SUMMARY ENVIRONMENTAL IMPACT ASSESSMENT

XIAMEN PORT PROJECT

IN THE

PEOPLE’S REPUBLIC OF CHINA

July 1997
CURRENCY EQUIVALENTS
(as of 24 July 1997)

Currency Unit — Yuan (Y)

Y1.00 = $0.12
$1.00 = Y8.32

As of 1 January 1994, the PRC’s dual exchange rate system was unified. The exchange rate of the yuan is now determined under a managed floating exchange rate system.

ABBREVIATIONS

GEF — Global Environment Facility
EIA — Environmental Impact Assessment
GB — Government Bulletin
GDP — Gross Domestic Product
IMDG — International Maritime Dangerous Goods
MARPOL — International Convention for the Prevention of Maritime Pollution
MIS — Management Information System
PRC — People’s Republic of China
SEIA — Summary Environmental Impact Assessment
SEZ — Special Economic Zone
TIO — Third Institute of Oceanography
XEPB — Xiamen Environmental Protection Bureau
XHB — Xiamen Harbor Bureau
XHBEMS — Xiamen Harbor Bureau Environmental Monitoring Station
XSEZ — Xiamen Special Economic Zone

WEIGHTS AND MEASURES

dB(A) — decibel
DWT — dead weight ton
m — meter
mg/l — milligram per liter
m/s — meter per second

NOTES

(i) The fiscal year (FY) of the Government and its agencies ends on 31 December.
(ii) In this Report, "$" refers to US dollars.
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I. INTRODUCTION

1. An environmental impact assessment (EIA) for the proposed Xiamen Port Project in the Xiamen Special Economic Zone (XSEZ), People’s Republic of China (PRC), was contracted by the Xiamen Harbor Bureau to the Third Institute of Oceanography (TIO) of the State Ocean Administration. It was prepared between January 1993 and January 1997, with preliminary field data collected in 1993-1994, the Project prefeasibility stage. The EIA was submitted in draft to the National Environmental Protection Bureau in October 1996, finalized, and subsequently approved on 3 July 1997. A map of the Project area of the port is provided as Appendix 1.

2. The EIA prepared by TIO was reviewed by Hyder Consulting Ltd. in association with Beijing Institute of Water Transportation Engineering Consultants, which subsequently prepared this summary environmental impact assessment (SEIA) following Bank guidelines, including additional analysis and recommendations.

3. The scope of work of the EIA included:

   (i) determination of the existing noise, water, atmospheric, and ecological pollution conditions within the proposed Project area;

   (ii) prediction of construction-induced noise, water, atmospheric, and ecological pollution levels;

   (iii) prediction of operation-induced noise, water, and atmospheric pollution levels;

   (iv) determination of existing social conditions, and prediction of any social impacts;

   (v) proposed mitigation measures for all potential impacts; and

   (vi) proposals for an institutional monitoring program during and after construction.

4. The EIA emphasizes the effects of the Project during construction and operation on the ecology, atmosphere, and marine environment. The methodologies used in the EIA included site investigations, existing and new field data collection, predictive mathematical modeling, and logical analysis. Under the Bank’s Environmental Assessment Requirements and Review Procedure, this SEIA is being circulated to the Bank’s Board of Directors 120 days prior to their consideration of the loan proposal. The main EIA report and addendum are available at the Project office on request. The Bank’s assessment and evaluation of the Report and environmental impacts related to the Project will be included in the documentation when the Project is considered by the Board.

II. DESCRIPTION OF THE PROJECT
5. Xiamen Port is an important commercial Harbor in XSEZ on the Fujian Province coast, in south east PRC. The port supports the rapid industrialization of XSEZ, as well as that of the hinterland in southeast Fujian Province, and is one of the foci for future development in the region, with potential for free-port status. The majority of traffic is foreign trade (containers, oil for transshipment, and dry-bulk), although there is a high proportion of Chinese coastal trade. Xiamen Port is excellently placed to exploit the recently lifted trade barriers between the mainland and Taipei, China. It is expected that port throughput will reach over 30 million tons by 2000.

6. The Project scope consists of the following components: (i) civil works, including dredging, soil improvement, and land reclamation, in the areas on either side of the existing Dongdu Phase-II development; (ii) construction of a 410-meter (m) long quay with two berths for 20,000-dead weight ton (DWT) general cargo vessels, one berth 260-m long for 20,000-DWT vessels, one berth 160 m long for 5,000-DWT vessels, and a 280-m long quay with three berths for 1,000-DWT vessels; (iii) cargo handling equipment including portal cranes, mobile quay cranes, reachstacker, forklift trucks, tractors-trailers, bagging machines, and other small equipment; (iv) associated onshore utilities and services including cargo storage buildings, pavements, and roads; (v) a tugboat with firefighting equipment as port service vessel; (vi) hardware and software for the management information system (MIS); (vii) equipment for the Xiamen Commodity Inspection Bureau; (viii) consulting services for detailed engineering, construction supervision, and MIS improvements; and (ix) technical training for Xiamen Port officials in port management, including MIS and electronic data interchange, port planning, marketing, and administration of a port regulatory body. The existing port and proposed project site are shown in the Xiamen Port Master Plan, Appendix 2.

7. Project construction will commence in 1998, and will be completed by the end of 2002. Project costs are estimated at approximately $100 million, of which $50 million will be provided from the Bank’s ordinary capital resources.

III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Environment

1. Meteorology

8. Xiamen Port is located on the west side of Xiamen Island, in Fujian Province. The marine approaches are bound on the southwest by the mainland coast, and on the northeast by the islands of Jinmen Dao and Xiaojinmen Dao. The region has a semitropical climate with a maximum average monthly temperature of 28.2°C (July and August) and a minimum average monthly temperature of 12.5°C (February).

9. Xiamen is affected by monsoon winds blowing from the northeast in winter, and from the southeast in summer. The prevailing wind is northeasterly (41.5 percent), and the mean wind speed is 2.2 meters per second (m/s). During the wet summer monsoon, the Xiamen region frequently experiences typhoons, with high winds and heavy rains. The port on average experiences three typhoons a year. The annual rainfall in Xiamen is 1,181 millimeters, mainly in the spring and summer months. Fog is experienced, on average, 22 days a year.
2. Marine Conditions

10. The port approaches are directly from the Strait of Taiwan through routinely dredged channels. Tides at Xiamen are semidiurnal, with a mean range of 3.98 m. Maximum surface current velocities are on the order of 1.2 - 1.4 m/s, with average surface speeds of approximately 0.65 m/s. The port area is well protected from waves generated in the open sea, and within the harbor area the main consideration is locally generated waves, which are usually less than 0.5 m high. The maximum wave height recorded in the vicinity of Dongdu is 1.6 m (1 in 10 year return period). Natural sedimentation rates are low (up to 40 centimeters per annum) and dominated by fine silts overlaying fine sands and silty clay on a bedrock of heavily weathered granite.

11. The regulatory standard for seawater quality adopted by the Project is the PRC National Sea Water Standard, Government Bulletin (GB) No. 3097-82. The water pollution predictive model used to evaluate impacts is the box sedimentation model. The EIA analyzed nine water quality indicators, including oil and suspended particulate material. Baseline data were obtained by collecting water samples at the surface and near the bottom (where depths were greater than 5 m) at 12 sites in both winter and summer, for both high and low water in 1993/94. Sediment samples were also collected. The results show that the water quality is generally good, easily meeting Category II (protected fish and spawning areas) standards, although inorganic nitrogen and phosphorus levels occasionally exceed Category III (shellfish, mariculture, and bathing) standards. This is principally due to the nutrient-laden waters of the Jiulong River, which drains a predominantly agricultural catchment, discharging into the western side of the approaches to Xiamen. Historical data collected by the Xiamen Environmental Protection Bureau (XEPB) over the last 15 years are also reviewed in the EIA report.

12. Mariculture sites cover over 14 square kilometers of the west sea area of Xiamen Port. Dredging activities are planned close to one key mariculture area. This is one of the most significant environmental issues associated with the Project. There are no notable areas of mangrove, and coral reefs are absent. Bottom sediments are generally fine sands. Sediment quality in the port area is good, as the west sea area is energetically flushed through the combined action of tides and the discharge of the Jiulong River to the west. Historical industrial discharges have not been significant. Suspended sediment levels are relatively low (surface average 21.9 milligrams per liter [mg/l], bottom average 84 mg/l). Seawater in the port area is not heavily polluted by emulsified or dissolved petrochemical products. While there are bathing beaches on the coast of Gulang Yu Island, they are well removed from the Project site.

3. Atmospheric Conditions

13. Environmental conditions at Xiamen Port are generally satisfactory, as the city is relatively small, with an urban population of about 400,000, and heavy industry is essentially absent, although growing. Air quality for all indicators is class II standard (protection of human health in urban areas under medium-term exposure), while in some areas very good class I standards (protection of human health and ecology under long-term exposure) are reached. All parameters monitored by the XEPB generally meet national and city specific standards. It is
not anticipated that port construction or operation activities will introduce excessive air or noise pollution, as appropriate mitigation measures are incorporated within the Project design.

14. The status of current atmospheric quality was evaluated in the vicinity of potential sensitive receivers in areas near the Project, reviewing data on sulfur dioxide, nitrogen dioxide, and total suspended particulates over a 15-year period (1981-1995). The regulatory standard for air quality adopted by the Project is GB No. 3095-96, Standard for National Ambient Air Quality.

15. Ambient air quality standards have just been tightened in Xiamen, although the historical data indicate that values of the key indicators are generally within these new limits. In some areas (Zaishang village, just northeast of berths 10 and 11) total suspended particulates have slightly exceed standard limits in the past, but recent data suggest that the situation has improved.

4. Noise Conditions

16. Baseline data on noise levels were obtained from four stations in the port area, three for daytime hours, and one station for 24 hours. The results showed that current noise pollution is not significant, reaching Category II (for commercial and industrial) standards in line with local regulations. The regulatory standard for noise pollution adopted by the Project is GB No. 3096-93, the PRC National and City Area Ambient Noise Standard. This is true within the port, and in peripheral urban areas. Being under the landing path for Xiamen airport, levels occasionally exceed this category, being up to 80 decibels (dbA).

B. Ecological Environment

17. The EIA analyzed the species, population, and distribution of phyto- and zooplankton, organisms, and benthos. Baseline data were collected at 14 sampling stations through the west sea area at both low and high tides, in both winter and summer. The evaluation showed that the ecology in the area is typical of that found in subtropical regions, although there are indications of sewage-related pollution. In the winter months in particular, species diversity is limited, together with overall abundance. The situation improves in the summer, although not dramatically.

18. Commercial fisheries are not important in the harbor area, with only small-scale traditional fishing. Dolphins are regularly observed in the outer harbor area, although visits are of short duration. Marine ecological value is generally low, with no significant conservation areas present. Dayu Island is well known for egrets; although they have been few in number in recent years, the area is protected, and the numbers are on the increase. The west sea area is adjacent to the Jiulong River estuary, which has more significant commercial fisheries, with more species diversity and abundance. It is an area of greater ecological and conservational value. Mariculture is by far the most significant ecological feature in the Project area. Mangroves and coral reefs are not present in the area.

C. Socioeconomic Environment
19. Xiamen is one of the five special economic zones (SEZs) of the PRC, and has consequently experienced recent economic growth well above the national average. The SEZ covering the municipality of Xiamen was established in 1981. The growth of Xiamen’s contribution to gross domestic product (GDP) averaged 24.7 percent during 1990-1995, being far above the national average growth for the PRC’s GDP (11 percent per annum). In 1996, Xiamen’s contribution to the PRC’s GDP was Y219.5 billion. The agriculture, mariculture, and fishery sectors represent the most important sources of livelihood, although in the immediate vicinity of the development, the industry sector is dominant.

20. The rapid growth is expected to continue, with already high foreign investment recently accelerating in 1995 and 1996. The Xiamen Economic and Social Development Plan forecasts slight reductions in GDP growth to 21 percent in 1995-2000. The expansion of the port, and associated industrial facilities in the nearby hinterland, will provide new employment opportunities in Xiamen both during and after expansion of the port and related infrastructure.

21. The Project site is uninhabited, and lies within the existing secured boundary of the Xiamen Port between berth 10 and Xiangyu wharf, and the southern end of Haitan wharf.

IV. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Atmospheric Pollution

1. Construction Impact

22. Dust generated during construction will not be a significant issue. Regular sprinkling of unpaved reclaimed land from the shore-side, and of associated working vehicles, will minimize any impacts from this temporary construction activity. The same will be true for general berth construction activities. Construction vehicles will be sprinkled on departure from the Project site to minimize particulate releases in the port hinterland. Any construction materials that might be wind-blown (e.g., cement) will be covered or stored in dedicated special depositories.

2. Operation Impact

23. During operation, the release of suspended particulate materials from broken cement bags will be a significant potential atmospheric impact. Emissions will be of small volume and short lived, however, and in the absence of any large volume bulk cargo handling, air pollution will not be of any significance during port operations. Fertilizers that will be handled at berth 11 are predominantly of the coarse grained "rock" type, and dust emissions will not be significant. Standard hoppers, short conveyors, enclosed bagging facilities, and bag transport handling techniques will be employed.
24. For break-bulk cement handling, mitigation measures will include instructing and training stevedores on rebagging needs, rapid but gentle cargo handling methods, the avoidance of berthsiding stacking, and sweeping and cleaning housekeeping measures after breakage. It is general good practice to avoid unloading during strong winds, and to provide stevedores with protective dust-proof gauze masks when handling dusty cargoes.

B. Water Pollution

1. Construction Impacts

25. The main environmental effect of dredging and land reclamation (during port construction and channel widening) is resuspension of bottom sediments. This causes increased suspended particulate material concentrations and deposition downstream. Other impacts are loss of bottom habitat, and faunal mortality due to shock waves from rock blasting. Predictive modeling has shown that the combined pollution effect of dredging, reclamation, and shock waves is not significant in the turning basins and berth foundations. Dredging operations, albeit temporary, for channel widening will have a negative impact on mariculture activities in Dongyu Bay unless mitigated.

26. There are no natural sensitive receivers in the water column of Xiamen west sea area. It is not an important breeding area for dolphins. No coral reefs or sensitive coastal wetland areas of biodiversity interest are present in the Project area. The majority of mariculture sites will not be influenced by construction activities, and the potential impacts at the Dongyu Bay sites will be carefully mitigated by proposals that have been assessed using predictive modeling. Seabed sediments are not contaminated in the Project area.

27. To minimize sediment resuspension during dredging, self-propelled suction hopper dredgers and grab dredgers will be used, together with back-filled "caisson wall in first" dam enclosure type reclamation procedures. The impact of accidental increases in dredging-related releases of fine suspended sediment has been assessed. The southern portion of the mariculture zone in Dongyu Bay could be at risk in the event of an accident. The risk is mortality of maricultured organisms. To protect mariculture in the event of accidents, detailed dredging management plans, including monitoring and mitigation options, have been developed. The plans include regular water quality monitoring, equipment and cutter head maintenance, and dredging operation termination and contractual penalties. The dredging management plan for the minimization of resuspension during channel widening operations involves no lean mixture overboard discharges during rising tides, at a cost of Y1.15 million.

28. Dredge spoil material will be dumped at a specially designated and controlled grade 3 dumpsite, in line with the requirements of the London Dumping Convention, at Baikeng, a low environmental use value zone well removed from the Project, in the outer port area. The spoil dumpsite is used for the disposal of all dredge spoil materials from the Xiamen Harbor area, and is managed and routinely monitored by the Xiamen Harbor Marine Superintendency. It has been the subject of a separate EIA study, which has been approved by XEPB. Source fill material from the land side will be general construction waste soil from projects in close proximity to Dongdu, thus minimizing road noise and air pollution impacts. The bulk of this process has already been completed. A limited amount of material remains to be sourced from
the hill behind the Project site. This is an established quarry, and the appropriate management and control mechanisms are in line with city environmental regulations on noise and air pollution. Marine side spoil will be sourced from two sites — one in Tong’an County (Bingzhou), and the other in the outer estuary of the Jiulong River (just west of the Haicang development). The sites are not in or near conservation areas or sensitive receivers, and extraction is strictly controlled by the Harbor Superintendency.

29. Explosive detonation equipment will be carefully designed, as will the explosion schedule, to achieve a reasonable balance between explosion frequency and magnitude in minimizing faunal mortality. Any accidental release of oil from construction (or operation; see para. 31) vessels will be mitigated through the use of oil skimmers, booms, and absorbents available on the ship waste protection vessel run by the Xiamen Harbor Bureau (XHB).

2. Operation Impacts

30. Potential water pollution during operation will come from four principal sources: (i) the “first flush” runoff during rainfall; (ii) "produced" wastewater from maintenance and washcleaning areas; (iii) domestic wastewater; and (iv) accidental spillage during fuel oil bunkering.

31. In the original Phase III proposal, bulk cargoes would not be handled at berths 5, 10, or 11, and a rain runoff settlement tank facility would not be essential. With fertilizers being handled at berth 11, a 185 cubic meter sump will be included in the design to collect rain runoff settlement, as this is current international good practice. A sump is also useful for incidents involving the accidental spillage of hazardous materials. The material can be carefully washed into the interconnecting pipework and retained for hauling away by tanker, thus minimizing risk of release to the marine environment. Likewise, although volumes of "produced" wastewater will be small, a facility for treatment should be seriously considered for inclusion in the design. Oily, emulsified, and detergent-laden wastewaters inhibit the performance of domestic wastewater treatment works, such that pretreatment is normally required before discharge to domestic sewerage systems. Also, parallel and planned developments of other berths will increase the volume of "produced" wastewater in the future. Now is the most economically efficient time to develop the necessary infrastructure. Domestic effluent will be treated at the existing Phase II sewage treatment works, improving its performance, as it currently operates inefficiently due to low influent flows. An equipped multifunctional oil spill vessel is available to deal with containment and cleanup of minor oil spills in the oil bunkering area of the outer harbor.

C. Noise Pollution

1. Construction Impacts

32. The main sources of noise pollution will be construction and dredging equipment, and related traffic noise inside and outside the port area. This will be a temporary effect and will be experienced at the same time as other urban developments proceed nearby. Consequently, few local residents will be directly affected by port-related construction. Work will be avoided between the hours of 2200 and 0600, and Standard GB No. 12523-90, the PRC National Noise Limit at Construction Sites, will be implemented at all times. Where relevant,
workers will be provided with ear protectors when exposed to excessive site-specific noise.

2. Operation Impacts

33. Noise sources during operation will be either mobile or fixed. The former will be vessels, automobiles, container trucks, bulldozers, and trains. The latter will be generators, fixed and rail-mounted cargo handling equipment, and ships at berth. All equipment at a port is a source of noise, so predictive modeling of potential impacts on the surrounding area was carried out. Noise levels are inherently variable in time and space, so conservative maxima achieved by coincidence of mobile and static sources have been used in the assessment. The main area of significance is the loading and unloading area near the berths, where ambient noise increases to Category III (>65 dbA in daytime, and >55 dbA at night) during cargo handling. The extent of impact, however, is limited to a 30-m radius during the day and a 200-m radius at night, so levels are insignificant outside the port.

34. Over 1 million tons of the 2.1 million tons of cargo throughput in the Project area will be handled by heavy duty trucks, so noise will be an issue along access roads, particularly Shudang Road. The completion of Haicang Bridge will relieve congestion in general, although noise level increases beyond Category III might be experienced within 20 m on each side of the access roads near the port entrance. Given the absence of dwellings in this area, this is not considered a serious issue.

35. Procurement of equipment that satisfies stipulated noise control standards is the main mechanism for mitigation to avoid noise problems in the port. Strict adherence to Standard GB No. 16170-96, Automobile Fixed Noise Value Limits, and ambient noise control rules in Xiamen will help minimize localized traffic noise in the vicinity of the port entrance access roads.

D. Ecological Environment

36. Environmental concerns about the dredging operations are the same as those discussed above under water quality. Analysis of the ecological system in the port area showed that there are no sensitive natural resources in the water column or on the seabed within the potential range of suspended sediment or deposition impacts. Thus, local marine ecology, other than mariculture, is not considered a key issue.

37. The mariculture site at Dongyu Bay will not be affected by short-term dredging operations if dredging is limited to inboard lean water mixtures during flood tides. On ebb tides, lean water mixture overboard techniques can be employed, as the tidal flow is away from the mariculture site.

38. To minimize the potential impact on marine ecology, dredging operations will be undertaken using cutter suction hopper dredgers, except where rock is present, and water quality samples will be taken regularly in the vicinity of potential sensitive receivers. If the construction schedule allows, it is recommended that operations be undertaken in the winter months, when species diversity and abundance are low. The EIA calculated that environmental protection measures for dredging impact mitigation will result in a 38 percent reduction in levels
of suspended material in an important mariculture region, equalling 8,000 kilograms of sediment not released to the water column. This underlines the effectiveness of the measures proposed to reduce water pollution under the Project. It is unlikely that accidental release of elevated dredging suspensions will significantly affect the Dayu Island conservation area, which is the home of the Fujian egret. Short-lived deposits of suspended material in the area as a result of increased fine material release could stress benthic organisms, with localized mortality, and thus reduced food chain availability for the egret. Mitigation measures for accidents are strictly recommended in the management of dredging, including routine monitoring, accident response planning, and contract termination and penalization.

E. Solid Waste

39. Solid waste in the port comes from two sources: (i) ships at anchor or in berth; and (ii) the port back-up area, including cargo storage and handling areas, the container freight station, equipment repair shops, and social support facilities such as shops and restaurants.

40. As part of the World Bank Global Environment Facility (GEF) - funded Dongdu Phase II Environmental Protection and Management Project, a sewage/garbage collecting ship and a rubbish incinerator are being procured. Ships at anchor and alongside will unload garbage onto the vessel for unloading at an incinerator (procured and awaiting installation) and an existing landfill site managed and controlled by Xiamen City. The city will continue to accept solid waste from the port in the interim, while awaiting implementation of the GEF procurements. Dustbins, rubbish trucks, and litter trucks will be procured as part of this Project, carrying waste to the city treatment plant initially, and to the port incinerator in the future.

V. ALTERNATIVES

41. The Project site is the preferred location for economic and multipurpose berth development in the Xiamen west sea area. The planning for the region includes berth construction in this vicinity. Infrastructure services are excellent, social services are well developed and effective, and there is environmental protection synergy with Dongdu Phase II development. Alternatives to the original Ministry of Communications proposal for Dongdu Phase III have been developed, focusing on the handling of fertilizer at berth 11. Broader alternatives to an expansion of the port would include development at (i) Xinglin or Paitou in the west sea area; or (ii) Haicang and Zhang Zhou, outside of the west sea area. The latter is outside the area of XHB responsibility. Alternative (i) could include extensive dredging to accommodate vessels sizes anticipated to visit the facility, with significant economic costs and environmental and resettlement issues due to the close proximity of important mariculture sites near Baozhuo Island. Alternative (ii) could entail further berth developments in an area categorized as "Environmental Planning Function Class IV" (port, tourism and fisheries [Class III] priority as opposed to port and tourism priority, within the west sea area), an area with greater environmental use value. Also, connecting infrastructure is not as well established as that in the vicinity of Dongdu.

VI. COST-BENEFIT ANALYSIS

42. The estimated cost of the Project is approximately $100 million at 1997 prices. The estimated economic rate of return is about 30 percent. It is anticipated that the total cost of Project environmental protection measures will be 0.3 percent ($247,000) of the construction
costs. There are no resettlement costs associated with the Project, and maximum synergy is being achieved through the parallel use of protection equipment procured under the World Bank GEF Ships Waste Environmental Management Project.

VII. INSTITUTIONAL ARRANGEMENTS AND ENVIRONMENTAL MONITORING PROGRAM

A. Institutional Arrangements

43. The port currently has an environmental protection unit with a manager and eight staff, four of whom are at the Xiamen Harbor Bureau Environmental Monitoring Station (XHBEMS). The unit reports directly to the Chairman of XHB and also liaises with the Ministry of Communications Specialist Environmental Group, and XEPB.

44. Four additional staff will be recruited to work in XHBEMS on this Project, as there is currently only enough capacity (four staff) to implement ongoing actions and activities. One individual will be dedicated to coordinating all environmental protection measures involved in the Project. During construction, this individual will consult with the Port Construction Command, XEPB, and the Harbor Superintendency. During operation, routine environmental monitoring information will be collected by XHBEMS, in consultation with XEPB, and circulated as necessary.

45. XHBEMS has received equipment and training under the GEF Project, and its personnel are well trained to sample and monitor environmental quality indicators throughout the construction and operation of the Project.

B. Environmental Monitoring

46. For monitoring water quality, suspended particulate material and oil concentration will be measured of 50 m, 500 m, and 1000 m downstream of construction-related dredging activities. These samples will be taken twice daily, once on the rising tide and once on the falling tide, at the channel widening site. Fortnightly (flood and ebb) sampling will be carried out at the turning basins and foundation/berth dredging sites. During land filling, weekly samples will be collected to monitor suspended particulate material concentrations at distances of 50 m and 200 m from the site. During operation, data on temperature, salinity, pH, and chemical oxygen demand, and oil samples will be collected at four stations between berths 4 and 12, once every quarter. Effluent quality from the sewage treatment plant will be tested daily, and the produced water treatment plant will be checked weekly.

47. During construction, the atmospheric quality (total suspended particulates, sulfur oxides and nitrogen oxides) will be monitored once a month at three sites in sensitive areas 50 m, 200 m, and 500 m away from the berths, for at least 24 hours. During operation, similar sampling at the same sites will be undertaken every six months. XHB will collate all results of
the monitoring program annually; interpret them; and, with copies of consultations and all necessary environmental and safety clearances (issued by relevant Government authorities), submit the annual reports to the Bank. Routine monitoring results will be discussed with, and reported to, XEPB and the Fujian Environmental Protection Bureau. A parallel program of routine monitoring will be undertaken at the licensed dredge materials dump site.

48. Monitoring of the acoustic environment will also be carried out at the same three sites as for air quality, with the same frequency and duration.

VIII. PUBLIC INVOLVEMENT

49. As is normal practice in the PRC, and as observed in the EIA, village leaders, residents committees, officials, the local peoples congress, etc. were consulted, and through them the local population was informed of the Project requirements and predicted impacts by flyers on 8 October 1996, with a public hearing on 18 October 1996. Since the Project has no resettlement or relocation issues, and has no direct negative impact on the earning opportunities of local people (including fishers), the interviewed public were in favor of it. The Project was approved by the Fujian Environmental Protection Bureau on 3 July 1997.

IX. CONCLUSIONS

50. The PRC is a signatory to the International Convention for the Prevention of Maritime Pollution (MARPOL) and the International Maritime Dangerous Goods (IMDG) Code. Under MARPOL and the IMDG Code, the PRC has established facilities at Xiamen to handle ship and port wastes, and to manage port operations in an environmentally responsible manner. The existing facilities have been designed to comply with these arrangements, and environmental monitoring will continue with regard to the specific requirements of these international conventions.

51. There are no resettlement or relocation issues directly associated with this Project. Future plans for relocation of all mariculture activities in the west sea area are independent of any issues associated with this Project.

52. There are no sensitive conservation areas, or sites of cultural heritage significance at or near the Project site, or associated sites. Mangroves and coral reefs are absent.

53. Current water quality in the Port area is good. More environmental protection equipment procured under the World Bank GEF Project is due to arrive in the next few months. This should result in continued improvements in water quality. It is recommended in the EIA that a settlement tank and a produced water treatment facility be incorporated in the design of this Project.

54. Air quality at the port is relatively good. Mitigation measures for the handling of break-bulk cement will maintain standards of air quality in the port.
55. Recently implemented urban wastewater treatment for a large part of Xiamen has improved water quality considerably in the harbor. Also, improved agricultural practices and environmental management in the catchment area of the Jiulong River have significantly reduced nutrient levels so that red tides no longer appear as they did in the mid-1980s. The port also has its own sewage treatment works which will work even more effectively with increased flows that approach design capacity.

56. An incinerator procured as part of the GEF Project will be functional in the next few months, probably located near the Gaoqi landfill site. Rubbish trucks and dustbins are being procured as part of this Project, together with greening buffer measures to improve visual amenity and minimize the diffusion of noise and dust in the port area.

57. Over Y1 million in environmental protection costs will be incurred as a result of a specially prepared dredging mitigation management plan. This will limit resuspension of fine sediments through "no lean water mixture overboard" operations on flood tides during channel widening dredging near the Dongyu mariculture site.

58. A rigorous monitoring plan has been recommended, and it will be implemented during construction and operation with the assistance of the well-established XHBEMS staff and facilities.

59. With the implementation of appropriate mitigation, the EIA has shown that the Project is socioeconomically and environmentally sustainable.