

15.3 Assessment of Environmental Impacts

The law on Environmental Protection of 1993 requires the investors, project managers or directors of the offices to conduct the assessment of environmental impact (Article 9). Article 11 of the law defines that the EIA shall be conducted in two phases, namely preliminary and detailed. Appraising power is given to the Ministry of Science, Technology and Environment (MOSTE) for large projects and to the provincial Department of Science, Technology and Environment for others. In case of the development of ports, all projects which may handle more than 500,000 m³ per year need to be appraised by MOSTE.

Major sources of adverse effects of port development can be existence of structures or landfills, construction activities in the sea and on land, dredging, disposal of dredged materials, and transport of construction materials, vessel traffic, ship discharges and emissions, spills and leakage from ships; and cargo handling and storage, hazardous materials, waterfront industry discharges.

Checklists of adverse effects of port development are used for IEE and the results indicate the need for a EIA study on changes in current patterns, disposal of dredged material, impacts on water quality, shoreline change, traffic load on access roads and relocation of inhabitants.

Reclamation and dredging have the most potentially adverse effects. Two dumping sites are provisionally supposed at offshore of Son Tra Peninsula. Simulation on the turbid water predicts that the dispersion of disposed material is limited to the area adjacent to the loading point at the supposed dumping sites.

As a result of current flow simulation in Lien Chieu, changes in the current velocity are limited to the area adjacent to the new port and no significant change is seen in the offshore. Water quality is assessed by a means of COD diffusion simulation and it is predicted that Han river is the major source of water pollution but the level of pollution is considered not so high. Construction of the new port will not cause any significant change in water pollution in Danang Bay.

Shoreline changes are predicted by sand drift simulation. The results indicate that sand accumulation and erosion will take place between the mouth of Cu De river and Nam O Headland, however, the width of onshore-offshore shoreline change will be less than 50 m. It will not induce serious beach erosion nor sand accumulation.

16. Conclusions and Recommendations

16.1 Conclusions

(Findings on the region)

Central region of Vietnam has not enjoyed the economic boom prevailing in the south and north region. To cope with this situation, the national government proposed or approved several projects in the region including the East West Transport Corridor, Dung Quat oil refinery, the South North Highway through Hai Van tunnel and industrial zone development as well as agricultural development. Transportation infrastructures including port facilities are in poor condition in the region to serve for the economic development.

(Port of Danang)

Port of Danang consists of two ports, i.e. Song Han port in the mouth of Han River and Tien Sa port in the west coast of Son Tra peninsula. Cargo throughput of Danang port was 870,000 tons in 1997, of which 70-80 % was handled at Tien Sa port. Existing two piers in Tien Sa port are deteriorated and require the rehabilitation of pile structure. Nguyen Van Troi bridge is used for port access, however, it allows the traffic under a weight of 13 tons. Upgrade of the bridge is also in urgent need.

(East West Transport Corridor)

East-West Transport Corridor Project is studied by ADB and regional countries. The route No.9 and the second Thai-Lao Mekong bridge were selected for early implementation. This report assumed that R9 will be developed firstly followed by R18. R16 will have a low priority.

(International Transit Cargo)

Southern provinces of Lao PDR and northeast Thailand are deemed as the hinterland of the new port subject to the completion of R9 and Route R16/R18 of the East West Transport Corridor project. Projected cargo volumes in 2020 are 646,000 tons through R9 and 822,000 tons through R16/18. It is assumed that R9 will be developed firstly followed by R18. R16 is deemed to have a low development priority.

(Natural Conditions)

Wind observations were also carried out in each project area throughout a year. The most frequent wind directions are N and SE in Chan May, NE and W in Lien Chieu, and ESE to SSE in Dung Quat.

Offshore waves were observed at two points on the coast of the central region. One ultrasonic – cum – water pressure – type wave recorder was placed on the seabed in the mouth of Danang Bay and another one was positioned off the Ky Ha Cape in Quang Nam Province. The maximum waves observed were 5.7¹⁾ m at the Danang bay mouth and 5.1²⁾ m at the Ky Ha offshore observation point.

Based on the observations and statistical analysis of 30 historical typhoons, offshore wave height for the return period of 50 years was estimated at 9.7³⁾ m in the deep sea off the Danang Bay and Chan May Cape, and at 8.8³⁾ m in the deep sea off Dung Quat Bay. Design wave height for the main breakwater of each port is 7.4³⁾ m for Chan May, 6.0³⁾ m for Lien Chieu and 6.6³⁾ m for Dung Quat.

(Seabed Soil Conditions)

Soil boring investigations revealed that a thick clay/clayey sand layer exists in Chan May bay and Lien Chieu waters. A stratum of fine sand was identified at the depth of -20 to -28 m in Chan May and at the -16 to -28 m in Lien Chieu. Seabed soil in Dung Quat mainly consists of sand and sandy clay with the bearing stratum at a depth between -20 to -25m.

(Demand Forecast)

A considerable increase in cargo throughput is envisaged in the central region owing to economic growth and industrial development. Projected seaborne dry cargo from/to the central region will reach 10-20⁴⁾ million tons in the year 2020. Expected cargo throughput in 2020 is about 5.4 million tons at Chan May port, about 10.7 million tons in Danang port complex (of which 8.5 million tons at Lien Chieu area), and about 30.6 million tons at Dung Quat.

(Capacity of the Present Port)

The capacity of Tien Sa port is assessed using a numerical simulation model, POSIM, assuming irregular ship arrivals and cargo capacities. In case that No.1-4 berths are rehabilitated and utilized, the port capacity is estimated at about 1.7 million tons and at about 2.2 million tons after the completion of Berth No.5. If Tien Sa No.6 berth were developed, the port capacity will reach to 3.1-3.3 million tons. The capacity of Song Han port is deemed to remain with the present level, i.e. about 200,000 tons.

¹⁾ This height is the significant wave height ($H_{1/3}$), of which the maximum wave height (H_{max}) is 9.0 m, caused by Typhoon *Friz* on 25 September 1997

²⁾ $H_{1/3}$, H_{max} is 7.9 m, caused by Typhoon *Friz*

³⁾ $H_{1/3}$

⁴⁾ excluding crude oil and oil products

(Master Plan)

Chan May port is planned to have one multi-purpose berth for container cargo vessels and general cargo trampers; one deep draft conventional berth for car carriers, passenger ships and general cargo trampers; three conventional berths for general cargo and bulk cargo; and 2 berths for product oil tankers. The main breakwater has a length of 1,290 m to shelter the port waters, and dredging of 4 million m³ is required for the approach channel and turning basin with a depth of -13^{5'} m. Land reclamation is planned for the wharves of 49 ha.

Lien Chieu port development plan has two full size container berths, one multipurpose berth and 8 conventional general cargo berths. The main breakwater has a length of 1,450 m to shelter the port waters, and dredging of 8 million m³ is required for the 2,700 m long approach channel and turning basin with a depth of -13 m. Land reclamation is planned for the wharves with a total area of 96 ha.

Requirements for the new port in Dung Quat are two deep sea tanker berths, six berths for coastal shipping tankers, two deep sea bulk berths for scrap metals, and nine berths for coastal shipping cargoes. Two oil dolphin berths with -13 m draft and three oil dolphin berths for coastal ships are designed along the main breakwater. East wharf has two alongside berths for general cargo trampers with a depth of 8 m and three oil dolphin berths for coastal tankers. West wharf is designed to cater to Panamax bulk carriers and general cargo trampers carrying mainly steel scrap, manufacturing goods, agricultural products, and other breakbulk cargoes. The main breakwater has a length of 1,660 m and the west breakwater is 2,170 m. Dredging of 5 million m³ is required for the approach channel and to secure a turning basin with a depth of -13 m. Land reclamation is planned for the east and west wharves with a total area of 137 ha.

(Initial Stage Development Plan)

The development of each of the three ports is possible if industrial development of their hinterlands is realized and the demand for a new port is confirmed. Since a new port development generally requires a large initial investment in breakwater and/or channel dredging at the first stage, an appropriate scale of development is necessary for the project to be feasible. ISP is proposed as a package plan for the first stage of development in Chan May, Lien Chieu and Dung Quat.

^{5'} All depths indicated here are the depth under CDL.

Chan May's initial stage development plan proposes a multi-purpose berth with a provisional alongside depth of -12 m (to be deepened to -13 m in the future) and two conventional berths with an alongside depth of -8 m, subject to the establishment and operation of Chan May Industrial Park.

Lien Chieu area is planned to have a multi-purpose berth with an alongside depth of -12 m and two conventional cargo berths in the ISP. Design depth of channel and turning basin is -11 m with a -12 m pocket dredging in front of the multi-purpose berth.

Dung Quat Port ISP is planned to have one dolphin berth for 50,000 DWT class tankers, four dolphin berths for coastal tankers and two conventional berths with an alongside depth of -8 m for general/bulk cargo. A 970 m section of the main breakwater is planned for ISP, of which a 370 section can be developed for the urgent need for product oil transportation.

(Implementation of Lien Chieu Development)

It is predicted that if the Tien Sa No.6 is developed, the first berth of Lien Chieu will become necessary by 2006/ 2010 depending on high/low cargo growth. In case that the Tien Sa No.6 is not developed, Lien Chieu will become necessary by 2004/2007 depending on cargo growth case. It is concluded that Lien Chieu has an advantage in land transportation, future development and rational development of hinterland although Tien Sa has an advantage in terms of less initial investment.

(Port Facility Design)

After comparing several designs of breakwater and quaywall, it was concluded that composite gravity type structure with hybrid caisson will be appropriate for deep sea breakwater and quaywall from the viewpoint of technical and economical aspects. In particular, the proposed structure will be suitable for the marine structure with high design wave heights and soft foundations.

(Cost Estimates)

The costs for the Initial Stage Development Plan are estimated at US\$151 million for Chan May, US\$158 million for Lien Chieu and US\$119 million for Dung Quat. Cost estimates include infrastructures, dredging, cargo handling equipment, navigation aids, tug boats, engineering services, contingencies and tax. Preliminary cost estimates of each Master Plan are about US\$ 258 million for Chan May, US\$359 million for Lien Chieu and US\$353 million for Dung Quat.

JICA Port Development Study in the Key Area of the Central Region

Estimated Project Cost of ISP Facilities	(million US\$)		
	Chan May	Lien Chieu	Dung Quat
Breakwaters, seawalls, groins and others:	51.6	42.2	33.5
Quaywalls and yard pavement:	50.1	38.5	35.8
Dredging:	6.4	14.8	3.9
Road, bridge, buildings, and other utilities:	7.9	11.6	13.4
Cargo handling equipment, navigation aids:	4.7	18.5	8.3
Engineering services, contingencies and tax:	30.2	32.1	24.3
Total:	150.9	157.7	119.2

(Economic Analysis)

The results of the economic analysis indicate that port development projects of each site are viable from the viewpoint of the national economy. Economic Internal Rate of Return of ISP is shown below including sensitivity tests.

	EIRR of ISP	Sensitivity tests ^{6/}
Chan May:	17.2 %	14.7 %
Lien Chieu:	19.4 % (High growth)	16.3 %
	18.4 % (Low growth)	15.5 %
Dung Quat:	20.8 %	18.2 %

(Port Administration and Operations)

Although several port administration and management bodies are identified in Vietnam, such as Vinamarine, Vinalines, local government and the military, Vinamarine will be an adequate body for the development of the new commercial port in the central region. For the development of Dung Quat Port, it will be appropriate that dredging work and breakwater construction be performed using public funds and oil related port facilities be build by the oil company to be established.

(Financial Analysis)

Owing to the fairly large investment in breakwater construction and capital dredging in the first stage, financial return of the Lien Chieu port development is not so attractive for the private investment, however, it is in a feasible range for the public sector subject to the procurement of soft loans like ODA. The result of the financial analysis is shown in the table below.

Financial Indicators	High Growth Case	Low Growth Case
FIRR:	5.7 %	5.1 %
Sensitivity tests ^{6/} :	3.3 %	3.0 %
Debt service coverage ratio:	Min. 1.36	Min. 1.48
Operating ratio:	39-53 %	40-67 %

^{6/} subject to 10% increase in development costs and 10% decrease in economic benefits

(Environmental Survey)

Field surveys covered waves, currents, water pollution, shoreline sediments, terrestrial flora and fauna, and local residents and cultural assets. Although coral reefs were found near the project areas, their locations are limited and generally in poor condition. Bottom habitat of particular high value/importance has not been detected. The hinterlands are generally unfertile, low productivity farm land and the area likely to be lost to waterfront use is currently low value, low populated land.

(Initial Environmental Examination)

Initial environmental examination indicated the need for a EIA study on changes in current patterns, disposal of dredged material, impacts on water quality, shoreline change, traffic load on access roads and relocation of inhabitants.

(Preliminary EIA for Lien Chieu)

To assess the impact of the port development, changes in tidal currents, beach accretion and erosion, the dispersion of water pollution and disposed materials are identified by means of computer simulation. Relocations of inhabitants are assessed at about 20 for the implementation of ISP of Lien Chieu. As a result, no significant adverse effect is shown in the preliminary EIA.

(Overall Evaluation of the Project)

Maritime transportation borne by the port development will greatly contribute to the development of the central region in terms of foreign currency earnings, job opportunities, trade promotion and industrial development. However, the development of a new port requires a fairly large capital investment in breakwaters and reclamation work in the deep sea area, so that financial feasibility is very critical in connection with construction cost and port revenues. As seen from EIRR, the port development projects in the three sites are economically effective and will have no particular difficulty in technical, environmental aspects. However, the timing of the development of Chan May Port and Dung Quat Port should be carefully decided in connection with the development of their hinterland. For the development of Lien Chieu, it will be feasible if a soft loan is available due to the fact that FIRR is calculated at 5.1-5.7 % while other financial indicators lie in a preferable range.

16.2 Recommendations

(Basic Strategies on Development of the Key Area of the Central Region)

Following points need to be carefully considered to secure a sound, steady and practical development of the Region.

- (1) In order to avoid possible adverse impacts of drastic and random development, the target projects need to be critically selected.
- (2) Development schedule should be appropriately controlled to be harmonized with local life and culture.
- (3) Initial scale of the target projects should be down-sized as far as possible so as not to jeopardize national and regional financial soundness.
- (4) Private sector participation in the development schemes is desirable in principle but needs to be controlled carefully.
- (5) Considering experiences in most advanced countries, Vietnam should take advantage of its “latecomer” position and avoid the mistakes made by other countries.

(Port Development Strategy for the Three Key Sites)

The final goal is to realize well balanced national development by creating a third social and economic core of the country following the other two advanced areas, namely Hanoi and Ho Chi Minh City. In this regard, the following are the most important points in developing ports in the region:

- (1) With the view to avoiding possible unproductive competition among the ports, duplication of functions and facilities should be strictly checked.
- (2) Construction of port facilities for industrial cargoes should be started upon confirmation of actual location of planned industries in the site.
- (3) The initial stage investment for the ports should be minimized to the extent possible.
- (4) The full scale potential port development concepts need to be appropriately planned and authorized.
- (5) Financial resources for public port development should be diversified including domestic/foreign private sector funds.

(Functional Allotment to Ports in the Area)

Functional allotment to ports in and around the area is proposed in the Conclusion of this Chapter. In connection with the proposed allotment, the following points are recommended:

- (1) When shipping lines call a port frequently, users generally enjoy such benefits as reasonable shipping freight rates, more options in selecting favorite shipping services, overall scale merit of cargo handling and so on. In this context, it is recommended that

utmost efforts of the country should be concentrated in developing commercial port functions with international standard container terminals at Danang Port Complex.

(2) In the long term, Chan May has the potential to be a multi-functional port due to its advantageous location, moderate natural conditions, locally prioritized industrial development schemes and active promotion policy of the province. In the short term, however, immediate and large scale commercial port development in this site may be relatively risky. It is recommendable that the central government should consider to support, if possible and appropriate, the project financially or institutionally, because it could also have a vital role for future national economic development, provided that the project scale and construction timing are reasonably planned and selected.

(3) A large industrial zone with a full scale oil refinery is to be developed in the direct hinterland of Dung Quat Bay. While public port functions may be required in the long term, the initial development components of the port should be focused on such industry related facilities.

(Port Administration, Management and Operation)

The current system of port administration of this country may be too complicated in some extent. Some suggestions in this regard are shown as follows.

(1) Generally speaking, the basic port sector development policy and nation wide port administration are to be under MOT for all commercial ports.

(2) Since the current administration by VINAMARINE and VINALINES may jeopardize consistent policy decision making in port sector affairs, further coordination by MOT may be required.

(3) Since the function of Vietnamese river ports is mainly limited to related local areas, it may be reasonable to let the local communities manage them under the overall supervision of MOT and/or IWB.

(Procurement of Financing Source for Port Development and Private Sector Participation)

Mobilization of private funds is not always successful nor appropriate from the public port development concept point of view. Even if the government wants to have instant money for the project by simply selling to private sector a vital part of the potential port development site, such a policy should not be applied.

(Attraction of International Transit Cargo)

The potential international transit cargo traffic from/to the neighboring countries through the project ports can not be realized simply by increasing the cargo handling capacity of the ports. Several critical conditions as shown in the following paragraphs need to be satisfied.

- (1) For the project ports in the Central Region, the international cross border facilities, custom clearance and documentation need to be improved and simplified in particular.
- (2) The newly developed container port in the Region should attract as many ship calls as possible, so that the port can establish its position as a international container hub port.
- (3) In order to keep steady flow of transit cargo, overall performance of the corridor should be sufficiently competitive through constant improvement of service and careful adjustment of the tariff and charges of the port.

(Engineering Surveys and Studies)

Considering Vietnam's lack of experience in constructing of a large scale seaports with long and deep marine structure, following items are recommended:

- (1) A considerable series of wave observation, at least for three years, at the appropriate offshore point of the project.
- (2) A set of annual shoreline survey and sounding at the project sites to check long term effect of possible topographic changes on shoreline and sea bottom.
- (3) In order to confirm accuracy of proposed prediction of sedimentation volume in the approach channel and basins, it is recommended that the Study should be followed, if possible, by deeper surveys and analyses by means of full scale computer simulation and site experiment by test pits.

(Detail Design of the Project Structures)

For the detail design of the project structures, following points need to be examined:

- (1) Confirmation of stability of the structures, estimation of consolidation settlement of the reclaimed land and selection of effective countermeasures need to be carefully examined.
- (2) The detail design for wave protection facilities should be carefully designed referring to advanced technology and experiences of the foreign countries.

(Implementation of Port Construction Works)

For safe, economical and efficient construction of the project structures,

- (1) The detailed weather and wave forecasts based on the recorded observation of air pressure, wind velocity and wave height are required.
- (2) It is recommended not to leave the structure uncompleted to avoid possible damage during the typhoon and north-east monsoon season.
- (3) Removal and replacement of soft foundation and reclamation should carefully be executed on the basis of the deformation monitoring of the foundation collected by minute observation.

(4) It is recommendable to confirm any shoreline changes or channel siltation through parallel observation with actual progress of the construction works.

(5) An appropriate base for construction works of the proposed large caisson should be prepared.

(Periodical Review of Port Plans)

Constant review and adjustment of the plans are essential to meet any contingency in the surrounding situation. For the three target ports in the Central Region, the recommended master plans should be carefully reviewed and adjusted, say, at least every five years.

(Authorization of the Recommended Plans)

The plans should officially be authorized to secure their status through proper procedure by laws, regulations or any other form if possible and appropriate.

(Human Resources Development Policy for Port Sector Development)

In order to cope with substantial shortage and weakness in staff resources, it should be seriously considered to establish the systematic training strategy for port administration, management and operation staff and engineers.

(Improvement of Port Statistics)

Although some port related data and statistics in Vietnam are well collected and compiled, following suggestions may be useful:

- (1) It is recommended to make further efforts for upgrading accuracy, reliability, consistency, coverage and contents of the statistics.
- (2) With a view to achieving the above mentioned objectives, standardization of statistics forms under jurisdiction of MOT need to be established.

(Natural and Social Environment Conservation)

Following suggestions may be useful for effective conservation and/or even upgrading of the environmental quality of the area:

- (1) It is important to understand that the final objective of port environmental policy is to secure better quality of environment for the residents, workers and visitors of the port so all people can fully accept and enjoy the existence of the port and its activities.
- (2) In order to achieve the above objective, it is essential to establish an environmental policy in respect to port development and institutional and organizational arrangements for effective port sector environmental administration.

(Financial Status of Danang Port Development Project)

The short term development plan of Lien Chieu area is considered financially viable. However, following suggestions may be useful in further strengthening the financial status of the project:

- (1) The potential external economy of the project should be internalized, if possible, by collecting a kind of special tax or charge from the direct external beneficiaries such as local port related industries and general private entities in a certain zone of Danang city. For the nation wide benefit of the project, it may be justified, if the situations allow, that an appropriate portion of the general income tax be used for a new port project at the initial stage of development in particular, when financial position is normally weak and tight.
- (2) With a view to increase the project income, one possible scheme is to rent for general commercial use a part of the available land and space created as a result of construction of the major project facilities.
- (3) The potential cost saving factors in the detail design and construction stage should be made in economic design, bidding process and procurement of construction materials.

(Development of Tien Sa and Lien Chieu Areas of Danang Port)

In selecting the most reasonable port development plan of Tien Sa and Lien Chieu, following points need to be considered:

- (1) Tien Sa area does not have enough future expansion room which make it considered inefficient for development of a large scale container port, from the cost performance point of view.
- (2) The location of Tien Sa area is not convenient enough for cargo transportation from/to the industrial zone of Danag city.
- (3) It is estimated in the Study that the maximum capacity of current Tien Sa port would be about 2.2 million ton/year, provided that the current port facilities would be fairly rehabilitated and maintained, and the access road and bridge would be improved accordingly.
- (4) Balance of total port capacity requirement need to be accommodated by new port development at Lien Chieu area.
- (5) The development project at Lien Chieu area requires considerably long time, at least four to five years until the first berth will start its service.
- (6) On the other hand, the corresponding port capacity for the increasing demand needs to be improved accordingly.
- (7) Considering the above points, the port capacity of Tien Sa port should inevitably be upgraded so as to accommodate the increasing traffic demand, at least for several years from now. This means that it is not realistic to start the new port development at Lien Chieu without any capacity expansion at Tien Sa.

(8) In this case, however, the development scale of Tien Sa port should be reasonably minimized due to its limited expansion room and economically/functionally inefficient nature of development of the site.

(9) The above development policy can be supported also by the situation that due to the unstable economic circumstances of the Asian countries makes the estimated future cargo traffic demand somewhat uncertain. Because the policy can allow the executing agency of the project to observe any changes in the economic environment of the region for a while, so that it could adjust the scale and timing of the new port development accordingly.

(Basic Development Concept of Chan May Port)

The port development at this site should be prudent enough due to its premature status of industrial location in its direct hinterland. In this connection, it is recommended to refer to following points for maximization of total development benefit of the project for the region.

(1) In general, the regional development of the provinces should be conducted at a relatively slow and steady pace compared with the other advanced regions which have already suffered the adverse effects of drastic and random industrialization so that Thua Thien-Hue provinces could maintain their valuable potential development resources for sustainable benefit.

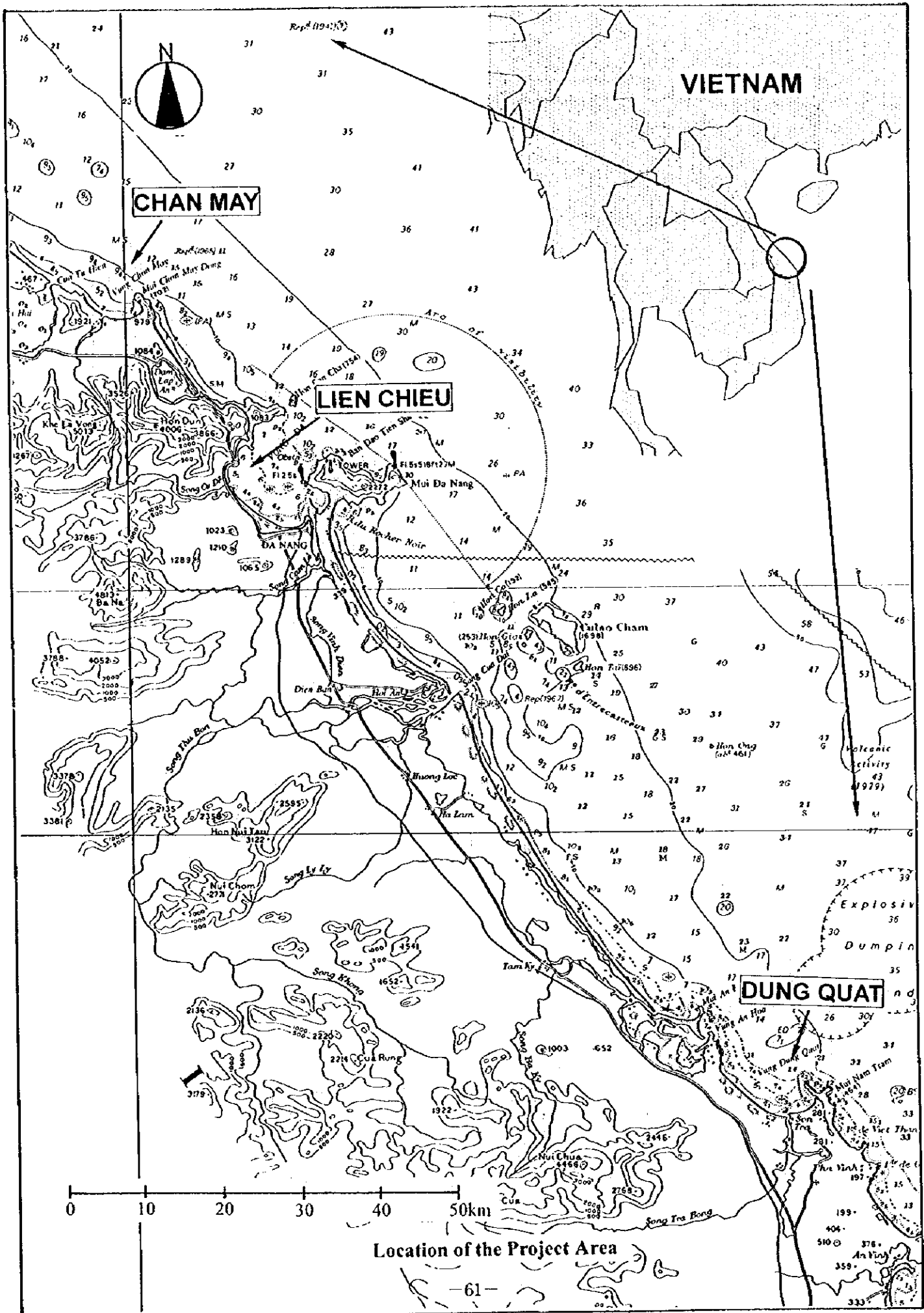
(2) As for the port function necessary to support commercial and industrial activities expected in the planned industrial park, it is considered wiser and more economical to utilize Danang Port as a out-port of Hue province for the time being by using Hai Van tunnel which is to be constructed rather than to have own large port immediately.

(3) In summarizing the above consideration, immediate development of a large scale port at Chan May area should be suspended for a while mainly for mitigating current economic burden of the country and the province. At the same time, however, the proposed development plan of the port will lead to great benefits in the future and should thus be maintained.

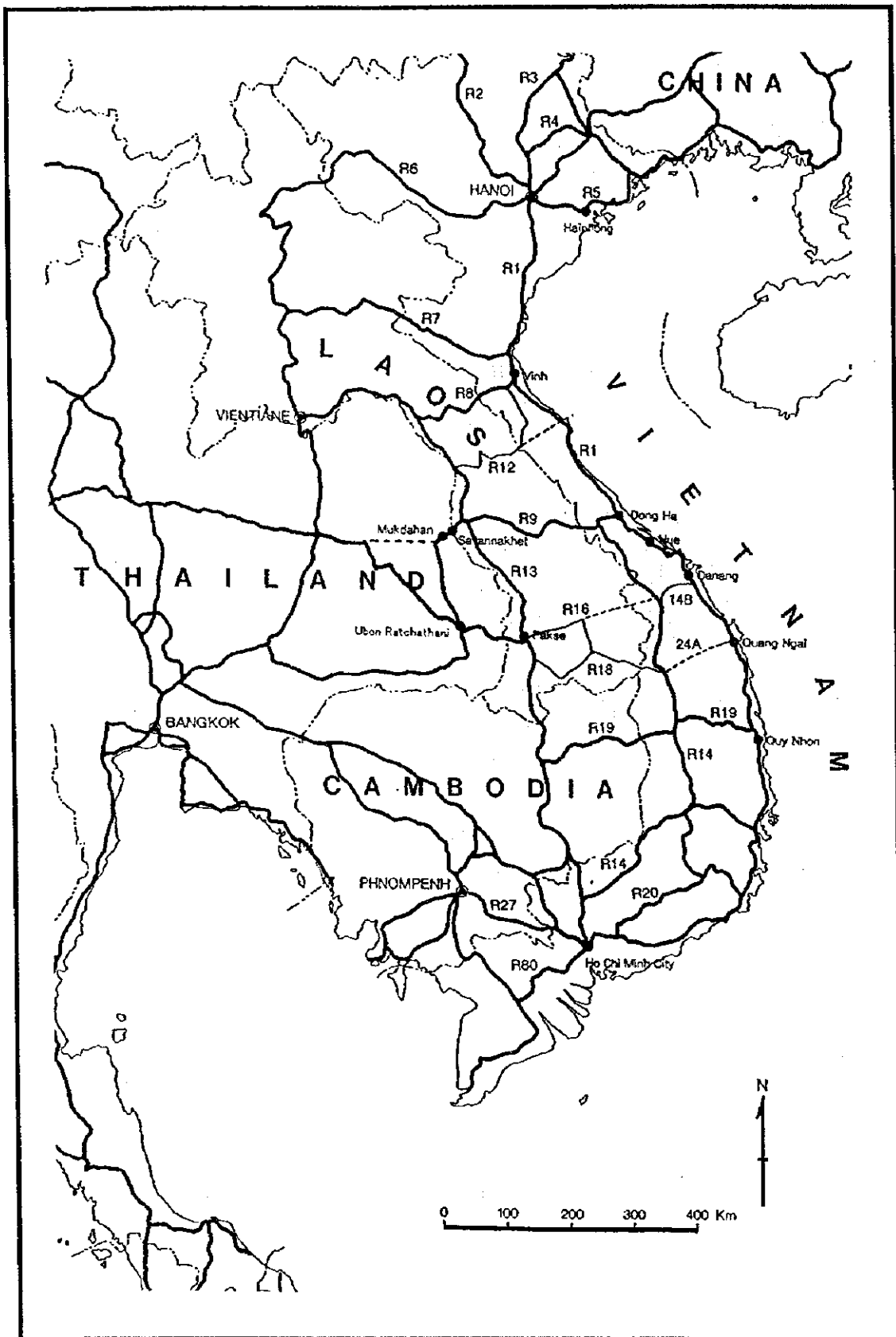
(Basic Development Concept for Dung Quat Port)

This type of large industrial port requires a corresponding scale of the exclusive port facilities for both private and public sectors for industrial and general cargo traffic generated by various private/public activities at the hinterland. In order to cope with this situation, the project needs to be supported by public fund expenses, in an appropriate extent, so that the project could be financially sustainable and the industrial location could be successfully promoted. As for the construction of the project facilities, it is important to start the initial development of the port and access road necessary for unloading construction materials of the project facilities at the earliest timing upon confirmation of location of the first industry at the site.

APPENDIX



Location of the Project Area



Road Network in Greater Mekong Subregion



CHAN MAY

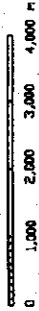
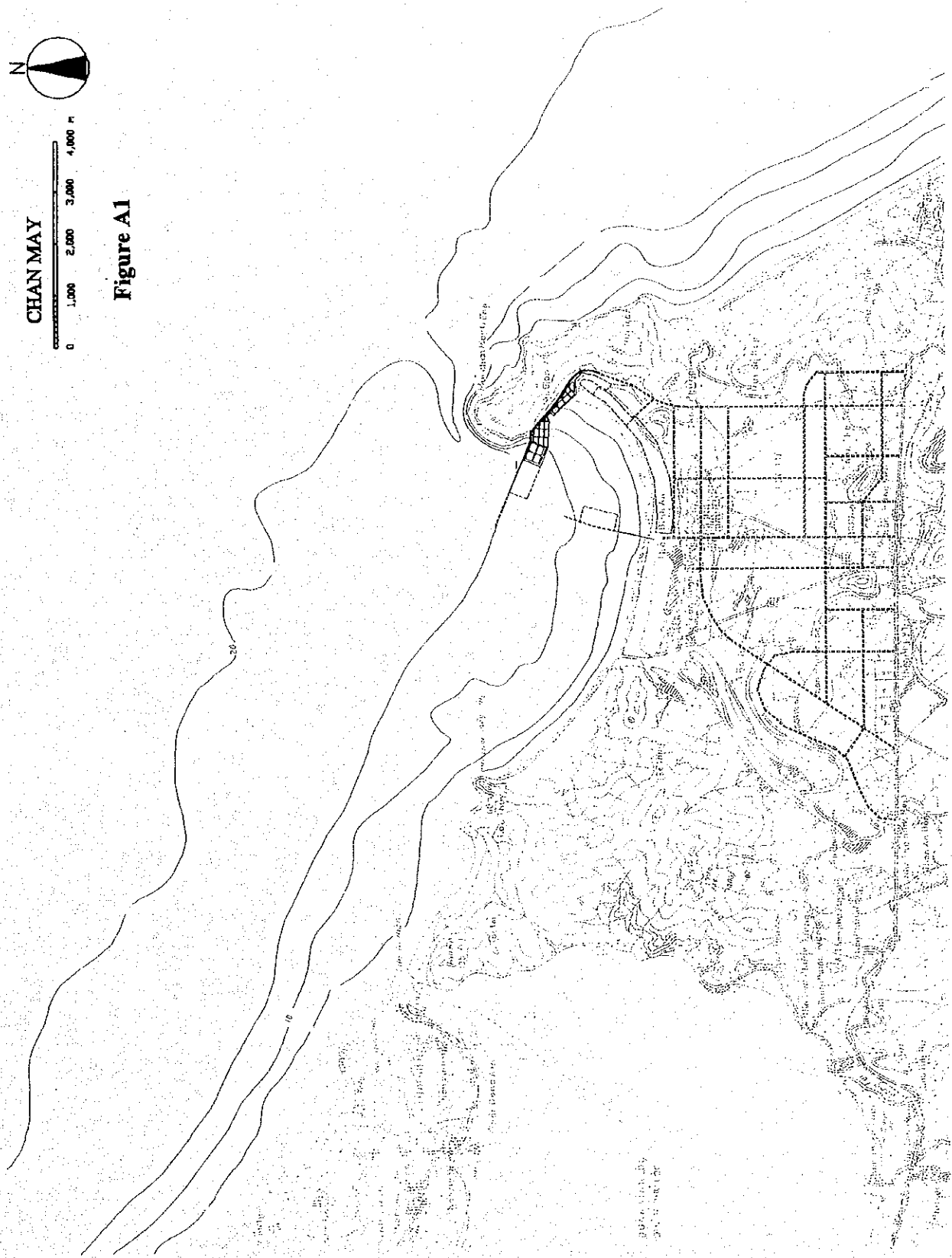
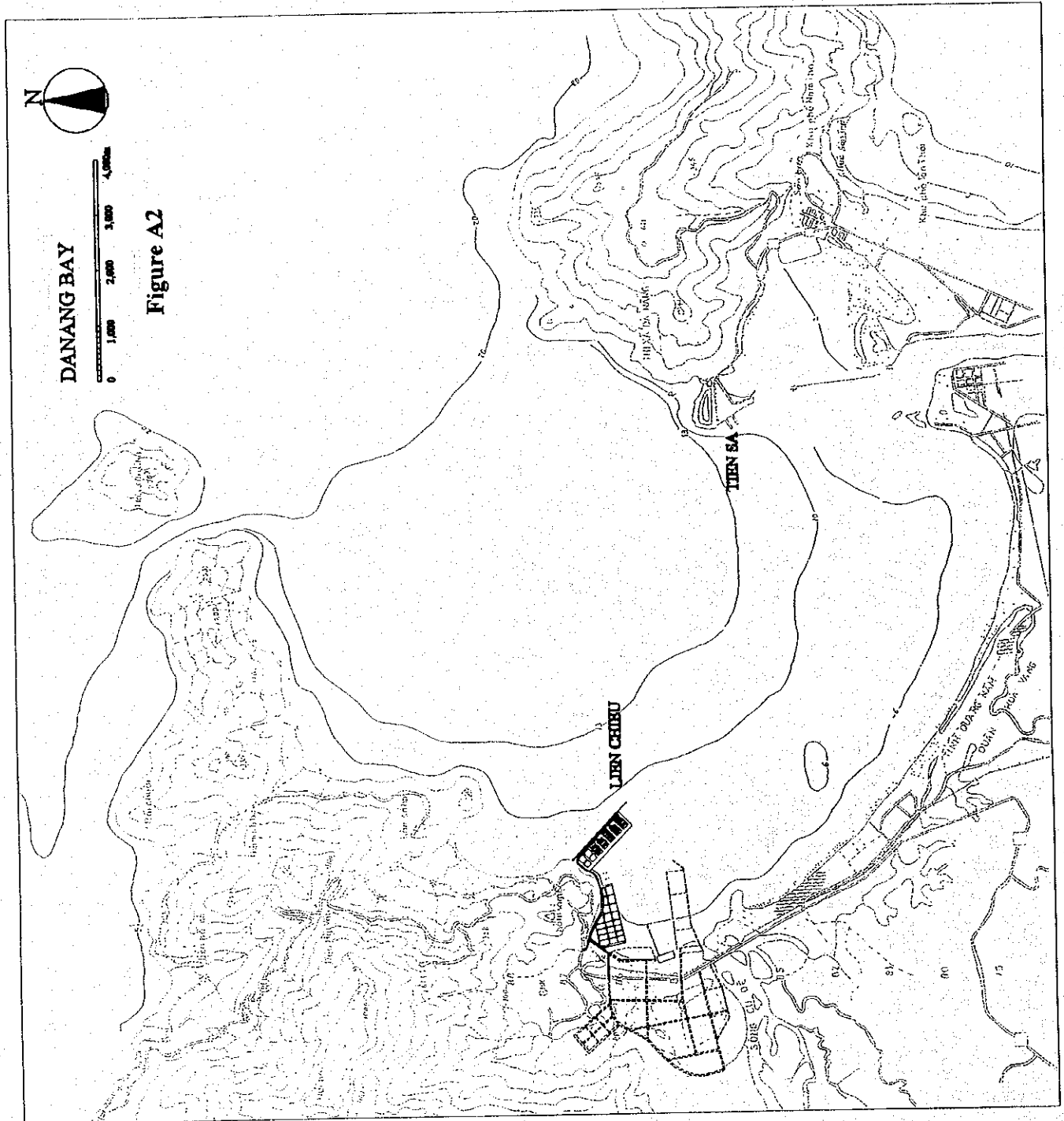


Figure A1

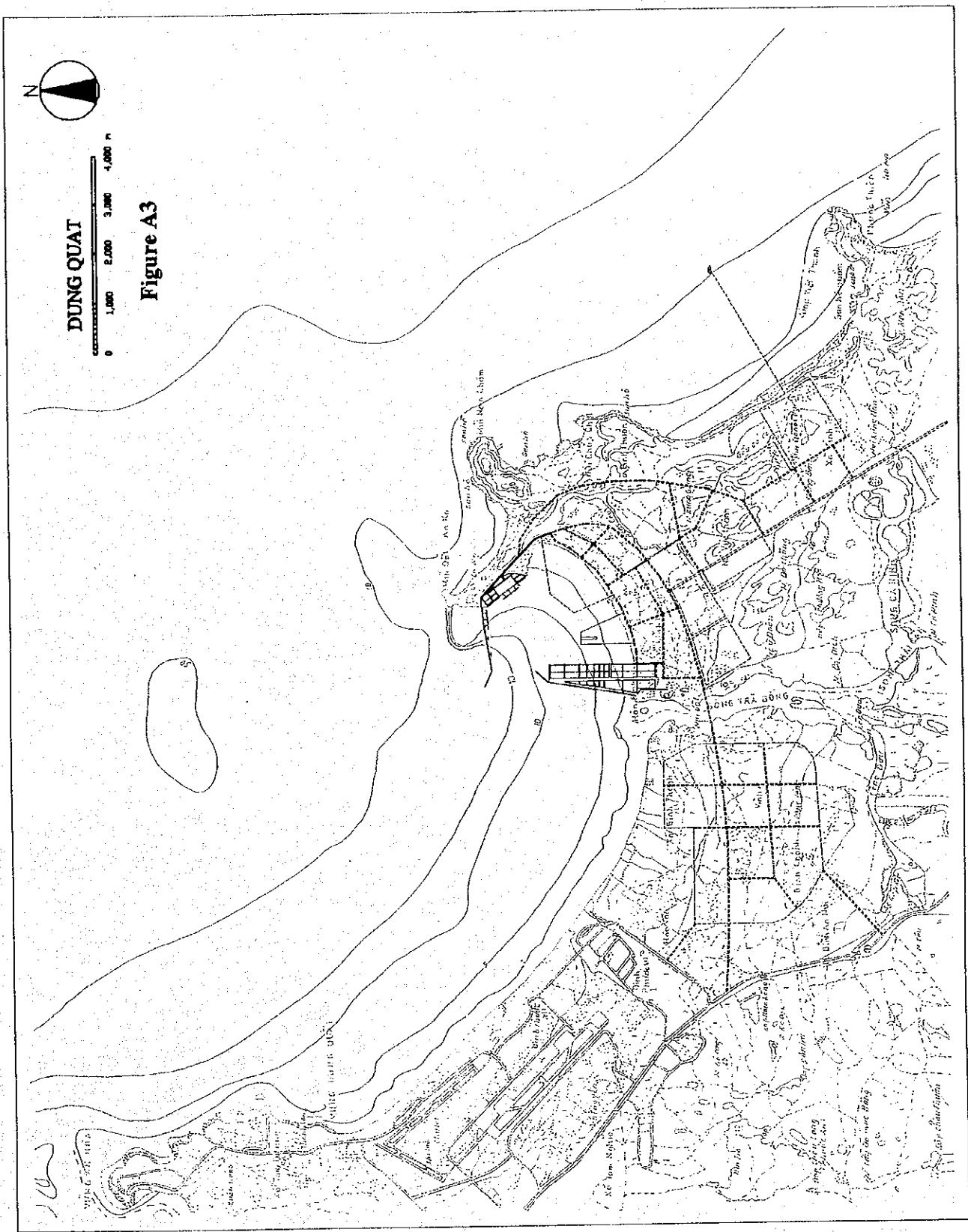




DANANG BAY



Figure A2



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