESE	30	
2	N	21	10
	ESE	17	
3	W	50	10
	E	10	

*Curreut Velocity is measured at 2.5m under the water surface

4) Bathymetric Condition,

18. Bathymetric Condition in the port basin which was carried out by the Study Team is shown in Figure I-4-8. Water depth of navigation clearance in the basin area defined by A.P.G. is minus 10 m. As a result of the survey it is concluded that the clearance is sufficiently kept.

19. In the criteria of A.P.G., water depth and width for navigation in the access channel are 7.45 m (In case of considering the amplitude advantage 9.45 m) and 122 m for two navigational lanes. In 1989 and 1990 dredging work was carried out and the present navigation route has been provided. Content of dredging work is mentioned below.

Dredging Section (km From Boya Mar)	Water Depth Before Dredging (m)	Target Depth By Dredging (m)
48.10 to 49.20	8.0 - 9.2	8.5
51.30 to 63.03	7.3 - 9.0	8.0
63.86 to 67.71	7.4 - 7.9	8.0
69.51 to 71.19	7.6 - 8.0	8.5

20. As a result of the survey, updated bathymetrical condition of access channel are summarised. (Refer to Figure I-4-9)

(1) Three shallow areas are found, those are 16 km to 17 km in distance (8.0 m deep), 53 km to 69 km (8.0 m to 9.0 m deep) and 72 km to 73 km (8,0 m to 9.0 m deep).

(2) In compare with the sounding result of 1991 (after dredging) and present condition, serious sedimentation is no found out.

(3) However, there is a tendency that new sedimentation progresses gradually in the section of 66 km to 6935 km and 72 km to 73 km.

5) Wave Condition

21. In the previous study A.P.G. 1985, it has been reported that swell and high waves in 2.4% of time on an average around the outer area of the access channel. In other words, usually, wave does not occur nor only low wave appear there. In addition waves inside the estuary consist of locally generated wind waves with a period of 4 seconds and its height is less than 0.5 m. In this study, wave observation inside the port basin has been carried out for 30 days. The result shows that wave condition in the basin is calm all the time (wave height is less than 5 cm) as shown in Figure I-4-10.

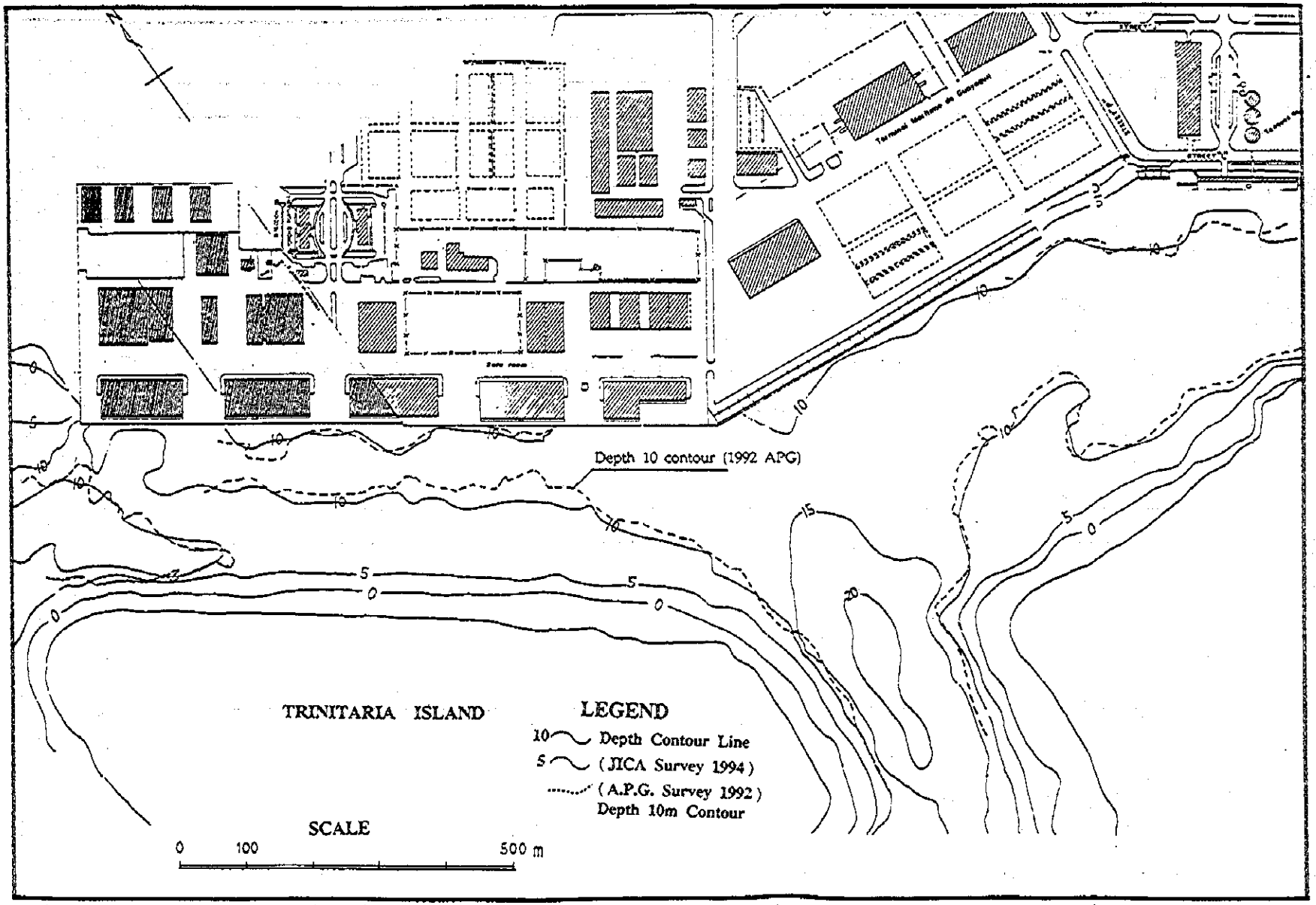


Figure I-4-8 Bathymetric Survey in Basin

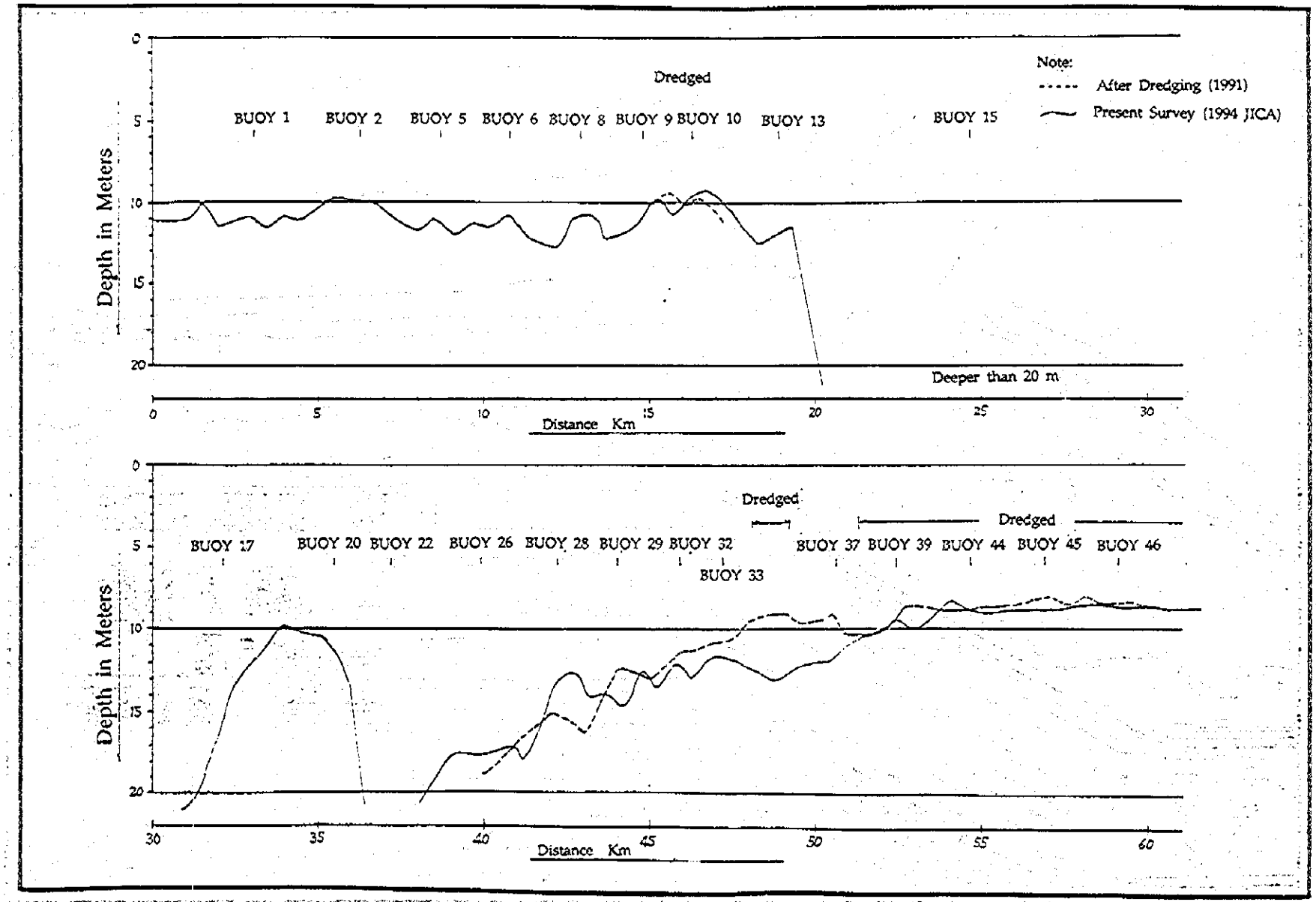


Figure I-4-9(1) Bathymetric Survey in the Access Channel

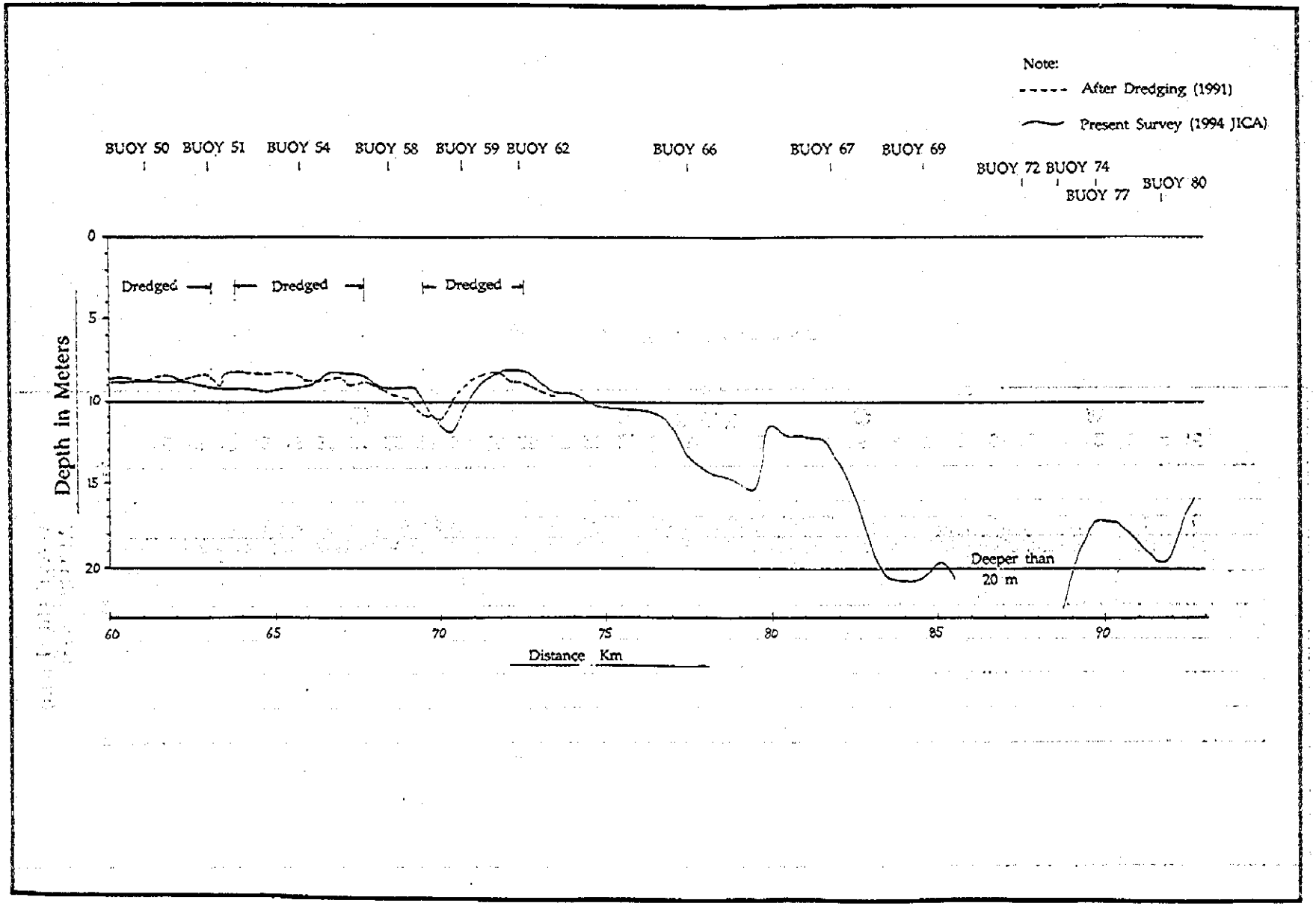


Figure I-4-9(2) Bathymetric Survey in the Access Channel

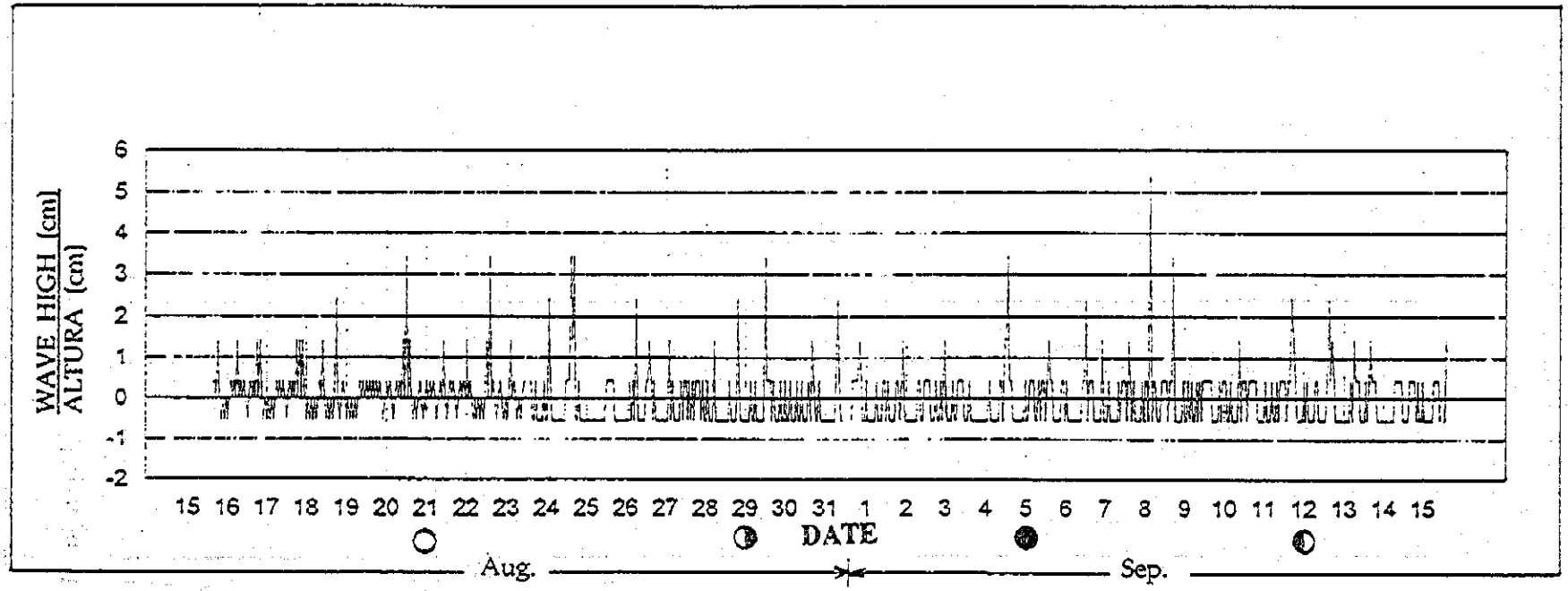


Figure I-4-10 Wave Observation

D. Soil Condition

1) Regional Geology

22. Project site is located in the inside part of the Guayaquil gulf. In the hinterland of the gulf sedimentary rocks (sandstone, mudstone) spread in the form of gentle hills 100 to 200 m high, which is called Tertiary Layer in geological time. On the other hand major geological composition in the gulf consists of Alluvial marsh and coastal deposits that has been sedimented through the process of geological sea recession. These sediments consist mainly of fine soil.

2) Subsurface Survey

23. Considering enlargement of the berth and other construction work of the port facilities, boring 10 holes 300 m long including S.P.T. and laboratory test were performed by the contractor "HIDROSUELOS" using the boring machine of the rotary. 7 (seven) borings were done on the future layout of the projected area line and 3 (three) were executed within the hinterland which belong to the projected lands. The location of borings is shown in Figure I-4-11.

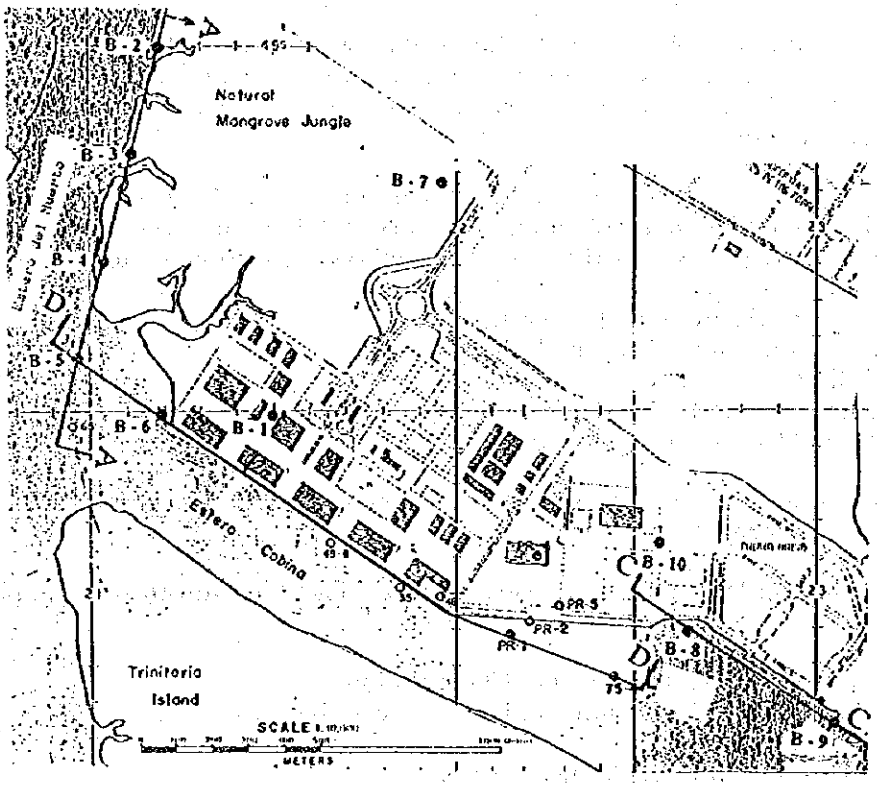


Figure I-4-11 Location of Borings

In each boring at every one meter deep, a SPT (standard Penetration Test) was performed, taking undisturbed soil sample at a time. In soft soil (clay or/ and slit), samples of undisturbed soil were taking using a thin wall sampler of the Shelby Tube Type, inserted into the ground by hydraulic pressure.

24. Ten boreholes (B-1 to B-10) totalling of 300 m were drilled and the depth of each boring was as follows:

Table I-4-8 Summary of Borings

ITEMS	DATUM LINE	B-1	B-2	B-3	B-4	B-5	B-6	B-7	B-8	B-9	B-10
SEA BED DEPTH	M.L.W.S. (M.S.L.)	+5.09 (+3.09)	+0.30 (-1.69)	-1.60 (-3.58)	-0.20 (-2.18)	-2.00 (-4.04)	-1.40 (-3.36)	-3.92 (+1.92)	-5.50 (-7.54)	+.090 (-1.13)	+5.34 (-3.34)
BOTTOM DEPTH	M.L.W.S.	-24.90	-29.70	31.60	-30.20	-32.00	-31.40	-26.40	-35.50	-29.10	-24.66
BORING LENGTH		30 m	30 m	30 m	30 m	30 m	30 m	30 m	30 m	30 m	30 m
NO. OF SPT		30	30	24	30	26	26	29	20	29	27
LABORATORY TEST	DISTURBED SAMPLE	(1)- 6.90 (2)-14.90	(3)-17.70 (4)-23.50	(5)-14.60 (6)-17.60 (7)-23.00	(8)-13.20 (9)-25.40	(10)-13.00 (11)-17.00 (12)-29.00	(13)-12.90 (14)-21.00 (15)-29.00	(16)-13.70 (17)-22.80	(18)-15.70 (19)-23.70 (20)-32.50	(21)-13.10 (22)-20.10 (23)-28.10	(24)-20.20
	UNDISTURBED SAMPLE	1-1: +2.10 1-2: +1.00 1-3: -1.10 1-4: -3.00 1-5: -5.00	2-1: -2.20 2-2: -5.70 2-3: -8.70	3-1: - 3.60 3-2: - 6.60 3-3: -11.60	4-1: -3.20 4-3: -8.70 4-2: None	5-1: -4.60 5-2: -6.00 5-3: -8.00 5-5:-10.00 5-6: -6.00	None	7-1:- 2.50 7-2:- 8.00		9-1: -2.50 9-2: -8.25	10-1: +0.34 10-2: -1.20 10-3: -5.00

For laboratory testing, 24 disturbed samples were obtained from the SPT sampler and 25 undisturbed samples were obtained from thin wall (Shelby Tube) samplers.

25. The soil samples obtained from the borings were sent to the laboratory for testing. All tests were performed according to the American Society for Testing and Materials (ASTM). The soil classification is carried out in accordance with the United Soil Classification System.

26. The SPT results are presented in tabular form as well grasped in the drill logs. The disturbed samples were obtained in every obtained in every case from the SPT samples after each test was performed. The following laboratory tests were performed on the disturbed samples.

- Grain size Analysis and Classification
- Liquid Limit and Plasticity Index Tests
- Specific Gravity Test
- Dry Density and Wet Density Tests
- Natural Moisture Content Test

For samples composed of loose sand or loose silty sand, the dry and wet density tests could not be performed.

27. The following laboratory tests were performed on the undisturbed samples obtained from Shelby Tubes Samplers:

- Grain Size Analyzis Test and Classification
- Liquid Limit, Plastic Limit and Plasticity Index Test
- Specific Gravity Test
- Dry Density and Wet Density Tests
- Natural Moisture Content Test
- Unconfined Compressive Strength Test
- Consolidation Test

3) Soil Type

28. As a result of boring work and S.P.T. soil type in the berth area is shown on the geological profile (Refer to Figure I-4-12).

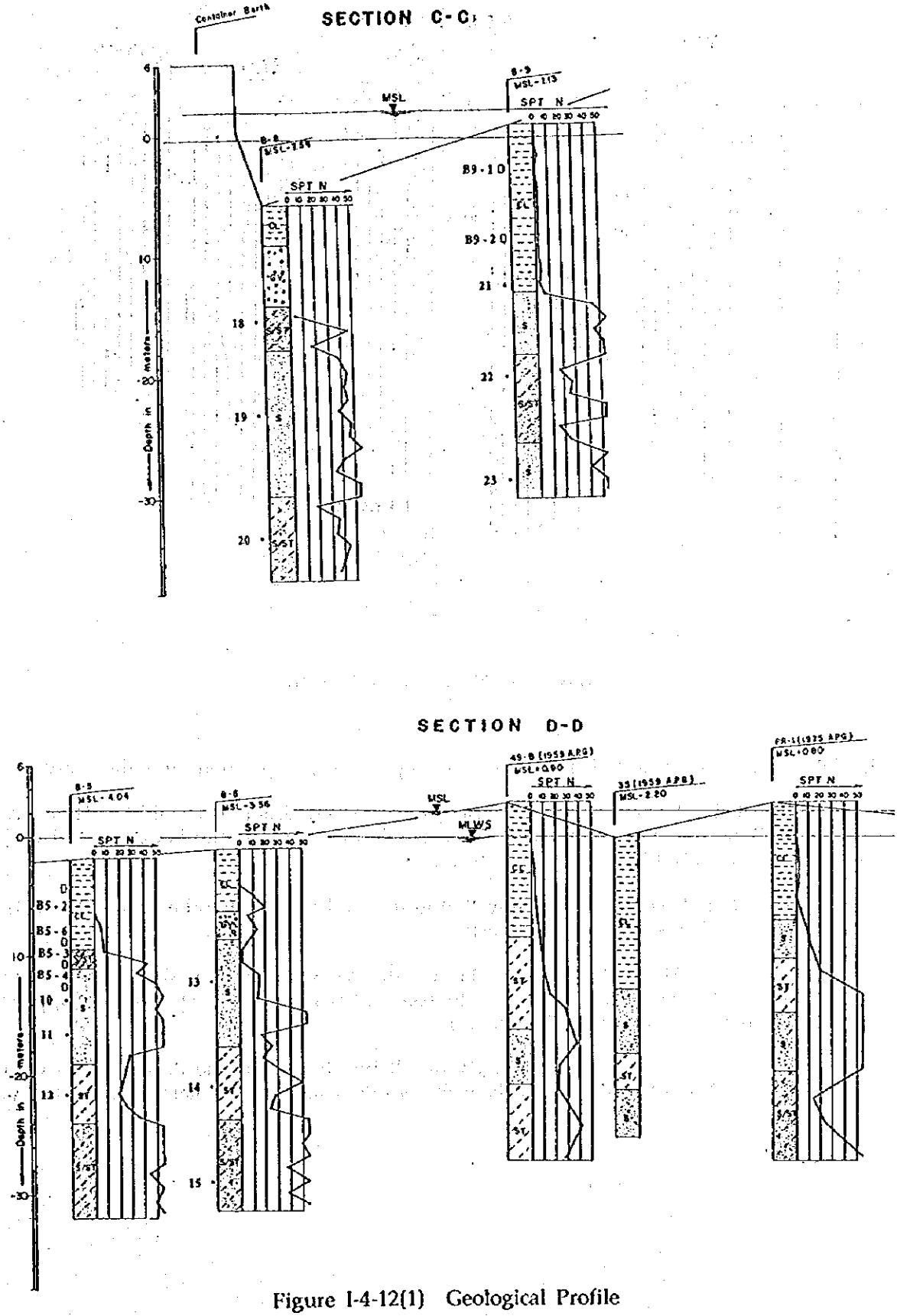


Figure I-4-12(1) Geological Profile

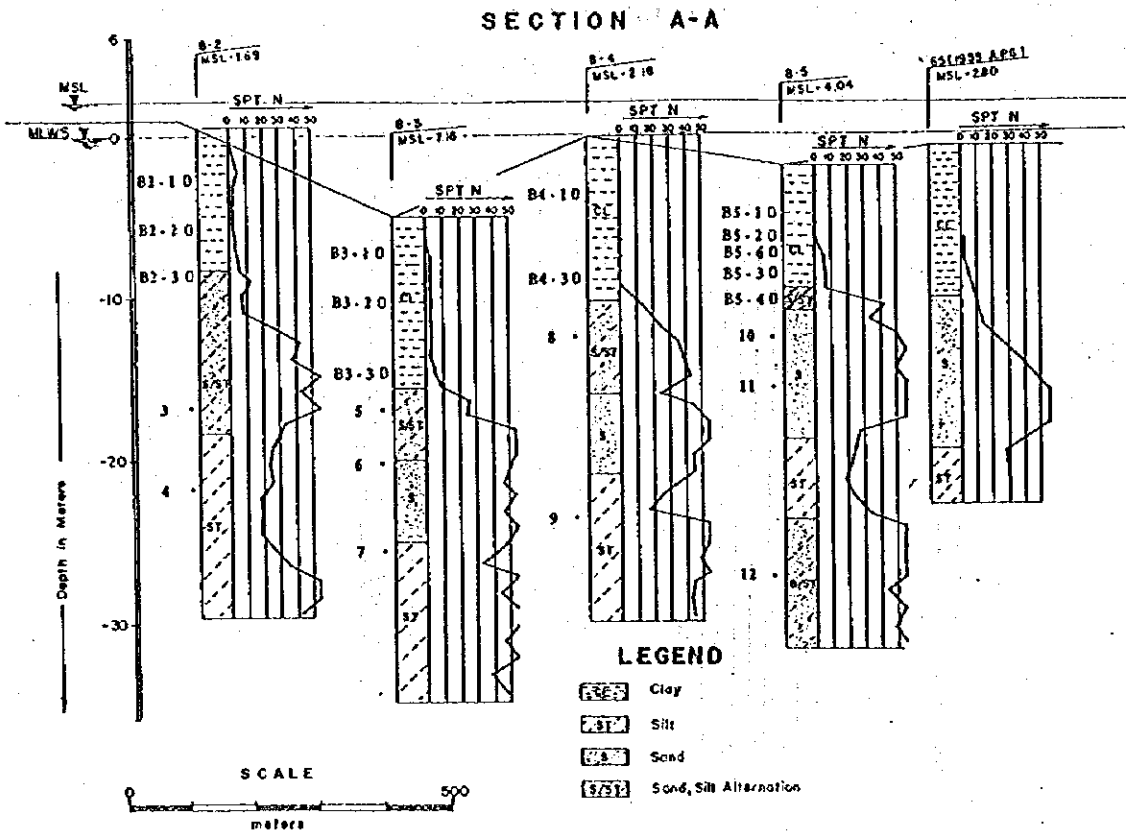


Figure I-4-12(2) Geological Profile

The following 4 kinds of soil distribute from top to deeper position, and those are:

(1) Clay (Cl): It covers the bed surface of the basin about 10 cm thick. This clay layer is combined with silt. It is very soft and its void ratio is extremely large, consequently big settlement is foreseen.

(2) Sand (S): It consists of mainly fine grain sand which underlies below the clay layer with about 3 to 7 m. thick

(3) Sand, Silt Alternation (S/St): From the View Point of grain size it is the mixture of fine sand and silt. In some places sand and silt fraction appear alternately 20 to 50 cm in interval.

(4) Silt (St): It is relatively homogenous silt which spreads the deeper range with about 10 to 20 m thick. Fairly well consolidated and it is hard in consistency.

4) Soil Properties

29. As a result of laboratory test, soil properties are summarised below. In the process of boring, undisturbed sample by thin wall sampler and disturbed sample of S.P.T. were collected and test have been carried out. Physical and mechanical properties of each soil type are shown below.

(a) Physical Properties

Table I-4-9 Physical Properties

Soil Type	GS	Sg	Wn	rt	pL	LL	PI
Cl	CH	2.7	30 - 130	1.3	37	96	59
S	SM	2.8	16 - 24	1.6	-	-	NP
S/St	ML	2.8	13 - 42	1.8	29	59	30
St	ML	2.8	37 - 50	1.5	36	66	30

Note: GS : Classification (ASTM)
CH : Clay of high plasticity
SM : Silty Sand
ML : Very find sand, silty sand with slight plasticity
Sg : Specific gravity of soil grain (g/cm^3)
Wn : Natural Water Content (%)
rt : Unit Weight (g/cm^3)
PL : Plastic Limit (%)
LL : Liquid Limit (%)
PI : Plasticity Index (%), NP Non Plastic

(b) Mechanical Properties

Table I-4-10 Mechanical Properties

Soil Type	S.P.T.N.	qu (kgf/cm^2)	C (kgf/cm^2)	Ø° (°)	Cc
Cl	0 - 1	0.2	0.05	0	2.5
S	40 - 50	0.5	0.05	45	Neglibible
S/St	30 - 40	0.5	0.2	40	Neglibible
St	20 - 30	1.0	0.4	35	Neglibible

Note:
S.P.T.N : Blow number of standard penetration test.

qu: Uniaxial strength (kgf/cm^2) : Average value test.
In case no test qu = (0.01-0.05) x N.
C: Cohesion (kgf/cm^2). It is empirically given by the formula
= (0.1 ~ 0.5) x qu.
Ø: Angle of internal friction (°). It is given by the formula Ø= Root (12N) + 15
Cc: Coefficient of consolidation

(c) Engineering Geology

30. Overlying Clay (Cl) on the bed top with 10 m thick is regarded as a serious settlement layer. As a consequence quantity of settlement is estimated at about 3 meters in case of ordinal embankment and/or structure construction. In addition negative friction in the layer should be considered.

31. Silt (St) and sand silt alternation layer (S/St) of which S.P.T.N. exceeds 30 underlying in the range of 20 to 25 m deep below MLWS can be considered for the pile and/or pier foundation (Refer to Figure 4.9). Actually in the existing berth, piles and piers are placed into this silt layer. Penetration depth of pile and/or pier is about 5 m on the average and bearing capacity is estimated at 30 ton/m^2.

32. As constructed in the existing berth, rip rap embankment of rock and/or boulder material is regarded to be an appropriate method for not only the counterweight action against sliding but also the protection against wave scouring.

E. Earthquake

1) General

33. Ecuador is located in the northern district of Andean Volcanic range and it is famous as an earthquake country. It is reported that in the whole part of Ecuador annual seismic occurrence is about 3,000 times. In order to study the seismic condition for the project, earthquake record around Guayaquil (inside 150 km in radius, for the past 10 years) have been collected as shown in Figure I-4-13.

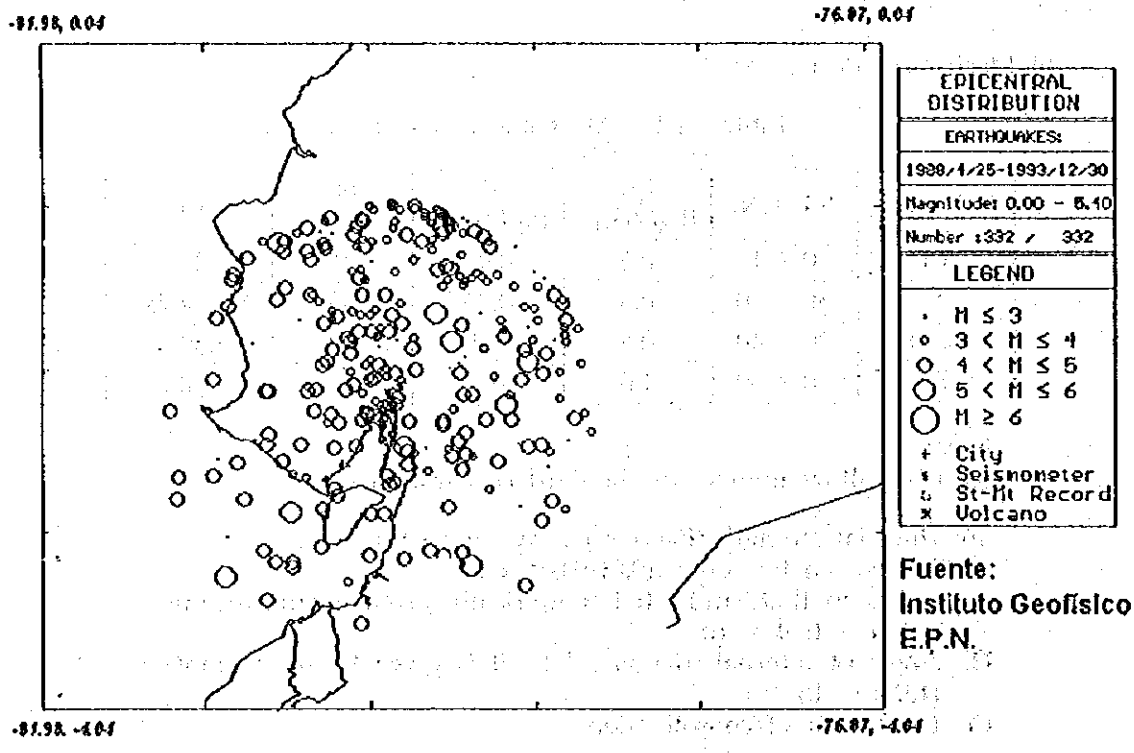


Figure I-4-13 Seismic occurrence Around Guayaquil

34. Frequency of earthquake in the project site. Total numbers of seismic occurrence in the past 10 years are counted at 332 (annual average 33). Among those, the earthquake of which magnitude is larger than 3.0 are counted at 277 (83%). Furthermore numbers of intensity larger than magnitude 605 are counted at 3 (0.9%).

2) Examples in the neighbourhood

35. Seismic coefficient (khg) for design. From the previous design documents of port structures of port structures of A.P.G. the seismic coefficient is unknown, however according to the design * report in relation to this region and also for the design of buildings or civil infra-structural in the neighbourhood, 0.15 has been adopted to be the seismic coefficient as show below.

Table I-4-11 Seismic Coefficient

Location	Kh	Structures
Chone - Portoviejo (150 km North of Guayaquil)	0.15	Tunnel, Channel
Daule - Peripa (100 km east of Guayaquil)	0.15	Dam (H = 80 m)
Catarama (70 km east of Guayaquil)	0.15	Pumping house (10 x 8 x 10 m)

Note: Detail Design on the Water Resources Development for Chone-Portoviejo River Basins

3) Seismic Coefficient Analysis

36. The design coefficient (Kh: the ratio of lateral force against vertical force should be determined with the following formula with consideration given to the classification of region where structured is located, that of the soil condition and the degree of importance of the structure.

$Kh = K \times Cs \times Ci$

where K = Regional sesmic coefficient
Cs = factor for subsoil condition
Ci = coefficient of importance

37. On the other hand, the Distribution Map of the Maximum Seismic Lateral Acceleration in Ecuador is shown by the Technical Research Institute, Ministry of construction in Japan, and the Distribution Map is in Figure I-4-14:

According to the map, 100-150 is an adequate value in the neighbourhood of Guayaquil, and the design seismic coefficient is:

$Kh = Dh/g = 150/980 = 0.153$

where Kh = Design seismic coefficient
Dh = Max. lateral-acceleration (Gal:cm/sec^2)
= 150
g = 980 cm/sec^2

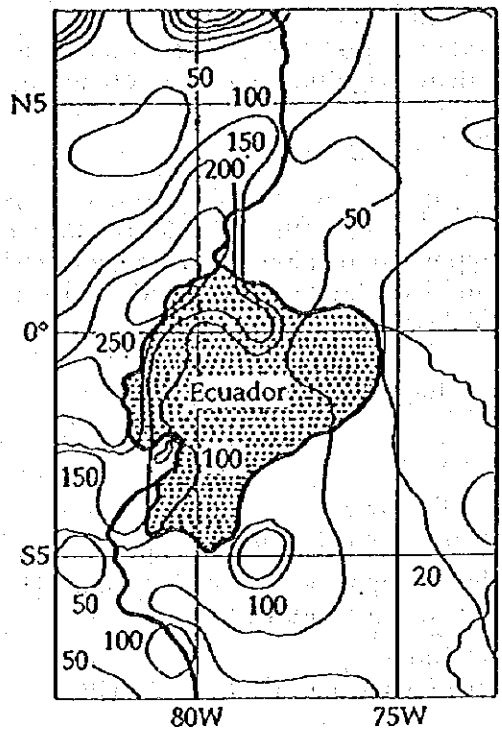


Figure I-4-14 Distribution Map of Acc. (Gal)
(Return period: 100 years)

4) Seismic Coefficient for the Project

38. Considering the relation between the coefficient of seismicity and the scales of structures, it is concluded that K_h = 0.15 is regarded as an appropriate value for the Project of the port of Guayaquil.

F. Characteristics of Estuary and River

39. It can be concluded that characteristics of natural condition at the existing port of Guayaquil is clam, similar to the inside sea. Since the port (both basin and access channel) is developed in the estuary and marsh area of the inner Guayaquil gulf, rough condition of outer-sea is mitigated. Only the beginning part of access channel (about 25 k long, 27% of the whole) faces the outer-sea condition.

40. As mentioned above, taking into account of calm condition there is no serious problem in the port such as high tide, wave, rapid current and strong wind for the port design. However form the river view points of Hydro and Geomorphology, following two defects are found, those are

(1) Ground surface is covered by huge amount of very loose fine soil o marsh which is apt to produce the sedimentation. Since 1985 prawn farms were rapidly developed around the estuary Salado and considerable area of natural reservoir for flood and erosion control was lost. As a result sedimentation were increased.

(2) Meandering of water course is found in two locations, i.e. (i) Puna Arenas (buoy No. 66 to 67) and (ii) La Esperanza (buoy No. 72 to 77), where flow of the channel is jammed and sedimentation is accelerated.

41. Characteristics of sedimentation around the port is summarised as follows.

(1) Upper reach area of buoy No 36 (access channel 48n km in distance). In this area many estuaries join at the estuary Salado (flow discharge of catchment area is large) and smooth flow is jammed by meandering, consequently large amount of sedimentary material is distributed.

(2) Generally, the following relation is empirically found between the grain size of sedimentation and the velocity of water flow (i) Sandy soil deposit in case of speedy flow. (ii) Clay and finer soil deposit in case of slow flow.

In the section of buoy No.) to 17 in the access channel (0 to 30 km in distance) flow condition is the same as outer sea (speedy), therefore sandy soil is distributed. On the other hand in another section from buoy No. 17 to the end of the access channel (30 km to 94 km in distance), condition is like creek (slow flow), consequently clayey soil is spread. m Especially, inner part of the channel (buoy No. 70 to end, 84 to 94 km in distance) water flow is extremely gentle, as a result suspending Clayey soil is widely drifted. density of this soil is 1.2 g/cm^3 or less and its thickness is about 3 m to the boring (hole No. B-6 and B-8 carried out in front of existing berth).