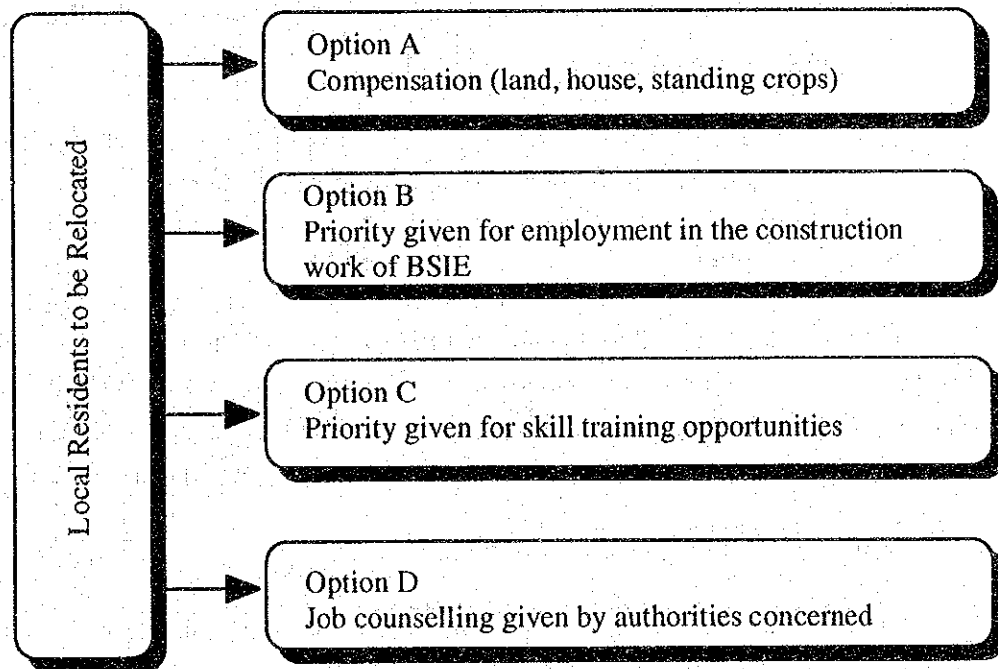


Possible Optional Measures for Compensation and Livelihood Support



9.3 Monitoring Plan

1) Monitoring of Air Pollution

(1) Location and Number of Monitoring Stations

A monitoring station must be able to grasp the level of air pollution and the pattern of its changes over the entire area it covers. Its covering range must be determined in the light of meteorological conditions, topographical features, and the distribution of pollution sources in the area. Upon determining the location of monitoring stations in areas crowded with pollution sources, such as industrial zones, it is considered that one monitoring station should cover an area of about 3 km in radius. And a broader area of about 5 to 10 km in radius should be covered for residential and other less polluted areas in general. The following factors must be considered in selecting the location of a monitoring station:

- The station must be located in a densely polluted area and in the area that represents the characteristic air pollution pattern.

- Additional stations must be set on the periphery of the area to monitor the amount of pollutants coming into the area from the neighboring province.
- The monitoring station must be arranged taking future land utilization plans into consideration.
- The monitoring station must be arranged in a proper manner to effectively evaluate the air pollution control measures being planned.

(2) Measurement Items

Generally, for the purpose of investigating pollution caused by industrial activities, the main items to be monitored are SO₂, NO_x and TSP. Other particular pollutants (such as hydrocarbons, HCl, CO, etc.) will be added occasionally, as necessary. The major artificial sources of each pollutant are presented in Appendix F.

(3) Structure and Instruments of Monitoring Stations

The integrated air pollution monitoring station must be equipped with following analyzers and instruments: SO₂, NO_x, CO, hydrocarbon and oxidant analyzers, high and low-volume air samplers, and meteorological instruments to monitor wind velocity, wind direction, atmospheric temperature, solar radiation intensity, etc.

A part of an existing building is often utilized as a fixed station. A fixed station is usually unmanned, and should preferably be made of ferro-concrete instead of wood for fire-prevention. In case of a prefabricated building, the use of heat insulating materials and an air conditioning system is essential and windows should be made as small as possible.

2) Monitoring of Water Pollution

(1) Monitoring Stations

Water pollution monitoring stations should be installed in the Bang Saphan area in the same manner as the monitoring stations for air pollution. Wastewaters generated in factories will be discharged into rivers after treated and have an effect on the receiving environment. Therefore, water quality should be monitored for both the effluent water and the receiving environment. Monitoring of effluent water, this means in-factory sampling, should be undertaken both before and after the wastewater treatment process. Measurement items and frequency differ depending on the characteristics of the water quality between effluent waters and the receiving environment. General measurement items and frequency ranges are mentioned below.

(2) Measurement Item and Frequency

- Primary pollutants generated from the process or site.
- Heavy metals or chlorinated hydrocarbons which are known to bio-accumulate.
- Nutrients (compounds of phosphorus or nitrogen) .

Monitoring of effluent waters should be carried out continuously, daily, monthly and sporadically according to necessity. However, it is not necessary to monitor the water quality of the receiving environment as frequently as in-factory monitoring because of its long time average influence.

10. EVALUATION OF DEVELOPMENT OF THE BANG SAPHAN INDUSTRIAL ESTATE

10.1 Method of Evaluation

The project evaluation has been carried in two steps in which the first step deals with the economic viability and the second deals with the financial viability. The economic viability of an infrastructure project is aimed at determining whether the project is consistent with the regional objective of industrialization of the Bang Saphan Area. The economic viability is measured in terms of the economic internal rate of return (EIRR).

On the other hand, the financial viability of a project is aimed at determining how the project can be implemented from the viewpoint of an infrastructure developer.

The financial viability of a project can be determined by either or both of the following approaches:

- a. "All capital" approach which looks at the discounted returns to all real investment flows for the project as a whole, irrespective of whether these come from equity or loans. This is expressed in terms of "Return on Investment" (ROI).
- b. "Equity capital" approach which looks at the proponent's equity contributions as the investment such that loan proceeds are treated as inflows while loan repayments are treated as outflows. This is expressed in terms of "Return on Equity" (ROE).

In this study, the financial viability of the project is evaluated principally by the "equity capital" approach because the decision makers have to decide whether debt financing could be secured for the project in due consideration of availability of debt finance and amount of its fund. The inflows and outflows to be used for the respective analysis are shown in Table 10.1 (refer to Appendix G for details).

10.2 Economic Viability

10.2.1 Method of economic analysis

The economic analysis of the industrial estate development is to be made in terms of EIRR, where the industrial output (production) to be generated by the potential industries located in the Industrial Estate is regarded as main benefits of the Project. EIRR is determined as a discount rate that equalizes the present value of the streams of costs and benefits over the project life (30 years), where the effect of the industrial estate development is evaluated in terms of value-added generated by the potential industries in the Industrial Estate.

10.2.2 Pre-conditions and assumptions

The pre-conditions and assumptions in relation to the industrial production are summarized as below.

Value-added to be Generated by Potential Industries

	2001	2006	2011
No. of employees	2,400	6,000	11,900
Value-added per employee (1,000 Baht)	2,340	3,090	2,870
Value-added (million Baht)	5,600	18,700	34,200

The value of "capital investment per employee" for the capital-intensive industries represented by petrochemical and steel manufacturing, is 1.6 million Baht/employee for the base case and 4.0 million Baht/employee for the sensitivity analysis.

10.2.3 Economic analysis

The project is economically evaluated in terms of the economic internal rate of return (EIRR) on a cashflow basis under the following pre-conditions;

Input

(+) Construction cost for Bang Saphan I/E (in 1996 price) 2,770 million Baht

(+) Cost for External Infrastructure ¹	11,590 million Baht
(+) Capital investment by potential industries in I/E	28,610 million Baht
(+) Working capital (30% of capital investment)	8,580 million Baht

Output

(+) Industrial value-added from I/E factory lots	2,874 thousand Baht per employee per year
(+) Value-added from Utilities	12% of the acquired cost per year

10.2.4 Results of economic analysis

For the base case, the cost of the external infrastructure is totally charged to the capital cost of the industrial estate development. EIRR has been calculated at 51%. This may be too much conservative. Therefore, the cost of the external infrastructure attributable to the Industrial Estate development is estimated at 3,270 million Baht, corresponding roughly to 30% of the total cost of 11,575 million Baht. EIRR has been calculated at 68% for the sensitivity analysis. The result of economic analysis is summarized in Table 10.2.

The reason of this high economic return is that the fabricated metal and machinery industries with relatively high value added are planned to establish instead of the low productivity of farm and bush land. From the economic viewpoint, it could be said that the project is significantly viable under such a condition that the environment for flows of foreign direct investment into this region is properly arranged on the Government initiative by aggressive capital formation for economic/social infrastructure development around the Bang Saphan area and the introduction of the concept of "Free Trade Area" (FTA) and prospective category of industry is established in line with this plan.

¹ Cost of External Infrastructure

The cost for development of the external infrastructure is estimated as follows;

1. Port facilities		6,100 million Baht
2. Water supply facilities		3,260 million Baht
3. Road	Access road, Interchange	1,170 million Baht
4. Power facilities	Transmission line	290 million Baht
5. Telecommunication		20 million Baht
6. Hazardous waste treatment		750 million Baht
		<u>11,590 million Baht</u>

10.3 Financial Viability

10.3.1 Method of financial analysis

The financial evaluation is made from two aspects, one for assessing the project as wholly financed from the developer's own fund (no debt financing), and the other for assessing the project from the investor's viewpoint where the return on equity is highlighted, incorporating debt, interest, repayment, etc..

The former is evaluated in terms of "Return on Investment" (ROI) based on the cashflow streams of revenues and expenses/costs. The latter is evaluated in terms of "Return on Equity" (ROE), that is, the profitability of the equity capital.

10.3.2 Preconditions and assumptions

1. Land Valuation

It is assumed that the transaction related to the transfer of land right takes place when the J/V is established. At the time of land transfer, the cash corresponding to the agreed amount of the land concerned is to be paid by the J/V to the private land holder.

The land acquisition cost for which the J/V is responsible, is estimated at 400,000 - 600,000 Baht/rai on average, or 10 - 15 US\$/m².

The land value is estimated at 10 US\$/m² for the base case.

2. Construction cost for the infrastructure in the industrial estate, and the external infrastructure

The cost for the infrastructure inclusive of land reclamation, road and drainage, water supply system, waste water treatment facility, and power distribution line within the industrial estate, is to be borne by the J/V.

In addition to the infrastructure construction in the industrial estate, for which the J/V is responsible, the external infrastructure construction for which the public sector is responsible, will be also a prerequisite to the development of the Bang Saphan Industrial Estate. The external infrastructure will be taken care of by the government agencies concerned.

3. Construction Schedule

The industrial estate with a total area of 3,750 rai, equal to 600 ha, is scheduled to be developed in three stages as follows:

	<u>Development area (rai)</u>	<u>Construction period</u>
Stage 1	680 rai (108 ha)	1999 - 2000
Stage 2	1,260 rai (202 ha)	2001 - 2003
Stage 3	1,810 rai (290 ha)	2004 - 2006
Total	3,750 rai (600 ha)	

4. Lot sales to investors

The sale price of factory lots is the most influential factor which affects the financial viability of the project and fully depends on the present situation and future plan of infrastructure such as port, power, water supplying facility, etc., market conditions, and marketability of the J/V.

The lot sale schedule is forecast as follows:

Lot sale	(in ha)											Total
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Phase I	10	20	15	7								52
Phase II			20	30	30	30	30	9				149
Phase III						20	30	45	40	40	39	214
Land sold	10	20	35	37	30	50	60	54	40	40	39	415
Cumulative land sold	10	30	65	102	132	182	242	296	336	376	415	

The sale price estimated at 50 US \$/m² for example, equal to 2.0 million Baht/rai in 2000, is assumed to be inflated at 5.0% per annum until 2010 and stagnant thereafter.

5. Disbursement schedule

The disbursement schedule of the total cost including establishment cost, land cost, and price contingencies estimated at 3% for the foreign currency portion and 5% for the local currency portion, is as follows:

	(1,000 US\$)											
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Construction Cost	0	817	847	7,140	22,533	6,738	18,040	21,000	2,184	8,337	32,391	33,931
Establishment Cost				500								
Land value (10US\$/m ²)				12,300		18,700			29,000			
Total(1,000US\$)	0	817	847	19,940	22,533	25,438	18,040	21,000	31,184	8,337	32,391	33,931
(million Baht)	0	20.4	21.2	498.5	563.3	636.0	451.5	525.0	779.6	208.4	809.8	848.3

10.3.3 Capital contribution of the private sector and IEAT

The capital structure in the initial stage, focusing on Phase 1, is assumed to be composed of 30% equity capital and 70 % debt finance as shown in Figure 10.1. The interest rate is assumed to be 7%.

The subsequent Phase 2 & Phase 3 development is supposed to be implemented under such a condition that the project cost be raised by debt finance and internal fund retained from lot sales without additional equity capital.

1. Ratio of equity : 30% of the project cost for Phase 1 (8,623,000 US\$)
2. Capital contribution (Provisional)
 - Private sector : 80% of the equity (6,898,000 US\$)
 - IEAT : 20% of the equity (1,725,000 US\$)
3. The balance of the project cost and the above equity amount shall be funded by the J/V Company through debt financing from the financial market and/or through internal funds retained from lot sales.

10.3.4 Result of the viability analysis

ROI and ROE are estimated at 13.6 % and 16.4 % respectively. The results of financial analysis are summarized in Table 10.3 for major parameters such as sale price.

The schedule of borrowing, repayment and debt outstanding (end of year) for the Base Case is shown in Figure 10.2.

A sensitivity analysis is made in addition as shown below and summarized in Table 10.4, showing the appropriate lot sale price under the condition of an adequate ROE.

	Lot Sale Price	
	US\$/m ²	Baht/rai
1) Land price of 600,000 Baht/rai:	56	2.2 million
2) Land price of 200,000 Baht/rai:	44	1.8 million
3) VAT is imposed (in the case the proposed concept "FTA" is not adopted):	51	2.0 million
4) 10% decrease in construction cost:	47	1.9 million
5) Combination of 2) and 4):	41	1.6 million

10.4 Evaluation of the Project

The viability of the Project depends on the lot sale price, valuation of the land, and construction cost. An appropriate rate of return on investment (ROI) can be compared with the opportunity cost, ranging from 10% to 15% in Thailand.

An appropriate rate of return on equity capital (ROE) has to be determined in comparison with the cost of capital, or "cut-off rate" set up by the individual investors. The appropriate rate of return on equity capital could range from 14% to 17%.

The sale price of 50 US\$/m² appears to be competitive in comparison with the lot sale price prevailing in the Eastern Seaboard and other Asian countries as shown in Table 10.5.

The project could be sufficiently viable in terms of ROI and also viable in terms of ROE at the sale price of 50 US\$/m² in the case that the land is valued at less than 10 US\$/m².

The project could be sufficiently viable from the economic viewpoint, judging from the fact that the calculated EIRR is higher than the opportunity cost, say 10 - 15% in Thailand.

It should be noted that, to make the project economically and financially viable, direct investment, not limited to Foreign Direct Investment (FDI) is vital to the success of the project as well as to the industrial development around the Bang Saphan area. In that respect, the Thai Government is advised to show a strong willingness to attract foreign

investment by financially supporting the infrastructure development in the Bang Saphan area, especially showing a positive attitude in the development of water resources for industrial water supply.

Concurrently, a lower land price of the industrial estate site shall be applied by the private enterprises which will jointly develop the Bang Saphan industrial estate, and the construction cost and operation & maintenance cost of the estate shall be minimized in consideration of the locational disadvantages of the Bang Saphan industrial estate.

11. RECOMMENDATIONS

The Bang Saphan industrial estate is one of the determining projects which are the key for the successful development of the Bang Saphan area. This study aims to clarify the feasibility of the development of the Bang Saphan industrial estate and leads to the results and recommendations summarized below:

1) The development of the Bang Saphan area, where the Bang Saphan industrial estate is planned as the core project, is envisaged for the following four reasons:

- (1) The Western Seaboard, which is expected to be contributive to the decentralization of the over-populated capital area and prospective to form the corridor to/from Myanmar and Southwest Asia under the perspective of the new era of open trade policy and expansion of Baht economic area, shall be developed urgently. For the development of the Western Seaboard, successful development of the Bang Saphan area, one of the key projects in the Western Seaboard development, is indispensable.
- (2) The industrial structure of Thailand, characterized by the processing and assembling industry and consumer goods industry at present, is starting to transform into a structure of integrated industry by the introduction of upper stream material industry. In the Bang Saphan area, the iron/steel industry has already started operation and an iron-related industrial complex is foreseeable by means of upgrading and expanding the iron/steel industry and establishing downstream industry as well as supporting and relevant industries in the Bang Saphan industrial estate.
- (3) The shallow shoreline in the Gulf of Thailand is unsuitable for construction of a deep sea port which is required for the material-based heavy industry. Bang Saphan as well as Map Tha Phut and Laem Chabang is one of the precious locations suitable for construction of a deep sea port in Thailand. This important and so called "finite port resource" should be effectively utilized by expanding the port facilities and developing industrial activities in the hinterland of the port.
- (4) Since Thai economy including industries is taking off, it is required to set up a new concept for Free Trade. The regime of Free Trade Area (FTA) is recommended to be introduced to cope with the recent situations such as the change in domestic economy and international movements of AFTA and WTO. The objectives of FTA recommended by the Study Team are not only to

contribute to export promotion by attracting foreign direct investment but also to strengthen competitiveness of the domestic industries through the expansion of trade. Bang Saphan is the right place to adopt FTA for trial.

2) The Bang Saphan industrial estate will be viable on both economic and financial points of view, if the following conditions are satisfied:

(1) External infrastructure concerning water supply, electric supply, transportation and telecommunications, fundamental for the industrial activities, should be developed and managed on the public sector initiative. As for the water supply facilities, especially, the Tha Sae dam planned by R/D should be realized urgently and a water conveyance pipeline of approximately 70 km from the Tha Sae dam to the Bang Saphan area is to be developed by the public sector, for instance IEAT.

Conveyed water will be distributed not only to the industrial estate but also to the iron/steel industry as well as to the new town and port area after purification. According to IEAT, the Government has decided to conduct the feasibility study of external infrastructure involving water and electricity supply facilities, which should be carried out as an urgent project.

(2) It is recommended that the Bang Saphan area inclusive of the Bang Saphan industrial estate be designated as a free trade area. Advantages of such a designation are as follows:

- Giving strong incentives for promoting of investment in the Bang Saphan industrial estate which is disadvantageous due to its remote location from Bangkok;
- Enhancement of viability of the Bang Saphan industrial estate project by the application of tax reduction and exemption in addition to the ordinary incentives.

(3) To strengthen competitiveness of the Bang Saphan industrial estate, the development cost should be reduced. The Bang Saphan industrial estate project is proven to be viable both economically and financially under the condition of application of the lot sale price of 50 US\$/m², however, the sale price should be low enough to attract the competitors. Land acquisition cost, for instance, could be minimized by the endeavor of the J/V Company for Bang Saphan industrial estate development.

3) Although the development of the Bang Saphan industrial estate shall principally be initiated by the private sector, the public sector, which will undertake the development of external infrastructure, shall participate in the industrial estate project to collaborate and integrate it with the Western Seaboard development.

(1) Under this context, a Board of Development and Management of Bang Saphan Free Trade Area shall be set up with the participation of relevant governmental bodies and representatives from the private sector. Under the Board, a Free Trade Area Corporation and several J/V companies shall be established to take charge of the development of the industrial estate, external infrastructure, and urban development. The industrial estate J/V Company will be formed by IEAT and the private sector. As for the external infrastructure, it is recommended that IEAT participates in J/V companies to keep the integration among the projects.

(2) The development fund for the industrial estate will be raised from the equity participation from the private and public sector as well as from loans from the financial market. On the other hand, some external infrastructure projects, of which return is expected to be low and in a long term, will require governmental resources.

Soft ODA loans will be contributive to the procurement of governmental budget for the stable accomplishment of the project.

4) Due consideration should be paid to the environmental conservation to cope with the environmental impact eventually caused by the development of the Bang Saphan industrial estate.

Judging from the extent of air pollution and water contamination by industrial activities, it is anticipated that the environmental degradation will be little compared to the environmental standard. Therefore, the result of projection together with the monitoring method to be taken shall be informed and explained to be residents of Bang Saphan.

As for the relocation of residents living in the proposed industrial estate site, a private company for industrial estate development will be in charge. However, IEAT, which is a participant to the industrial estate company, is recommended to assist the private company for smooth negotiation, especially for the relocation of educational and social facilities.

Environmental Impact Assessment defined by the law shall be made in advance of the implementation of the industrial estate referring to the result of this report.

Tables

Tables

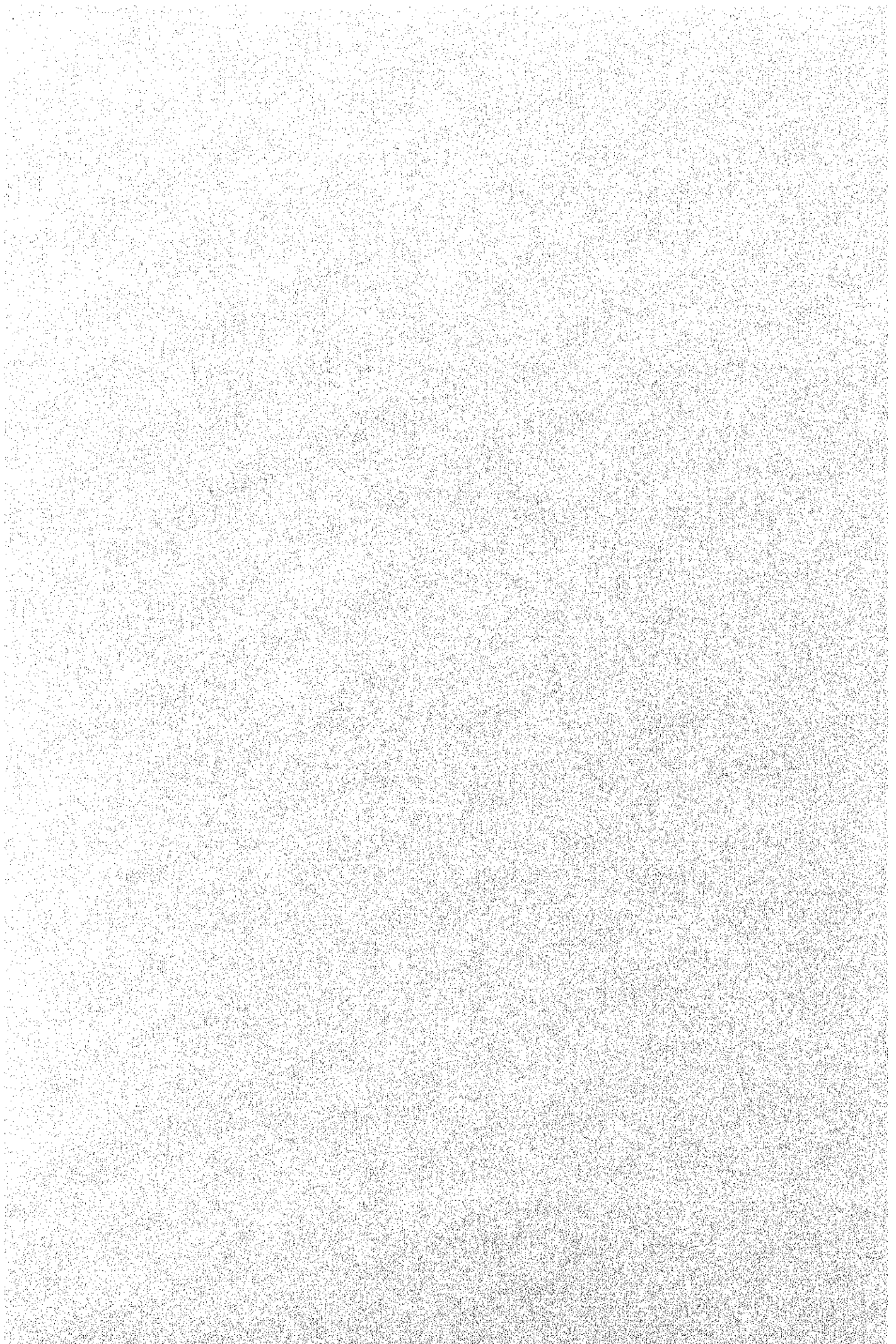


Table 1.1 Participants in the Study

(1/2)

(Steering Committee Members)

1.	Mrs. Anchalee CHAVANICH	Deputy Governor, IEAT, Committee Chairwoman
2.	Mr. Chavalit CHOKRATANACHAI	Chief Engineer, IEAT
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Table 1.1 Participants in the Study

(2/2)

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- | | | | |
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Table 2.1 Top 10 Export Industries by Export Value and by Growth

Top 10 Export Industries by Export Value

		Million Baht		Share to Total (%)	
		1990	1994	1990	1994
Manufactured Products		440,395	922,791	100.00	100.00
1000	Textile Products	84,472	133,469	19.18	14.46
1200	Machinery & Mechanical Appliance	45,431	118,020	10.32	12.79
1400	Electrical Apparatus	32,785	102,438	7.44	11.10
1600	Electrical Appliance	32,523	88,124	7.38	9.55
1300	Precious Stones & Jewellery	34,858	44,684	7.92	4.84
1500	Footwear	20,213	39,258	4.59	4.25
1900	Plastic Products	9,116	30,351	2.07	3.29
1700	Base Metal Products	11,859	24,718	2.69	2.68
3300	Vehicle Parts & Accessories	3,729	19,979	0.85	2.17
2000	Canned Fish	15,742	19,810	3.57	2.15

COMODITIES

1010	Garments	65,798	100,580	14.94	10.90
1210	Computer & Parts	38,671	92,059	8.78	9.98
1410	Integrated Circuits & Parts	21,580	45,308	4.90	4.91
1211	Parts(Computer)	29,532	38,847	6.71	4.21
1640	Television	6,489	22,195	1.47	2.41

Top 10 Export Industries by Growth 1990-1994

		Million Baht		Share to Total (%)		
		1990	1994	1990	1994	94/90*
Manufactured Products		440,395	922,791	100.00	100.00	20.31
2600	Cements	47	2,831	0.01	0.31	178.59
3500	Optical Appliance & Instruments	1,565	11,054	0.36	1.20	63.02
3100	Transformers, Generator, & Motors	2,997	16,163	0.68	1.75	52.39
3300	Vehicle Parts & Accessories	3,729	19,979	0.85	2.17	52.14
1900	Plastic Products	9,116	30,351	2.07	3.29	35.08
1400	Electrical Apparatus	32,785	102,438	7.44	11.10	32.95
3900	Sport Requisites	2,583	7,508	0.59	0.81	30.57
3600	Chemical Products	2,146	5,827	0.49	0.63	28.37
1600	Electrical Appliance	32,523	88,124	7.38	9.55	28.3
3700	Leather Products	2,199	5,738	0.50	0.62	27.1

COMODITIES

3320	Motor Cycle Parts	659	6,353	0.15	0.69	76.21
1610	Air Conditioning	1,955	13,492	0.44	1.46	62.08
3310	Passenger Cars & Parts	1,506	9,961	0.34	1.08	60.37
1620	Refrigerators & Equipment	1,370	5,298	0.31	0.57	40.23
1130	Brassieres	821	3,121	0.19	0.34	39.63
1640	Television	6,489	22,195	1.47	2.41	35.99

*: Growth Rate: Current Price

Source: Monthly Bulletin, Sep. 1995, Bank of Thailand

Table 2.2 Industrial Estate in Thailand (1/3)

No.	Zone	Region	Province	Name of I.E.	Developed Year	Developed (Organization)	Total Area As of 789	Total Area As of 695	Area Already Occupied As of 695	Available Land As of 695
1	I	C	Bangkok	Bangchun I.E.	1972	HEAT	677	677	677	0
2	I	C	Bangkok	Ladkrabang I.E. Phase I & II	1983	HEAT	949	949	949	0
3	I	C	Bangkok	Ladkrabang I.E. Phase III	1989	HEAT	812	812	812	0
4	I	C	Bangkok	Miraburi I.E. Phase I & II	1996	HEAT	57	570	570	0
5	I	C	Bangkok	Cenapolis	1988	HEAT	168	96	96	72
6	I	C	Bangkok	Namkai Ladkrabang GIZ 1	1990	Join of HEAT	300	300	300	0
7	I	C	Bangkok	Namkai Ladkrabang GIZ 2	1990	Join of HEAT	270	270	270	0
8	I	C	Bangkok	Jongsati I.P.	Private	Private	930	930	930	0
9	I	C	Bangkok	Bangpoo I.E. Phase I	1977	HEAT	3,930	5,763	5,763	0
10	I	C	Bangkok	Bangpoo I.E. Phase II	1994	HEAT	798	2,060	2,060	1,800
11	I	C	Bangkok	Bangphue I.E. Phase I & II	1984	HEAT	798	798	798	0
12	I	C	Bangkok	Bangphue I.E. Phase III	1988	HEAT	523	1,300	500	800
13	I	C	Bangkok	Theparak I.E.	1988	HEAT	523	523	523	0
14	I	C	Bangkok	M Thai I.E.	Private	Private	826	826	826	0
15	I	C	Bangkok	Samut Sakorn I.E. (GIZ)	1992	HEAT	640	640	630	10
16	I	C	Bangkok	Samut Sakorn I.E. (Dy-ding P&C)	HEAT	HEAT	1,401	1,401	1,220	181
17	I	C	Bangkok	Jongsati I.P.	1992	Private	930	930	930	0
18	I	C	Bangkok	Nava Nakorn I.Z.	1972	Private	2,027	4,045	3,945	100
19	I	C	Bangkok	Bangkhadi I.P.	1989	Private	954	1,174	1,174	0
20	I	C	Bangkok	Mah Boonkong I.E.	HEAT	HEAT	1,410	1,410	1,410	0
21	I	C	Bangkok	Bangkok Airport I.E.	1990	HEAT	680	680	680	0
			Subtotal			12,963	26,166	23,203	2,963	
22	E	E	Chachengsao	Well Grow I.E. Phase I		HEAT	948	948	948	0
23	E	E	Chachengsao	Well Grow I.E. Phase II		HEAT	1,744	1,744	1,744	0
24	E	E	Chachengsao	Well Grow I.E. Phase III	1991	HEAT	1,723	1,723	1,723	460
25	E	E	Chachengsao	Gateway City I.E.	1992	HEAT	4,441	4,441	2,645	1,796
26	E	E	Chonburi	Chonburi (Boo-Win) I.E. GIZ	1991	HEAT	2,846	2,846	1,337	1,509
27	E	E	Chonburi	Chonburi (Boo-Win) I.E. EPZ	1991	HEAT	760	760	683	77
28	E	E	Chonburi	Bangpakong I.E. Phase II	1991	HEAT	2,330	2,330	2,330	0
29	E	E	Chonburi	Bangpakong I.E. Phase III	1994	HEAT	829	829	404	425
30	E	E	Chonburi	Bangpakong I.E. Phase IV		HEAT	1,000	1,000	1,000	0
31	E	E	Chonburi	Bangpakong I.E. Phase V		HEAT	913	913	913	0
32	E	E	Chonburi	Sriracha I.P.	1988	Private	1,202	1,202	1,202	0
33	E	E	Chonburi	Laein Chabang I.E. (GHE)	1990	HEAT	2,200	2,200	2,200	0
34	E	E	Chonburi	Laein Chabang I.E. (EPZ)	1990	HEAT	1,100	1,100	900	200
			Subtotal			2,150	22,036	15,716	6,320	
35	C	C	Ayutthaya	Hi-Tech I.E. (GIZ)	1992	HEAT	1,000	1,000	905	95
36	C	C	Ayutthaya	Hi-Tech I.E. (EPZ)	1992	HEAT	800	800	460	40
37	C	C	Ayutthaya	Bangpa-in I.E. (GIZ)	1994	HEAT	1,073	1,073	1,029	44
38	C	C	Ayutthaya	Bangpa-in I.E. (EPZ)	1996	HEAT	165	165	131	34
39	C	C	Ayutthaya	Saha-ananaskom I.E.		HEAT	1,549	1,549	1,049	500
40	C	C	Ayutthaya	Rojana I.P. (Phase I & II)		Private	1,788	1,788	1,388	400
41	C	C	Ayutthaya	Ayutthaya I.P.		Private	754	754	0	754
42	C	C	Saraburi	Saraburi (Kaeng Khui) I.E.	1993	HEAT	1,029	1,029	300	729
43	C	C	Saraburi	Naeng-Khae I.E.	1993	HEAT	1,337	1,337	624	713
44	C	C	Saraburi	Siam Cement Ind. Land.	1993	Private	3,577	3,577	700	2,877
45	C	C	Saraburi	Kaeng Khui Ind. Center (TPH)	1997	Private	1,800	1,800	0	1,800
			Subtotal			820	14,572	6,586	7,986	

Table 2.2 Industrial Estate in Thailand (2/3)

No.	Zone	Region	CHZ/EPZ	Province	Name of I.E.	Developed Year	Organization	Total Area As of 7/89	area As of 6/95	Total area As of 6/95	area As of 6/95
46	3	E	GHE	Rayong	Siam Eastern I.P.	1995	Private	957	381	576	576
47	3	E	GHE	Rayong	Eastern I.E. (Map Ta Phut)	1993	BEAT	2,430	1,347	1,083	1,083
48	3	E	GHE	Rayong	Eastern Seaboard I.E.	1993	BEAT	3,560	0	3,560	3,560
49	3	E	GHE	Rayong	TPI Rayong Complex	1997	Private	3,200	1,000	2,200	2,200
50	3	E	GHE	Rayong	Map Ta Phut I.E.	1989	BEAT	6,000	6,000	0	0
51	3	E	GHE	Rayong	Map Ta Phut I.E. (Expansion)		BEAT	1,214	0	1,214	1,214
52	3	E	GHE	Rayong	Padaeng I.E.	1994	BEAT	540	540	0	0
53	3	E	GHE	Rayong	Rayong I.P.	1993	Private	1,400	900	500	500
54	3	E	GHE	Prachinburi	304 Ind. Park	1994	Private	2,500	600	1,900	1,900
55	3	E	GHE	Prachinburi	Prachinburi I.P.	1991	Private	1,768	0	1,768	1,768
56	3	E	GHE	Prachinburi	Prachin I.P.		Private	1,410	630	780	780
57	3	E	GHE	Prachinburi	Kaohin I.P.	1993	Private	1,700	1,000	700	700
		E					6,000	26,679	12,398	14,281	14,281
58	3	NE	GHE	Nakhon Ratchasima	Northeastern I.P. (GIZ)	1996	Join or BEAT	5,572	3,072	2,500	2,500
59	3	NE	EPZ	Nakhon Ratchasima	Northeastern I.P. (EPZ)	1996	Join or BEAT	1,000	0	1,000	1,000
60	3	NE	GHE	Nakhon Ratchasima	Suranaree I.Z.	1988	Join or BEAT	3,000	2,000	1,000	1,000
61	3	NE	GHE	Ubon Ratchaburi	Saha-Ubonnakorn GIZ 1		Join or BEAT	3,048	2,648	400	400
62	3	NE	GHE	Ubon Ratchaburi	Saha-Ubonnakorn GIZ 2		Join or BEAT	1,000	0	1,000	1,000
63	3	NE	GHE	Ubon Ratchaburi	Ubon Ratchaburi I.E.	1995	BEAT				
64	3	NE	GHE	Udonthani	Udonthani I.E.	1995	BEAT	785	685	100	100
65	3	NE	GHE	Khon Kaen	Khon Kaen 1	1995	BEAT	763	0	763	763
66	3	NE	GHE	Khon Kaen	Khon Kaen 2	1997	Private	1,161	0	1,161	1,161
67	3	NE	GHE	Sisagake	Sisagake I.E.	1997	Private				
68	3	NE	GHE	Nongkhai	Nongkhai I.E.		BEAT				
69	3	NE	GHE	Buri Ram	Buri Ram I.E.		BEAT				
		NE					530	16,329	8,405	7,924	7,924
70	3	N	GHE	Lumpoon	Saha Group I.P. Lumpoon		Private		50	500	500
71	3	N	GHE	Lumpoon	Northern Region I.E. (GIZ)	1985	Join or BEAT	1,780	1,780	0	0
72	3	N	EPZ	Lumpoon	Northern Region I.E. (EPZ)	1985	Join or BEAT	766	675	91	91
73	3	N	GHE	Lumpoon	Lumpoon I.P.	1991	Private	808	717	91	91
74	3	N	GHE	Chian Rai	Chian Rai I.E. GIZ	1995	BEAT	1,000	0	1,000	1,000
75	3	N	EPZ	Chian Rai	Chian Rai I.E. EPZ	1995	BEAT	675	0	675	675
76	3	N	GHE	Pichit	Pichit I.E. 1+2 (GIZ)		BEAT				
77	3	N	EPZ	Pichit	Pichit I.E. 1+2 (EPZ)	1996	BEAT	650	60	590	590
78	3	N	GHE	Nakon Sawan	Nakon Sawan I.E.		BEAT				
79	3	N	GHE	Lampang	Lampang I.E.		BEAT				
80	3	N	GHE	Phayao	Phayao I.E.		BEAT				
81	3	N	GHE	Phrae	Phrae I.E.		BEAT				
82	3	N	GHE	Pissulok	Pissulok I.E.		BEAT				
		N					1,750	6,818	3,282	3,336	3,336
83	3	W	GHE	Ratchaburi	Ratchaburi I.E.		BEAT				
84	3	W	GHE	Prachuap Khiri Khan	Prachuap Khiri Khan I.E.		BEAT				
85	3	W	GHE	Chumphon	Chumphon I.E.		BEAT				
		W									

Table 2.2 Industrial Estate in Thailand (3/3)

No.	Zone	Region	GIE/EPZ	Province	Name of I.E.	Developed Year	Developed Organization	Total Area As of 7/89	area As of 6/95	Total area As of 6/95	area As of 6/95
86	3	S	GIE	Songkhla	Songkhla I.E. (Chalung) GI/Z		BEAT		319		259
87	3	S	EPZ	Songkhla	Songkhla I.E. (Chalung) GI/Z		BEAT			60	
88	3	S	GIE	Sueithani	Sueithani I.E.		BEAT		115		115
89	3	S	GIE	Padang	Padang I.Z.		Joint by BEAT				
90	3	S	GIE	Nakhon Sri Thammarat	Nakhon Sri Thammarat I.E.		BEAT				
91	3	S	GIE	Krabi	Krabi I.E.		BEAT				
92	3	S	GIE	Satun	Satun I.E.		BEAT				
93	3	S	GIE	Yam	Yam I.E.		BEAT				
94	3	S	GIE	Narathivas	Narathivas I.E.		BEAT				
95	3	S	GIE	Songkhla	Southern Region I.E. (GI/Z)	1995	BEAT	230		0	230
96	3	S	EPZ	Songkhla	Southern Region I.E. (EPZ)	1995	BEAT		200		200
									864		804
TOTAL								48,426	226,064	130,240	86,824

Note) C:Central Region, E:Eastern Region, N:Northern Region,

NE: North Eastern Region, W:Western Region,

S:Southern Region

GIE: General Industrial Estate, EPZ: Export Processing Zone

Table 4.1 Selection of Industrial Categories for the Bang Saphan Industrial Estate (1/3)

Food Manufacture Group	
○	Meat Products
○	Dairy Products
○	Miscellaneous Livestock Products
○	Canned seafood and seaweed
○	Miscellaneous seafood products
○	△ Soy sauce "soyuu" and edible amino acids
○	Glucose, starch syrup and high-fructose corn syrup
○	Wheat flour milling
○	Vegetable oil and fats
○	Edible oil and fats
○	Noodle, macaroni and spaghetti
○	Compound fertilizers

Textile Manufacture Group	
●	Spinning mills and cotton
●	Twisting yarns, except bulky yarns
●	Fabric mills, woven cotton and spun rayon

Petroleum and Coal Group	
○	● Nitrogenous and phosphatic fertilizers
○	● Inorganic pigments
○	● Compressed and liquefied gases
○	● △ Basic petrochemicals, including derivatives produced from an integrated process
○	● △ Aliphatic intermediates, including Aliphatic solvent
○	● Methane derivatives
○	● Fermentation industry
○	● △ Medical material preparations
○	● Lubricating oils
○	● Greases
○	● Tire and tubes for automobiles
○	● Mechanical rubber products
○	● Rubber sheets

- Regional resources based industrial category
- ◎ Port-oriented industrial category
- Policy-oriented industrial category
- △ Industrial category selected from demand survey

Table 4.1 Selection of Industrial Categories in Bang Saphan Industrial Estate (2/3)

Wooden and Furniture Group		
○	●	Flooring mills
○	●	Sawing and planning mills,n.e.c.
○	◎	Particle board
○	●	△ Wooden furniture, except Japanese

Paper and Pulp Group		
○	◎	● Paper
○	◎	● Paperboard
○	●	● Corrugated paper
○	●	● Office paper products

Steel Industrial Group		
○	◎	△ Steel pipes and tubes
○		△ Cold finished steel bars
○	◎	△ Wire drawing
○		△ Coated steel pipes
○		△ Coated steel wire
○	◎	△ Iron casting, except cast iron pipes and malleable iron castings
○		△ Malleable iron castings
○	◎	△ Steel castings
○		△ Secondary forgings
○	◎	△ Iron and steel shearing and slitting
○		△ Iron and steel scrap preparation for smelting
○		△ Cast iron pipe
○	◎	△ Fabricated construction-use metal products
○		△ Fabricated architectural metal products,except structural hardware
○	◎	△ Fabricated plate work and sheet metal work

- Regional resources based industrial category
- ◎ Port-oriented industrial category
- Policy-oriented industrial category
- △ Industrial category selected from demand survey

Table 4.1 Selection of Industrial Categories in Bang Saphan Industrial Estate (3/3)

Ceramics Industrial Group	
<input type="radio"/>	Processed flat glass
<input type="radio"/>	Glass containers
<input type="radio"/>	Fire bricks
<input type="radio"/>	Miscellaneous clay refractories
<input type="radio"/>	Carbonaceous electrodes

Processing and Assembly Industrial Group	
<input type="radio"/>	Boilers
<input type="radio"/>	Steam engines, turbines and water wheels
<input type="radio"/>	<input type="checkbox"/> Pumps and pumping equipment
<input type="radio"/>	Air compressors, gas compressors and blowers
<input type="radio"/>	Conveyers and conveying equipment
<input type="radio"/>	Oil hydraulic equipment
<input type="radio"/>	Chemical machinery and its equipment
<input type="radio"/>	<input type="checkbox"/> Miscellaneous general industry machinery and equipment
<input type="radio"/>	Office machines
<input type="radio"/>	Miscellaneous office, service industry and household machines
<input type="radio"/>	Refrigerators and air conditioning apparatus
<input type="radio"/>	Generators, motors and other rotating electrical machinery
<input type="radio"/>	Power and distribution transformers, except electronic appliances transformers
<input type="radio"/>	<input type="checkbox"/> Household electric appliances
<input type="radio"/>	Radio communication equipment
<input type="radio"/>	Storage batteries
<input type="radio"/>	Motor vehicle bodies and trailers
<input type="radio"/>	<input type="checkbox"/> Motor vehicle parts and accessories

Shipbuilding and Repairing Group	
<input type="radio"/>	Steel shipbuilding and repairing
<input type="radio"/>	Hull blocks

- Regional resources based industrial category
- Port-oriented industrial category
- Policy-oriented industrial category
- Industrial category selected from demand survey

Table 5.1 Development Framework of Bang Saphan Area

Year		Area (ha)	Direct Employee	Water Demand /l		Electric Demand (MW)	Cargo Demand (1,000 ton/year)	Remarks	
				(m ³ /day)	(MCM)				
1995	Iron/Steel Group	35	560	5,000	1.83		1,935	Volume of Water Reservoir: 1.45MCM	
	General Industry	0	0	0	0.00				
	Total	35	560	5,000	1.83	94.00	1,935		
2001	Iron/Steel Group	100	2,400	32,000	11.68		5,500		
	General Industry	50	2,400	2,600	0.95		1,500		
	Subtotal	150	4,800	34,600	12.63		7,010		
	Port		1,600	500	0.18				
	Total	150	6,400	35,100	12.81	400.00	7,010		
Scenario 1	Iron/Steel Group	145	4,700	98,700	36.03		6,900		
	General Industry	210	6,000	23,700	8.65		3,500		
	Subtotal	355	10,700	122,400	44.68		10,400		
	Power Plant	105	200	1,800	0.66		4,400	Ash disposal site of 170 ha is exclusive.	
	Port		1,600	500	0.18				
Total	460	12,500	124,700	45.52	1,830.00	14,800			
2006	Scenario 2	Iron/Steel Group	145	4,700	98,700	36.03		6,900	
	General Industry	300	9,500	43,100	15.73		8,850		
	Subtotal	445	14,200	141,800	51.76		15,750		
	Power Plant	105	200	1,800	0.66		4,400	Ash disposal site of 170 ha is exclusive.	
	Port		1,600	500	0.18				
Total	550	16,000	144,100	52.60	1,860.00	20,150			
Scenario 1	Iron/Steel Group	260	4,700	98,700	36.03		15,900		
	General Industry	360	11,900	61,100	22.30		9,730		
	Subtotal	620	16,600	159,800	58.33		25,630		
	Power Plant	105	200	1,800	0.66		4,400	Ash disposal site of 170 ha is exclusive.	
	Port		2,300	500	0.18				
Total	725	19,100	162,100	59.17	1,890.00	30,030			
2011	Scenario 2	Iron/Steel Group	260	4,700	98,700	36.03		15,900	
	General Industry	550	20,400	96,900	35.37		10,710		
	Subtotal	810	25,100	195,600	71.39		26,610		
	Power Plant	105	200	1,800	0.66		4,400	Ash disposal site of 170 ha is exclusive.	
	Port		3,000	500	0.18				
Total	915	28,300	197,900	72.23	1,950.00	31,010			

Note: Domestic and irrigation use are exclusive.

Table 5.2 Land Use Concept of Bang Saphan Area

	(ha)				(rai)			
	Scenario-1		Scenario-2		Scenario-1		Scenario-2	
	2000	2010	2000	2010	2000	2010	2000	2010
1 General Industrial Estate	52	360	52	550	325	2,250	325	3,438
2 Iron/Steel Industry	102	260	102	260	638	1,625	638	1,625
3 New Residential Area	40	350	40	690	250	2,188	250	4,313
4 Business/Commercial Area	0	60	0	80	0	375	0	500
5 Recreation/Tourism Area	50	220	50	220	313	1,375	313	1,375
6 Social Facility Area	0	80	0	80	0	500	0	500
7 Park/Recreation Area	120	120	120	120	750	750	750	750
8 Institution /Education Area	0	120	0	120	0	750	0	750
9 Port	100	250	100	250	625	1,563	625	1,563
10 Power Plant (IPP) /1	0	105	0	105	0	656	0	656
Total	464	1,925	464	2,475	2,900	12,031	2,900	15,469

Note: /1 Ash disposal site of 170 ha is exclusive.

Table 8.1 Implementation Organization for Infrastructure of Bang Saphan Industrial Estate

	F/S	E/S	Construction	Maintenance /Operation	Remarks
1 Water Supply System					
1) Reservoir(Tha Sac)	RID	RID	RID	RID	
2) Reservoir(Bang Saphan River)	RID	RID	RID	RID	
3) Pipeline(Tha Sac~Bang Saphan)	IEAT/PWA	IEAT/PWA	IEAT/WW	IEAT/WW	
4) Pipeline(Bang Saphan Reservoir ~ Bang Saphan)	IEAT/PWA	IEAT/PWA	IEAT/WW	IEAT/WW	
5) Purification Plant	-	IE Co.	IE Co.	IE Co.	
6) Distribution Facility	-	IE Co.	IE Co.	IE Co.	
2 Port					
1) Jetty for Ore/Coal	PP Co.	PP Co.	PP Co.	PP Co.	
2) General Cargo Berth	PP Co.	PP Co.	PP Co.	PP Co.	Governmental assistance is recommendable for the construction.
3) Back Support Area (Container Deposit, General Cargo Warehouse, etc.)	PP Co.	PP Co.	PP Co.	PP Co.	
3 Road					
1) Access Road to IE (R4 ~ IE)	DOH	DOH	DOH	DOH	
2) Access Road to Port (IE~Port)	DOH	DOH	DOH	DOH	
3) Road inside IE	IE Co.	IE Co.	IE Co.	IE Co.	
4) Community Road in Bang Saphan Town (R. 3169)	-	DOH (1996)	DOH (1997~1998)	DOH	will be improved by 1998
5) Community Road in Bang Saphan Town (Provincial Road)	-	PKK Province	PKK Province	PKK Province	
4 Electric Supply					
1) IPP	Private	Private	Private	Private	
2) 500 kV transmission line	EGAT	EGAT	EGAT	EGAT	
3) Expansion of Bang Saphan SS	EGAT	EGAT	EGAT	EGAT	
4) Development of New SS	EGAT	EGAT	EGAT	EGAT	
5) 115 kV TL (BS SS ~ IE)	PEA	PEA	PEA	PEA	
6) 115 kV TL (New SS ~ IE)	PEA	PEA	PEA	PEA	
7) SS in IE	PEA	PEA	PEA	PEA	
8) Distribution line in IE	IE Co.	IE Co.	IE Co.	IE Co.	
5 Telecommunication					
1) Switching station in IE	TOT	TOT	TOT	TOT	
2) Optical cable from SS of IE to Bang Saphan SS	TOT	TOT	TOT	TOT	
3) Distribution line in IE	IE Co.	IE Co.	IE Co.	IE Co.	
6 Solid Waste Disposal					
1) Hazardous Waste Disposal	MOI/Private	MOI/Private	MOI/Private	Private	
2) Incinerator for General Waste	IE Co.	IE Co.	IE Co.	IE Co.	

RID	: Royal Irrigation Department
PWA	: Provincial Waterworks Authority
WW	: Western Water Resources Development and Management Co., Ltd.
IE Co.	: Industrial Estate Company (Assumption)
DOH	: Department of Highway
PKK	: Prachuap Khiri Khan
PPCo.	: Prachuap Port Company
EGAT	: Electricity Generating Authority of Thailand
PEA	: Provincial Electricity Authority
MOI	: Ministry of Industry
TOT	: Telephone Organization of Thailand

Table 10.1 Inflows and Outflows for Economic and Financial Analysis

1. Economic Analysis of the Project		
EIRR = Economic Internal Rate of Return		
<u>Economic costs</u>	<u>Sources of fund</u>	<u>Economic Benefits</u>
1. I/E development cost	Developer	Value-added generated by
2. External infrastructure cost	National Budget Industrial Operators	"Industrial operator" in I/E
3. Investment cost of "Industrial operator" (including "working capital")		
2. Financial Analysis of the Project		
a) "All capital" method		
ROI = Return of Investment		
<u>Financial costs</u>	<u>Sources of fund</u>	<u>Financial Benefits</u>
1. Development cost *1	Developer *2	Revenue from lot sale
2. O/M cost		
*1	Inclusive of land acquisition cost and development cost of I/E.	
*2	Developer's own funds (No debt financing)	
b) "Equity capital" method from the viewpoint of equity participants		
ROE = Return on equity		
<u>Financial costs</u>	<u>Sources of fund</u>	<u>Net cash flow</u>
1. Development cost		Net cash flow
Equity	Equity from the developer	(Income after tax,
Debt	Borrowing from the bank	depreciation and
2. O/M cost		repayment)

Table 10.2 Summary of Economic Analysis

	<u>Capital investment per employee</u>	<u>External infrastructure cost</u>	<u>EIRR</u>
<u>Base Case</u>	1.6 million baht/employee	11,575 million baht	51.2%
<u>Sensitivity Analysis</u>			
	4.0 million baht/employee	11,575 million baht	36.0%
	4.0 million baht/employee	3,270 million baht	41.9%
	1.6 million baht/employee	3,270 million baht	67.5%

Table 10.3 Summary of Financial Analysis

Case 1 (Base Case)

		Sale price	ROI	ROE
Land price	10 US\$/m2	44	10.5%	66.0%
	(400,000 baht/rai)	49	13.1%	14.3%
		50	13.6%	16.4%

Table 10.4 Summary of Sensitivity Analysis

		Sale price	ROI	ROE
Land price	15 US\$/m2	53	10.9%	9.1%
	(600,000 baht/rai)	55	11.8%	13.9%
		56	12.2%	16.9%

		Sale price	ROI	ROE
Land price	5 US\$/m2	36	10.5%	-
	(200,000 baht/rai)	43	14.9%	14.5%
		44	15.5%	16.2%

		Sale price	ROI	ROE
Land price	10 US\$/m2	46	10.6%	-
	(400,000 baht/rai)	50	12.6%	13.8%
		VAT imposition	51	13.1%

		Sale price	ROI	ROE
Land price	10 US\$/m2	42	10.9%	-
	(400,000 baht/rai)	47	13.8%	15.1%
		Construction cost : 10% decrease	48	14.3%

Combination case		Sale price	ROI	ROE
Land price	5 US\$/m2	33	10.5%	-
	(200,000 baht/rai)	38	13.8%	10.9%
Construction cost : 10% decrease		41	15.9%	15.1%
		42	16.6%	16.7%

Table 10.5 Land Price (Free-hold) in Asian Countries

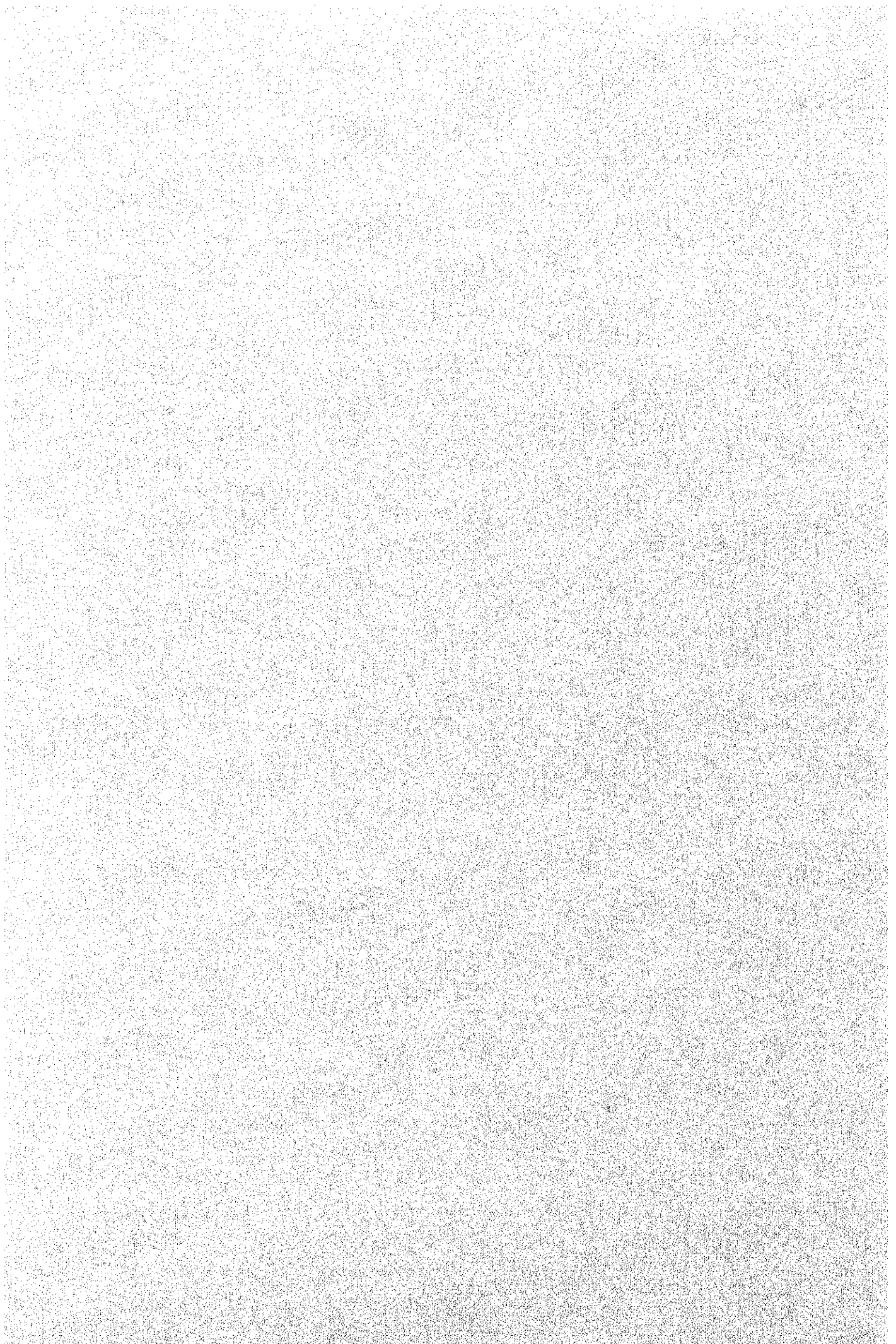
	Malaysia (Kuala Lumpur)	Indonesia (Jakarta)	Thailand (Bangkok)
Average Price	85-128	60-66	82.5
			(As at 1995.9)

(in US\$/m²)

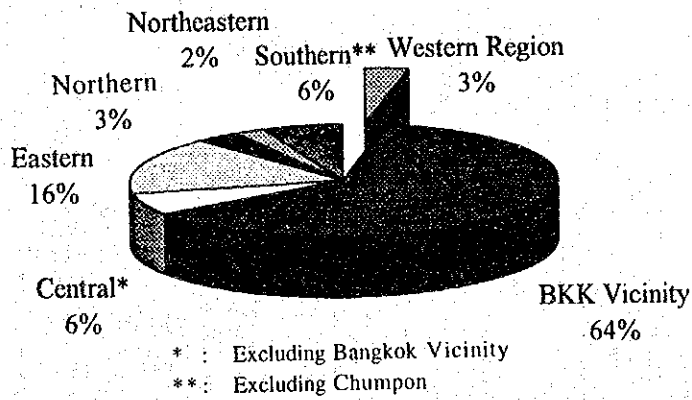
Land Price (GIZ) in Thailand

	Bangpoo 2	Wellgrow	Bang pakong 2	Bang pakong 3
Km from BKK	34km/East	36km/East	57km/East	57km/East
million Baht/	3.3	3.3	2.7-2.9	2.9
US\$/m ²	82.5	82.5	67.5-72.5	72.5
				Nong Kae
	Ban-Wa(Hitech)	Easter	Saraburi	
Km from BKK	60km/North	190km/south-eastm	120km/North	93km/North
million Baht/	2.6	3.6	1.7	2.2
US\$/m ²	65	90	42.5	55
	Gateway City	Samutsakhon	Saharattanakorn	Southern (Chalung)
Km from BKK	82km/East	50km/West	82km/North	30km/South of Songkhla
million Baht/	3.2	3.2	1.5	990.000
US\$/m ²	55	80	37.5	24.7

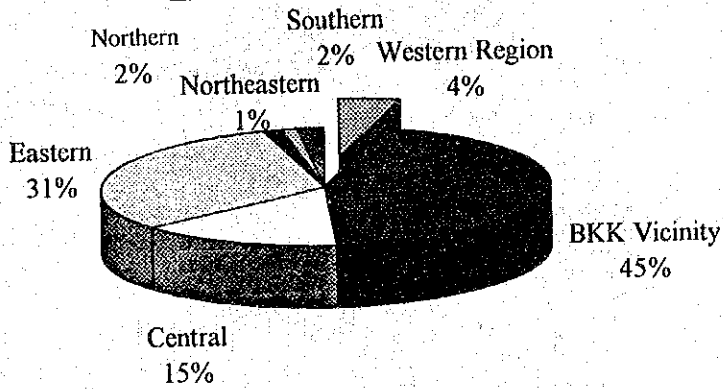
Figures



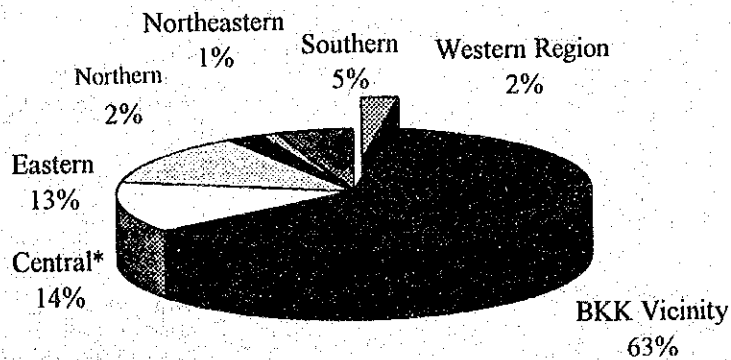
Number of Projects by Region



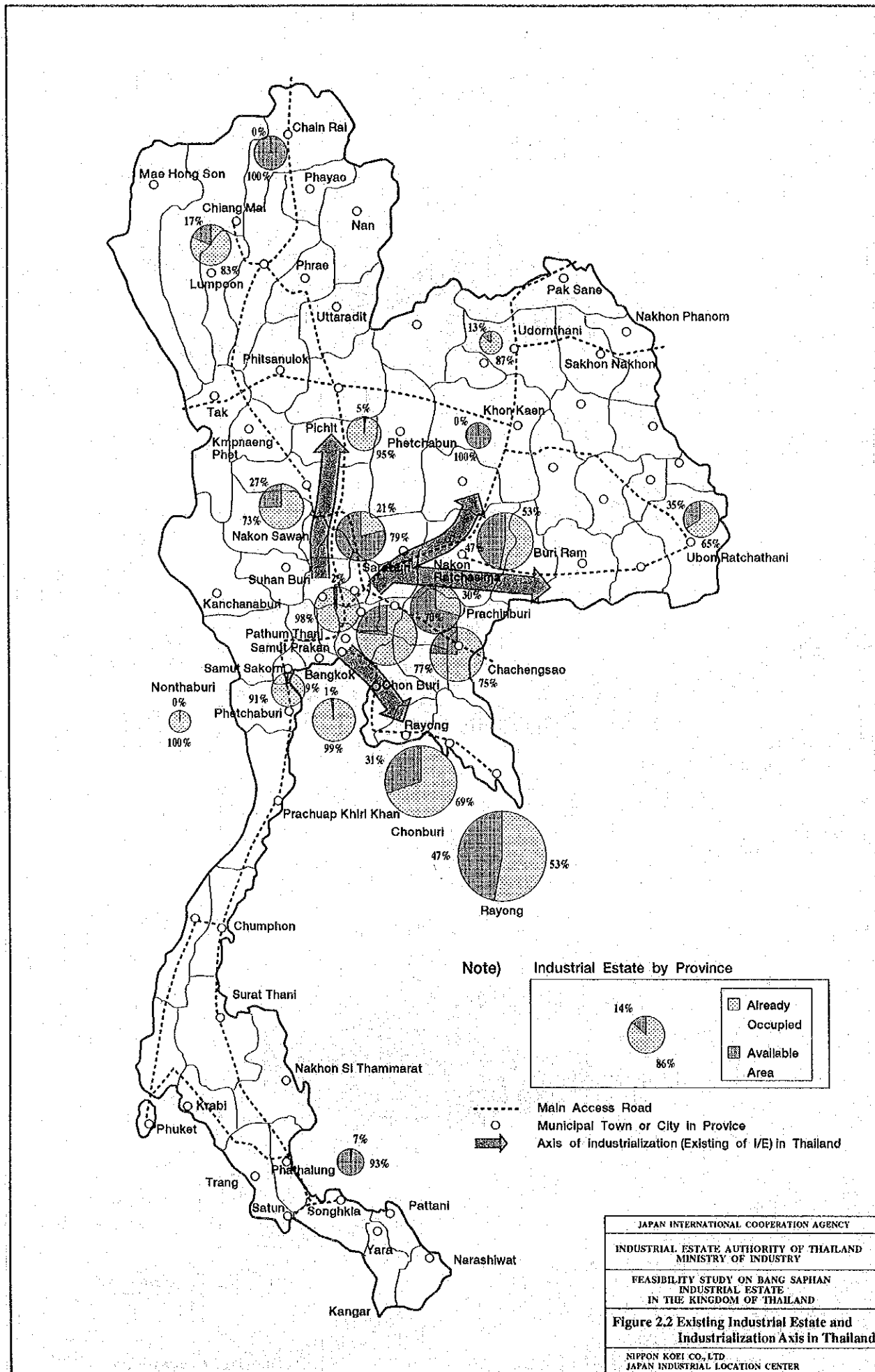
Total Investment by Region

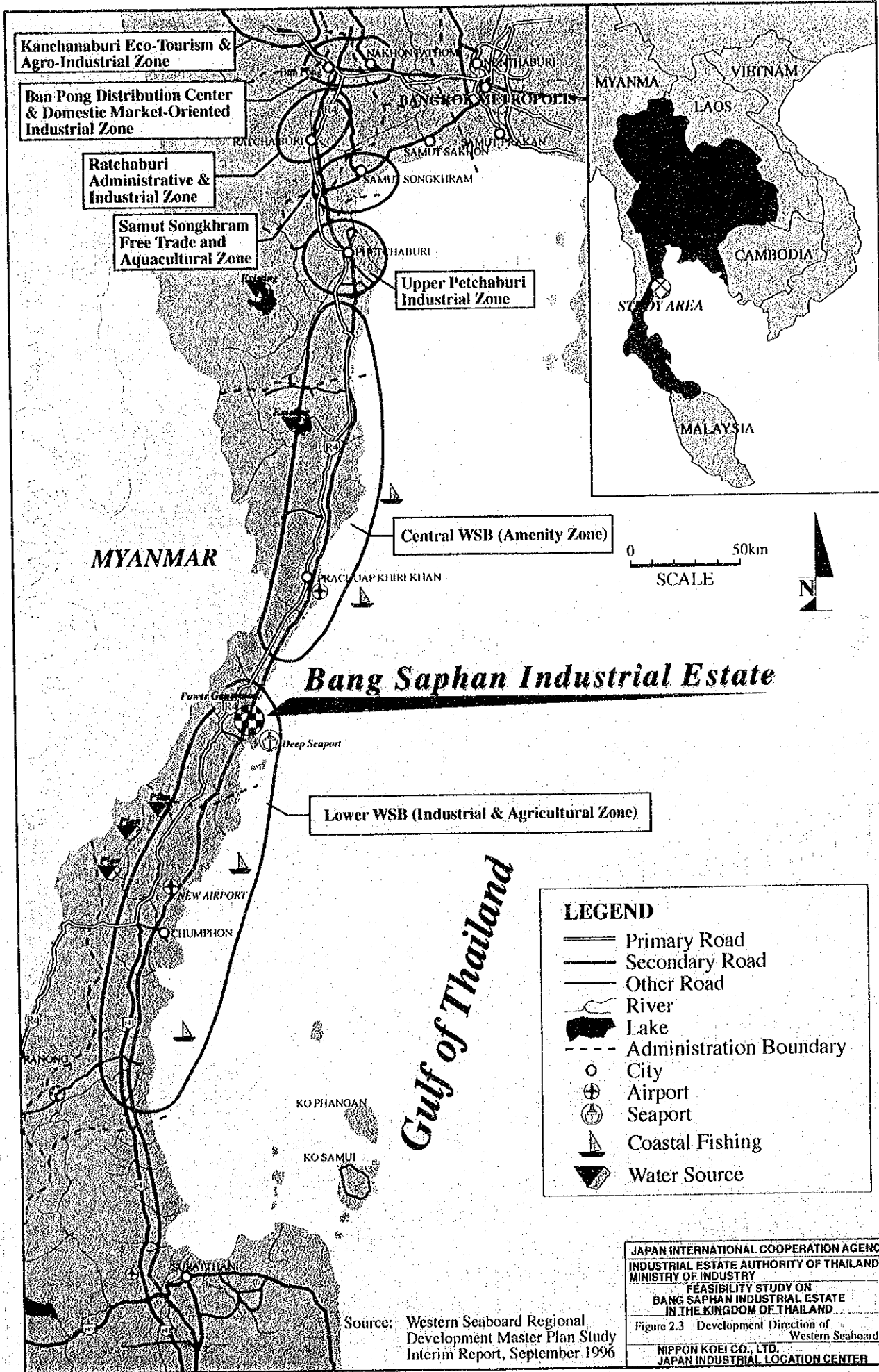


Number of Employee by Region



JAPAN INTERNATIONAL COOPERATION AGENCY
INDUSTRIAL ESTATE AUTHORITY OF THAILAND MINISTRY OF INDUSTRY
FEASIBILITY STUDY ON BANG SAPHAN INDUSTRIAL ESTATE IN THE KINGDOM OF THAILAND
Figure 2.1 Foreign Direct Investment by Region (1994)
NIPPON KOEI CO.,LTD JAPAN INDUSTRIAL LOCATION CENTER





Kanchanaburi Eco-Tourism & Agro-Industrial Zone

Ban Pong Distribution Center & Domestic Market-Oriented Industrial Zone

Ratchaburi Administrative & Industrial Zone

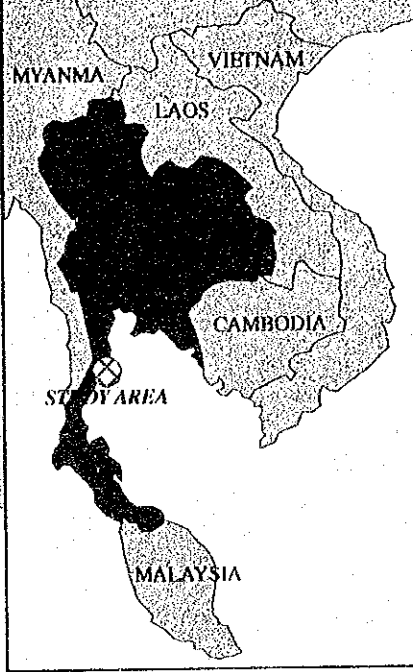
Samut Songkhram Free Trade and Aquacultural Zone

Upper Petchaburi Industrial Zone

Central WSB (Amenity Zone)

Lower WSB (Industrial & Agricultural Zone)

Bang Saphan Industrial Estate



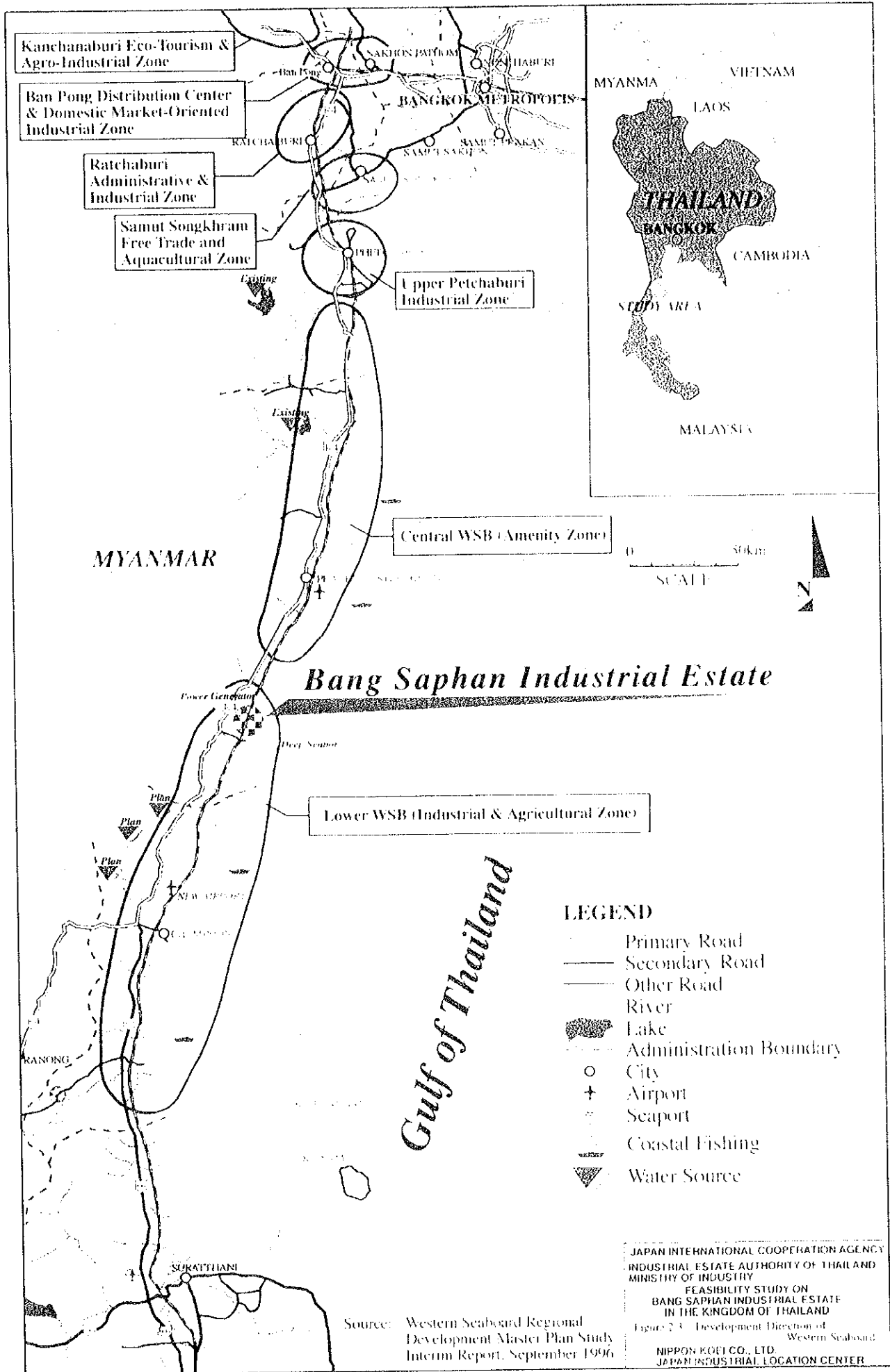
LEGEND

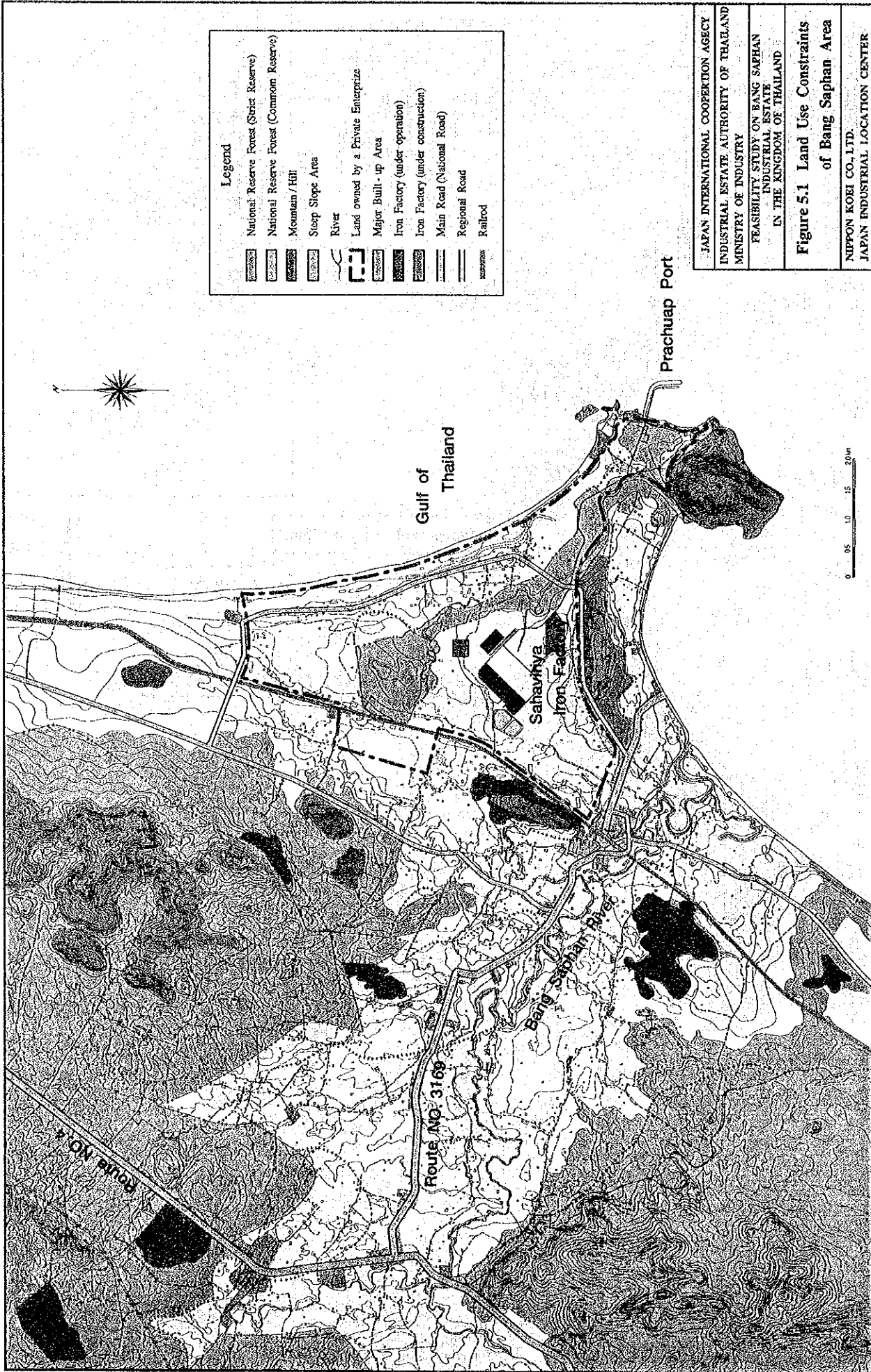
- Primary Road
- Secondary Road
- Other Road
- River
- Lake
- - - Administration Boundary
- City
- ⊕ Airport
- ⊕ Seaport
- ⚓ Coastal Fishing
- ▲ Water Source

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 INDUSTRIAL ESTATE AUTHORITY OF THAILAND
 MINISTRY OF INDUSTRY
 FEASIBILITY STUDY ON
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 IN THE KINGDOM OF THAILAND
 Figure 2.3 Development Direction of
 Western Seaboard
 NIPPON KOEI CO., LTD.
 JAPAN INDUSTRIAL LOCATION CENTER

Source: Western Seaboard Regional Development Master Plan Study Interim Report, September 1996

Gulf of Thailand





Legend

	National Reserve Forest (Strict Reserve)
	National Reserve Forest (Common Reserve)
	Mountain / Hill
	Steep Slope Area
	River
	Land owned by a Private Enterprise
	Major Built-up Area
	Iron Factory (under operation)
	Iron Factory (under construction)
	Main Road (National Road)
	Regional Road
	Railroad

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 MINISTRY OF INDUSTRY
 FEASIBILITY STUDY ON BANG SAPHAN
 INDUSTRIAL ESTATE
 IN THE KINGDOM OF THAILAND

**Figure 5.1 Land Use Constraints
 of Bang Saphan Area**

NIPPON KOEI CO., LTD.
 JAPAN INDUSTRIAL LOCATION CENTER

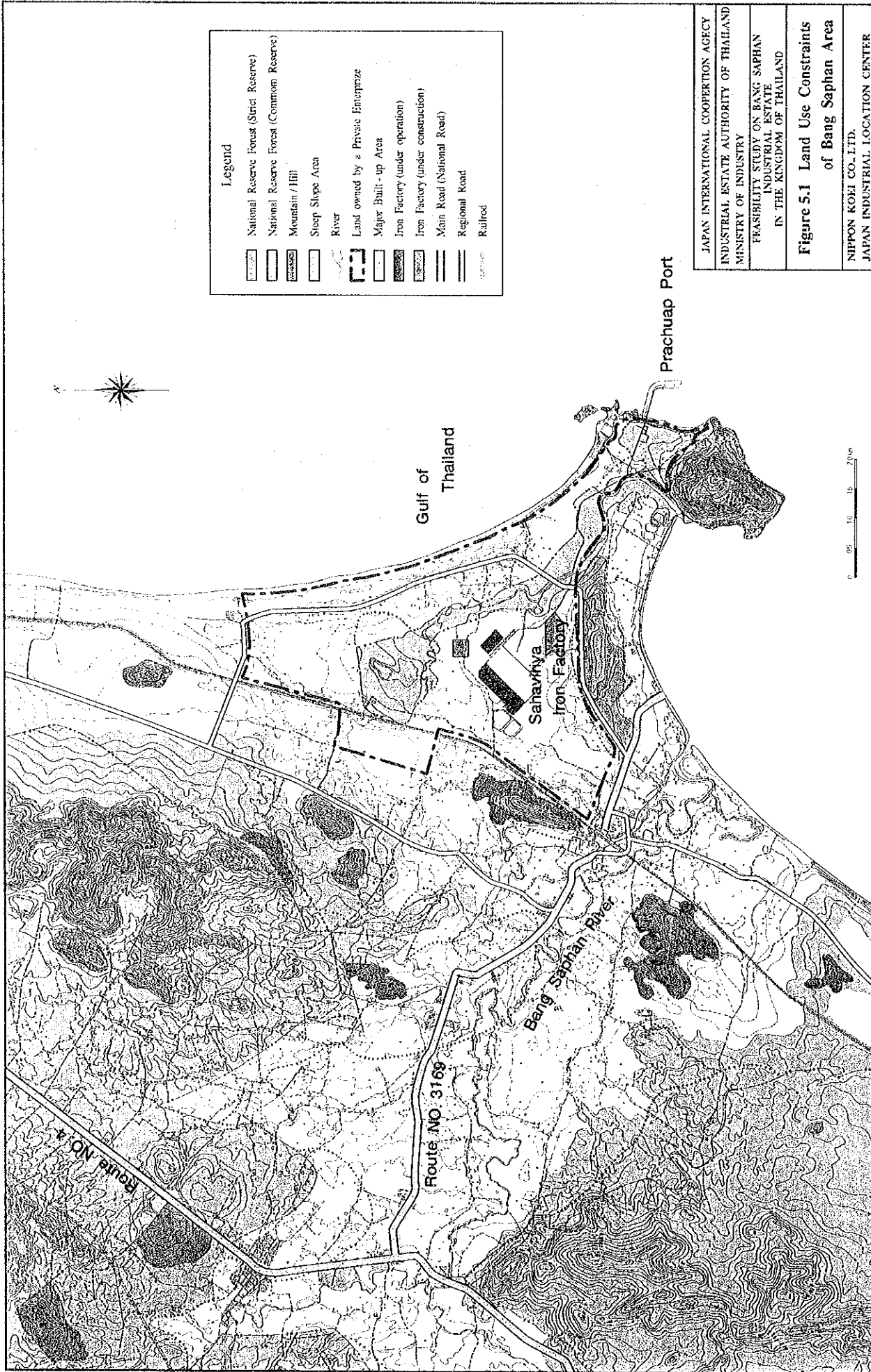
Gulf of
Thailand

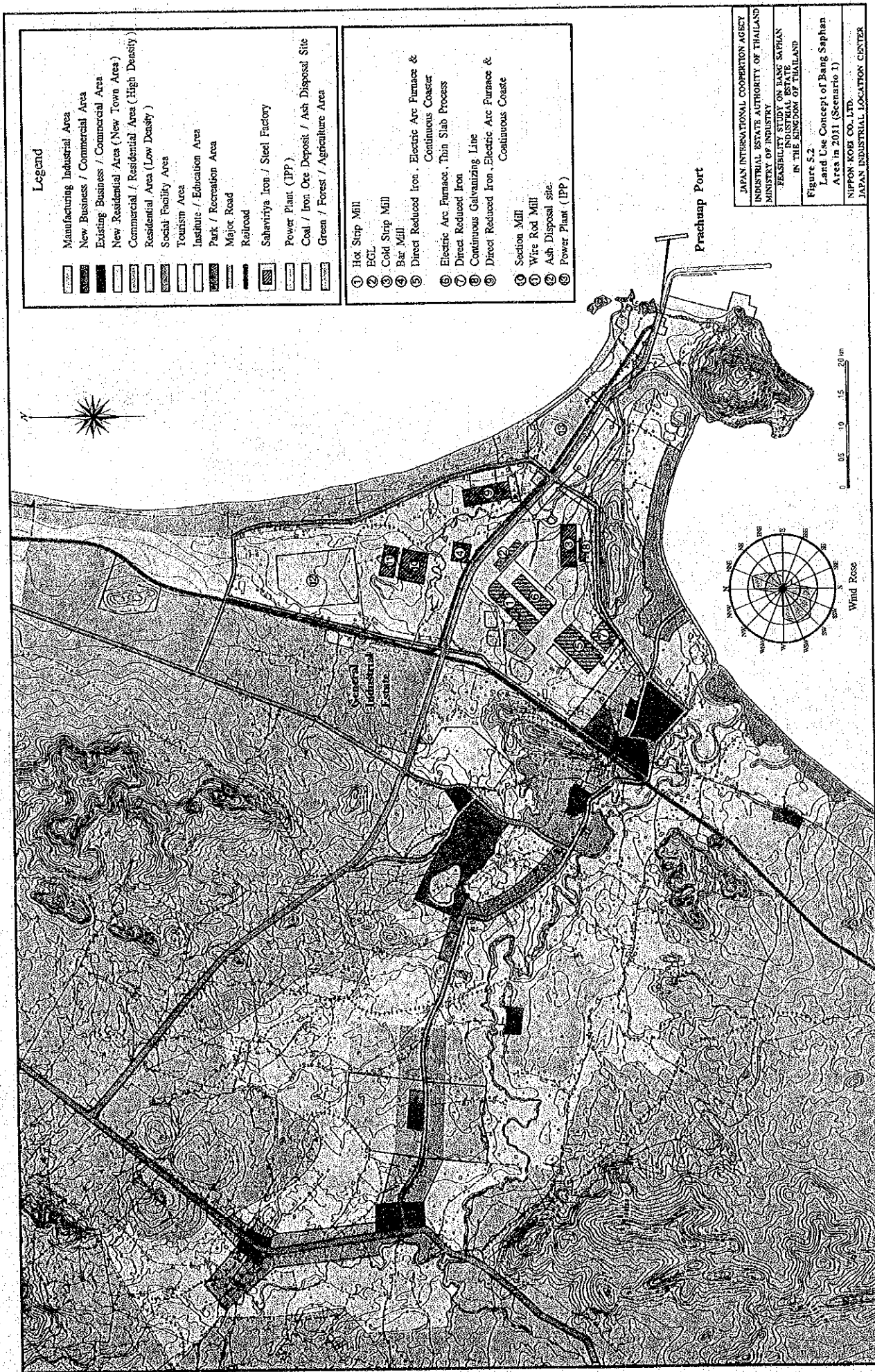
Prachuap Port

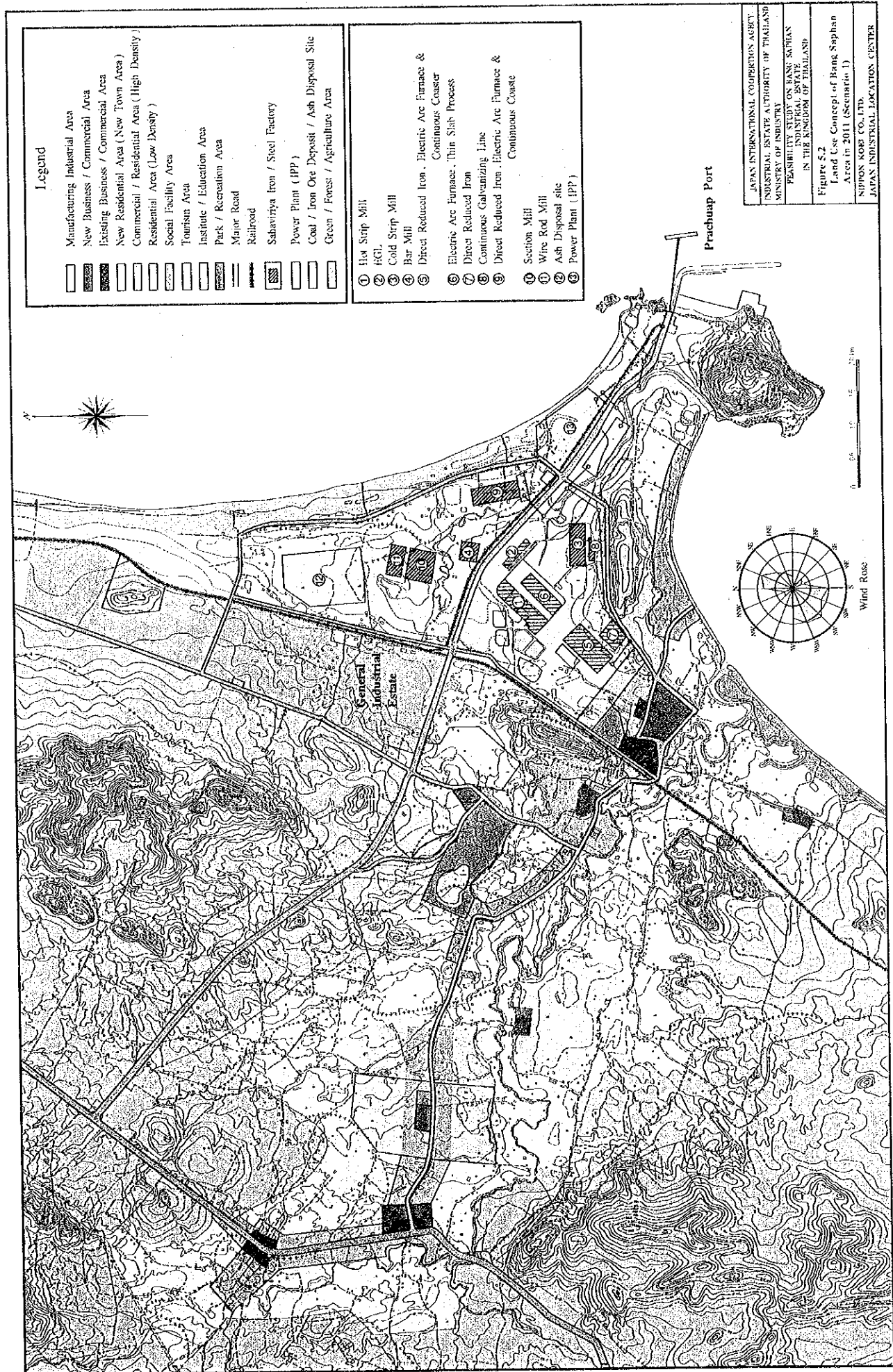
Sahavkva
Iron Factory

Route No. 3169
Bang Saphan Pkwy

0 0.5 1.0 15 20 km







Legend

- Manufacturing Industrial Area
- New Business / Commercial Area
- Existing Business / Commercial Area
- New Residential Area (New Town Area)
- Commercial / Residential Area (High Density)
- Residential Area (Low Density)
- Social Facility Area
- Tourism Area
- Institute / Education Area
- Park / Recreation Area
- Major Road
- Railroad
- Sahaviriya Iron / Steel Factory
- Power Plant (PPP)
- Coal / Iron Ore Deposit / Ash Disposal Site
- Green / Forest / Agriculture Area

- ① Hot Strip Mill
- ② HCL
- ③ Cold Strip Mill
- ④ Bar Mill
- ⑤ Direct Reduced Iron, Electric Arc Furnace & Continuous Coaster
- ⑥ Electric Arc Furnace, Thin Slab Process
- ⑦ Direct Reduced Iron
- ⑧ Continuous Galvanizing Line
- ⑨ Direct Reduced Iron, Electric Arc Furnace & Continuous Coaster
- ⑩ Section Mill
- ⑪ Wire Rod Mill
- ⑫ Ash Disposal site
- ⑬ Power Plant (PPP)

JAPAN INTERNATIONAL COOPERATION AGENCY
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 MINISTRY OF INDUSTRY
 PEABODY ENERGY GROUP
 IN THE KINGDOM OF THAILAND

Figure 5.2
 Land Use Concept of Bang Saphan
 Area in 2011 (Scenario-1)
 NIPPON KOGYO CO., LTD.
 JAPAN INDUSTRIAL LOCATION CENTER