Summary Initial Environmental Examination of the Korangi Wastewater Management Project in the Islamic Republic of Pakistan

Appendix 4

Introduction

This summary initial environmental examination (SIEE) report for the Korangi Wastewater Management Project summarizes the findings of the initial environmental examination carried out during the Fact-Finding Mission fielded by the Bank in May 1996, the *Report on Environmental Aspects of Sindh Urban Environmental Sanitation Project* submitted to the Bank by a Bank-financed staff consultant in December 1996, and other findings during Project preparation.

The Project was conceived within the context of the increasing emphasis of the Government of Pakistan on improving social indicators (especially health), which have remained stagnant for nearly a decade. The Karachi Water and Sewerage Board (KWSB) will be the Executing Agency for the Project, overseen by a Project Steering Committee (PSC). KWSB has authority for water and sewerage services for all of Karachi and has received three Bank loans, two specifically for sewage collection and treatment.

A Karachi Sanitation Master Plan completed in 1988 proposed a three-phase program of capital works. The designs for the first phase, completed in August 1990, identified among others, the Korangi treatment plant (capacity: 120,000 cubic meters per day), and the Korangi trunk sewer (5.8 kilometers [km]). The Project aims to improve the urban environment and public health in Korangi and nearby Landhi townships by reducing human exposure to polluted wastewater, and the water quality of the estuarine and marine environment of the Malir River and Ghirzi Creek by collecting and treating industrial and municipal effluent.

A. Project Description

The physical works for environmental improvements include the following: (i) construction of a 50 km small-diameter lane sewer, (ii) construction of a 5.8 km reinforced concrete box culvert trunk interceptor sewer, (iii) rehabilitation and extension of sewers (70 km), and construction of a series of biological waste stabilization ponds with low-lift pumps, screens, and grit removal chambers. Besides the physical works, there are Project components for capacity building and community participation, and implementation assistance. The sewer will run the 5.8 km from the existing Korangi pumping station, which presently discharges flows to the Malir River, to the treatment plant. It will serve the mainly industrial area of Karachi east of the Malir River and will provide treatment of the sewage, including the tannery works, and other industrial and municipal effluent.

The Project provides for the restoration of the Korangi and Landhi sewerage conveyance system, and the construction of the first phase of a sewage treatment plant (STP) to meet the needs for wastewater management until the year 2005. KWSB owns sufficient land to expand the STP in the future to provide two additional phases, which is sufficient for the needs until the year 2020. The Project is complementary with private sector efforts of industrial waste pretreatment and resource recovery, and will provide ultimate wastewater treatment to achieve Environment Protection Agency (EPA) standards.

B. Description of the Environment

The Project area is located on a peninsula of about 14,000 hectares (ha) in the densely populated, mainly industrial area southeast of Central Karachi, bounded by the Malir River to the north and the Arabian Sea to the south. The area consists of two townships, Korangi and Landhi, and covers about one fifth of the land area of the city of Karachi. There are about 1.3 million permanent residents and 200,000 factory workers in 5,000 industries. Construction of factories in the industrial estate started in the mid-sixties. According to the Korangi Association of Trade and Industry

(KATI) 2,800 assorted large and small units exist in the estate today. Not all are operational. These figures do not include the industry in Landhi. A considerable number of plots (30 percent) of land for industry are still vacant. The 40-year old sewerage system is only partly functional.

Karachi is the nation's largest industrial area, which consists chiefly of textiles, chemicals and tanneries — all producing noxious and potentially hazardous effluent. The Project covers the industrial area of Korangi, producing wastes with an estimated 500 tons of biological oxygen demand (BOD) daily, all of which flows untreated to the Malir River. At low tide, a coating of tar and oil refinery residue, covering the sand of the banks of the Malir River, is exposed. Of the over 25,000 industrial units in Karachi, about 5,000 in Korangi and Landhi. Tanneries, which number approximately 250 (175 registered), have established an Environmental Management Program, supported by the Government of Sindh's EPA (GOS-EPA). The program, still at an early stage, aims at (i) use of cleaner technology in tanneries, (ii) installation of chromium recovery plants, (iii) solid waste management, (iv) occupational health and safety, and (v) combined effluent treatment plant. There are also other private initiatives for sewage treatment. A volume of 218 million gallons of wastewater was generated daily in Karachi in 1994, and as the quantity of water supply increases and the city grows, the estimate for 1998 is 303 million gallons per day (MGD). One objective of the World Bank-assisted Second Karachi Water Supply and Sanitation Project is to bring an additional 100 MGD of water from the Indus River to the city to meet the growing domestic and industrial demand. The facility for the additional 100 MGD is due for completion at the end of 1997. There are two main treatment plants, both relicts and in need of total refurbishment. A third smaller treatment plant with aerated lagoons is not in use. The existing treatment facilities show a shortfall of 178 MGD, and the untreated domestic and industrial wastewaters cause a major source of pollution.

Most of the areas of the city are served with a conventional sewer network. The sewers are designed to deal with wastewater flows only, as the rains are so infrequent. However, the sewage produced exceeds the network capacity. In most areas the network is dilapidated and requires special efforts for maintenance. In the past, the inadequacies and blockages in the existing

system have been relieved by making holes in the sewer pipes, allowing them to surcharge and the sewage to flow into the nearby gullies, drains, and rivers. Untreated domestic and industrial wastewaters are a source of health hazard with waterborne diseases, and cause structural damage to the mostly concrete pipe network, which is subject to corrosion from sewage gases and acidic wastes. The leaking sewers contaminate the water supply by permeating the leaking water supply pipes when pressure is lacking.

KWSB shares the concern and is well aware of the problems of pollution. In 1985, it formulated a policy to collect the polluting sewage that discharges to the coastal waters. KWSB has completed contracts for refurbishment of two treatment plants (TP 1 & 2), which will treat some 97.5 MGD of sewage. The works for the Mauripur sewage treatment plant started in 1994, and 54 MGD of sewage would be treated at the first stage in late 1997. If the phased program of sanitation works is allowed to continue, the untreated sewage flow in the Malir and Lyari rivers will be negligible.

The recipient area of the wastewaters from Korangi is the Ghirzi Creek, which is part of the ancient estuary of the Indus River, 10 km southeast from downtown Karachi. The climate is tropical. Only during floods is the creek essentially watered by other than wastewaters discharging from Korangi. With the Project, those waters will be cleaner due to treatment, and the outfall of the treatment plant will collect the waters that presently discharge to the creek anyway. From the north, waters of the Malir River flow through the Ghirzi Creek to the same area, which opens into the sea 5 km the southwest.

The Malir River has a wide bed with a narrow strip of floodplains along its banks. The lower part of the river basin is largely covered with unconsolidated sediments. Most of the area is covered with fine to coarse sand, slightly silty, stiff and occasionally mixed with gravel and boulders. In the riverbed, their thickness may not be more than 10-15 feet. The inlets in the river are limited: there are presently eight, and the sewage flowing from them could be controlled. The banks and bottom of the Malir River are partly cultivated, and the wastewater and storm water from the Korangi area as well as groundwater are used for irrigation. During the dry season, the river flows in a very limited area and the riverbed is wide. Due to the negligence of governing bodies and ignorance of the subsequent results,

farmers have encroached upon the riverbed and are growing various types of crops in the riverbed. They have also altered the route of flowing water. This practice is common in areas from the National Highway Bridge to Shah Faisal Colony No. 2 causeway, after which small spots of agricultural activities are found. Many of those farmlands are subject to flooding as they are located outside of flood control embankments constructed after major flooding in 1977. In addition to agricultural activities, cattle dens are also present in the riverbed. The practice of solid waste dumping and burning in the riverbed is prevalent.

The coastal area in front of Korangi is floodplains and tidal flats, largely covered by mangrove swamps, mudflats, and creeks. The Project site is located at the northern edge of a mangrove area of the old Indus River delta, although it no longer takes any flow from the Indus and the creeks are entirely tidal. Five km south and southeast from Korangi is the navigation channel through Phitti Creek to Port Qasim, which is located 25 km eastward. The mangrove areas, especially Korangi Creek, provide a buffer between land-based industry and the rest of the mangrove ecosystem. Besides the wastewaters from Korangi, the sea area is loaded by other wastewaters from the city and industrial areas. The Pakistan Steel Mill and the Karachi Electric Supply Corporation's power plant withdraw, use, and discharge cooling water.

C. Screening of Potential Environmental Impacts and Mitigation Measures

Interference with other utilities, streets, access to buildings, etc., will have a moderately significant effect, as the construction works of the trunk sewer can create nuisance for nearby settlements. The community will be informed of the proposed locations, and appropriate access to buildings will be ensured by careful design. As the site is an industrial area, the disturbance will be acceptable. The land for the treatment plant is already controlled by KWSB, and there are no permanent human settlements in its immediate vicinity. The site is urban land with no particular vegetation or wildlife.

As a moderate secondary effect, the practice to irrigate the land between the industrial area and the riverbank with raw wastewater cannot be continued.

The design of the Project has to address the loss of irrigation water by providing farmers with access to the treated water or another source. The area of affected land is about 500 ha. As there are no permanent settlements dependent on those waters in that area, resettlement is not required.

The valuable mangrove ecosystem or aquatic life of the sea area finally receiving the treated effluent will not be violated by the Project. Treatment will improve the quality of water as well as the conditions of local fisheries. Some parts of the currently polluted shoreline may recover to normal tidal plains. However, that positive effect is limited by other sources of pollutants discharging to the same area.

Adverse effects of overflow or bypassing hazards are not likely, as the design aims particularly at reducing those problems. Standards for industrial effluent that will be received in the system are a major concern, and have to be carefully addressed to mitigate the risk to an acceptable level. These mitigation measures are recommended:

(i) The quality of industrial wastewaters to be received has to be assessed to judge the need for pretreatment before taking them to the KWSB network, with emphasis on heavy metals and other toxic substances.

(ii) KWSB has to reject effluent that cannot be safely treated to the level required by national standards.

(iii) A tariff system has to be created for industrial effluent and applied in contracts between KWSB and the producer of the effluent, on a cost-recovery basis.

(iv) Regular monitoring has to be established to ensure that practices comply with contracts and standards.

(v) The institutional capacity of KWSB has to be strengthened to meet the requirements of industrial effluent monitoring.

Methods for sludge disposal will be designed taking into account the possible hazard caused by heavy metals or other chemical residuals. With careful planning and maintenance, the environmental risk can be generally minimized. The problems of having hazardous materials illegally in sewers as well as inadequate management of industrial wastes discharge to sewers will be addressed by monitoring, training, and other measures as reported in para. 16. The hazard of sulfide corrosion will be addressed in selecting materials and designing the facilities.

Silt runoff from construction operations or from exposed areas after the works will be minimized by timing of operations and by resurfacing the exposed areas. An important mitigation activity is to ensure geotechnical stability and resistance to erosion (caused by flood and other factors) at the sites. Construction works will be carefully monitored. The safety of workers, prevention of communicable diseases and those transmitted by insects, and the risks of hazardous materials will be taken into account.

Noise and vibrations will be addressed by appropriate planning and controls. In an industrial area, they are considered a minor effect. Disturbance to street traffic for prolonged periods will be taken into account in construction scheduling, and appropriate temporary arrangements will be made.

During the operational stage of the Project, the possible toxic gases in sewers and hazardous materials in sewage pose a risk in terms of occupational health. Mitigation of that risk requires on-the-job training of workers, first-aid facilities, and monitoring. The risk of inadequate operation of the plant will be addressed by training, and by monitoring of operation and maintenance (O&M).

D. Institutional Requirement and Environmental Monitoring Program

KWSB was created in 1983 and assumed the water and sewerage services from the Karachi Metropolitan Corporation (KMC). KWSB is a semiautonomous body and a subsidiary of KMC. Some 85 percent of KWSB's staff are employed in the Technical Services Department, and most of the remaining employees are engaged in supporting operational activities. The Sewerage

Wing of the Department is responsible for all wastewater collection, treatment, and disposal operations. Deficiencies identified in KWSB's capabilities in the area of environmental monitoring and control will be addressed under the Project by providing consulting services. To address the particular environmental needs of the Project, additional institutional strengthening is recommended in the form of training, equipment, and facilities for monitoring. Investment programming will be a part of the update of the Karachi Wastewater Management Plan, to be financed under the Project. To ensure that beneficiaries' needs are fully integrated into the Project, KWSB has, among other issues, agreed to support an integrated training program.

The Sindh EPA was formed in 1993. In the same year, it issued draft effluent guidelines for industrial and municipal discharges, which became legally enforceable in 1996. Industries must comply with EPA effluent regulations. Those guidelines and standards are recommended as classification basis for the establishment of industrial effluent tariffs and monitoring for the Project. The Government will assure that, prior to Bank approval of the construction contract award, KWSB will obtain approval from the Sindh EPA for the design of all sewage conveyance and treatment works under the Project to ensure that facility designs (including pretreatment provided directly by industries [not part of the Project]) meet the existing standards for municipal and industrial effluent. Recently adopted KWSB by-laws require pretreatment at polluters' expense to ensure that the integrity of the biological treatment process is not jeopardized. In Korangi, KATI has been organized to address the challenge of meeting the industrial effluent discharge limits. KATI proposes eventually to take over O&M of some of the KWSB assets in Korangi.

The outline of the environmental monitoring program for the Project is as follows:

(i) sampling and assessment of flow from industrial units joining the system, two times a year (or other frequency as advised by authorities and standards), and laboratory analyses of the samples;

(ii) summary report of the monitoring results with comments on the operation, raw materials, processes, and products of the unit at the time of sampling, and as average;

(iii) regular sampling and assessment of flow at the outfall of the treatment plant, and between the key sections of the treatment process, and at a laboratory in accordance with the standards;

(iv) annual sampling in April-May of sediments from the recipient water body; analyses including the concentrations of heavy metals, percentage of organic matter, other parameters as advised by EPA; and

(v) reports to present statistics, conclusions, and recommendations, based on the results of the above programs, and an operation logbook of the wastewater treatment plant.

E. Findings and Recommendations

The Korangi Wastewater Management Project will, if properly implemented, result in significant improvement in the environmental conditions of the area and in the creeks receiving the effluent. It is anticipated that the loading of wastewater on the seashore will be reduced by 40 to 90 percent depending on the parameter, except for some very soluble elements. Special emphasis has to be given to sludge removal and disposal to keep the toxic compounds, enriched to the sludge, away from the irrigated areas, food production, and aquatic ecosystem.

The industrial wastewaters joining the sewage and treatment system are to be checked and regularly monitored, to maintain the biological processes of the treatment plant and comply with standards of the treated effluent. It may be noted that domestic wastewaters treated together with industrial effluents can promote the elimination of hazardous compounds. A regular monitoring system for the treatment plant and for sediments in the recipient water area is required.

Development of a tariff system is recommended to facilitate the collection of appropriate revenue from industries joining the system. The national, provincial, and local standards for effluents and the environment have to be followed, and advice of the Sindh EPA sought as appropriate.

It is recommended that during the design, construction, and operation stages of the Project, attention is paid to erosion control, prevention of groundwater pollution, occupational health, and safe operation of the system. Participation of the affected people in the design of activities that may harm their interest should be organized, and the local community should be well informed about the intended works. Environmental documents should be made publicly available in the local language.

In the zone between the industrial area and the riverbank, where the Project will have an effect on the availability of irrigation water, appropriate measures will be taken to provide access to the treated water or to irrigation water supply from other sources (e.g., upstream or groundwater), as agreed upon with the affected people.

An environmental and institution building component of the Project is recommended to strengthen the capacity of KWSB to organize, treat, and monitor the effluents from the Korangi and Landhi areas, and to operate the wastewater treatment plant, to facilitate environmental monitoring with sufficient baseline data during the design phase of the Project, to prepare a plan for compensation of irrigation water for the affected people, and to liaise with the local community, industrial associations, and nongovernment organizations to incorporate their views into the Project design and implementation.

The environmental benefits of the Project have been assessed quantitatively in the economic analysis. Indirectly, the quality of life of approximately 1.5 million people will be improved, and a major threat to the aquatic ecosystem of the seashore and mangrove area will be eliminated. It is considered that all Project costs, excluding the expenses for the mitigation measures, aim at environmental improvements. Assessment of environmental costs and benefits in the context of economic analysis of the Project is recommended.

F. Conclusions

The Project has several environmentally beneficial components. The anticipated adverse effects on the environment can be mitigated to an acceptable level. It is considered that a full-scale environmental impact assessment is not required, provided that the environmental and institution building study will be established as outlined, to address the need for additional information.