LEFT BANK OUTFALL DRAIN STAGE 1 PROJECT – TIDAL LINK

WORLD BANK FACT FINDING MISSION

Technical Note and Recommendations

BACKGROUND

The Left Bank Outfall Drain Project and the purpose of the Tidal Link

1. The Left Bank Outfall Drain (LBOD) is intended to drain saline ground and surface water, and storm runoff , from 1.27 million acres of irrigated land in the four districts of Sindh Province to alleviate water logging and salinity. LBOD collects excess irrigation water, saline seepage, pumped saline groundwater, rainfall runoff and industrial and municipal wastewater[1]. At its terminus near the coastal zone, the LBOD empties into two existing and smaller drains, DPOD[2] and KPOD. These latter two drains empty into two natural, shallow lakes, *Shakoor Dhand* and *Pateji Dhand* respectively. These Dhands are two of the numerous shallow lakes and depressions that form the larger wetland known as the *Rann of Kutch*. The Rann of Kutch lies in both India and Pakistan. At the completion of the LBOD Stage 1 project, disposal of the expected large volume of saline drainage water[3] into this nationally and internationally important wetland became a major concern.

2. Three possible options were considered for the terminus of the LBOD drain: one option was to continue to empty most of the LBOD flow through KPOD into Pateji Dhand, which is connected to the Rann of Kutch in wet years or during high water; the second option was to empty the drain directly into the Rann of Kutch where it would find its way to the sea; and the third was to empty the drain directly into the sea through an independent canal linked directly with an active tidal creek. The first two options were dropped partly because the Rann of Kutch is an international wetland and partly because of the potential adverse impact on Pateji Dhand and the small Dhands connected to it. The third option, which utilizes a direct, independent link canal to the sea, *The Tidal Link*, was finally chosen.

3. The adopted scheme included the construction of a 26 mile Tidal Link canal running from northeast to southwest across the Rann of Kutch connecting KPOD to an active tidal creek, *Shah Samando Creek*. The canal would physically separate the four major Dhands in the Sindh portion of the Rann of Kutch, called *Sanhro, Mehro, Cholri, and Pateji,* from the Rann of Kutch. The upland drainage water of KPOD would be confined within the deep cut of the Tidal Link Canal bounded at both sides by high

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1 The drains are commonly used to dispose of untreated municipal and industrial wastewater even though is not consistent with Pakistan Environmental Law.

2 *Kadhan Pateji* Outfall Drain (KPOD), originally one of the main drains for the area irrigated from the Kotri Barrage on the Indus. Its outfall was into Pateji Dhand. *Dhoro Puran* Outfall Drain (DPOD), a small stream emptying into the Shakoor Dhand, excavated to carry stormwater from LBOD

3 The design discharge from LBOD is 4440cfs. DPOD will carry 2000cfs of stormwater, and the balance of baseflow (1240cfs) and stormwater (2200cfs) will be carried by KPOD.

earthen embankments. The top of the embankment was fixed at 20 feet above mean sea level (amsl) to avoid overtopping from both sides since water levels in both the Pateji and Cholri Dhands and Rann of Kutch sometimes exceed +8.0 to +10.0 amsl.

4. The tidal influence (backwater) would extend from Shah Samando Creek all the way up the Tidal Link to KPOD, but sea water was not expected to extend farther than 12 miles upstream from the tidal creek (to RD –93), just below the Dhands. The northern side of the embankment running along Pateji and Cholri Dhands was provided with an overflow concrete-crested weir (Cholri Weir), 1800 feet long. The top of weir was fixed at +4.5 feet amsl to prevent over-drainage of the Dhands at low tide, and to allow temporary flow of canal water into the Dhands to attenuate water levels in the canal at high tide .

Cost and Financing of the Tidal Link.

5. The implementation of the Tidal Link canal and the overflow weir was started in September 1991 using an ICB contract for construction, and an international consulting firm for the design and construction supervision. The construction of the Tidal Link and Cholri Weir was completed on time. The total cost of construction was about PRs 800 million, funded in part by the Saudi Development Fund.

Objectives of the Bank Mission

6. The Bank fielded a fact finding mission during the period March 12-17, 2000. The Objective of the mission was to understand the technical details and process of the failure and the damages to the Tidal Link, to understand the possible technical, environmental and social consequences, and to suggest to the Government of Sindh further steps to be taken. The GOS Additional Chief Secretary[4] had constituted a high level Technical Review Committee of senior technical experts in May, 2000. The Committee made its report to GOS in October, 2000 [19][5]. The mission visited the tidal link site, listened to the views of various Government and Non-Government Officials including members of the Committee (Attachment 1), and reviewed the various reports (Attachment 2) including the Technical Committee's report.

POST COMPLETION OPERATING EXPERIENCE OF THE TIDAL LINK

Initial Operating Experience

7. Almost as soon as the Tidal Link began operating on June 6, 1995 it experienced significant erosion and scour problems along both banks and the bed. In some sections, almost 50 percent of the total embankment body was lost with erosion still in progress. The remedial works along the embankment were undertaken by WAPDA O&M (South), but the bank sloughing, bed and bank erosion continued. Meanwhile, differential

[4] Vide notification No. WR(W/W)5(P&D)79/69

[5] The number in the brackets refers to the list of documents consulted by the mission given in Attachment 2

settlement of the upstream face of the Cholri Weir was detected beginning in 1995 and remedial works were undertaken and completed by the end of 1996.

Damage to the Tidal Link and Cholri Weir in 1998 & 1999.

8. Undermining and erosion caused 250 feet of the weir section length to collapsed on June 24, 1998. Many attempts were made to close the breached weir section, but all failed due to monsoon weather and the remoteness of the site. By the end of October 1998 the federal and provincial authorities and the consultants who visited the breach site jointly decided to stop further remedial works after the breach in the Weir had increased to 450 feet length from the southern end [16]. On May 21, 1999 a catastrophic tropical cyclone hit the Tidal Link area causing severe damage, including the almost complete destruction of the Cholri Weir, and breaches of both Tidal Link embankments in 56 places.

Function and Impact of the Tidal Link.

9. The primary objective of the Tidal Link was to evacuate the saline drainage water of LBOD to the sea. The objective had been achieved before the occurrence of the June 1998 weir collapse and May 1999 cyclone breaches. A substantial net outflow from the KPOD and Dhands to the sea was observed with an average rate of 1000 cubic feet per sec (cfs). The net outflow in the Tidal Link was accompanied by a sharp reduction in salinity in the Dhands (by about half[8]).

10. Since the collapse of weir and the cyclone breaches in the embankment, the whole water and salinity balance of the Tidal Link and the Dhands have changed. The tidal link flow is no longer confined, and is instead, now intermingled with the flow to and from the Dhands and the Rann of Kutch at every tide cycle through the breaches along the embankments. The salinity has been increased in the Tidal link up to RD –35. This has become especially pronounced in the last one and a half years because of the severe drought that has significantly decreased drainage flow from KPOD.

REPORT OF THE GOVERNMENT OF SINDH (GOS) TECHNICAL COMMITTEE TO REVIEW DAMAGES TO THE TIDAL LINK AND CHOLRI WEIR

The Recommendations of the Technical Committee.

11. The high-level Technical Committee reviewed available project documents and monitoring data and made extensive field inspection. Among the Committee's key findings and observations are: 56 breaches in the southern and northern embankments of the Tidal Link, severe erosion of the canal banks; evidence of scour of the canal bed, and a considerable part of the berm on top of the embankments had bean washed away; most of the northern embankment along with the entire berm has been eroded; the section of the channel has been widened considerably at a couple of places; the water level in the Dhands has been lowered and drained by the Link; the water was flowing within the Tidal Link during the low tide when the Committee visited the site. At high tide, the

water apparently flows over the banks at some of the low points or through the preached sections.

12. The judgement of the Committee was that the Tidal Link is continuing to function and the ongoing channel evolution would stabilize sometime in the future with a section that would generally follow the current alignment However, in light of the uncertainties concerning the factors governing the ongoing changes within the Tidal Link, and the uncertain viability of conventional options, the Committee made the following recommendations in their May, 2000 [19] report:

- No repair should be carried out in Tidal Link as damages done by cyclone are beyond the repair limit;
- Any remedial work for Cholri Weir is also not recommended;
- The Tidal Link is discharging its fluid into the Sea with good gradient;
- Continue monitoring of water levels in Tidal Link and KPOD for at least one year; and
- Carry out a survey of the bed levels in the Tidal Link.

13. As this Committee's report covered mainly the technical aspects of the failure, a second committee was constituted in December 2000, to assess the environmental and social consequences of the failure. This second Committee is still continuing its work.

General Comments on the Recommendations of the GOS Technical Committee.

14. The mission held discussions with the Committee members and other Pakistani officials and NGOs (Attachment 1) after thorough examination of the situation, including a site visit and review of the existing documentation (Attachment 2). Considerable damage occurred to the berms and embankments of the Tidal Link. Direct connections between the Link and the Dhands have developed in several places after the northern embankment had been completely eroded. The downstream part of the Weir was breached completely and has turned into a wide opening to the Dhands where a similar drainage channel has also been formed. Water during high tide freely enters the Dhands through these openings. Wide and deep drainage channels have been created in the bed of the Dhands by the water freely drained from the Dhands at low tide.

15. The mission generally agrees with the conclusions and recommendations of the GOS Technical Committee regarding the Tidal Link and Cholri Weir. The no-action recommendation of the committee is justified not only because the damage is beyond repair by conventional methods, but also because the scour of the channel bed and erosion of the embankments are still active under the influence of the uncontrolled tidal flow through the tidal link and flow to and from Rann of Kutch and the Dhands. These conditions will render any attempt to repair the damages following conventional methods useless. Moreover, repair or replacement of the Cholri Weir is also meaningless because tidal and drainage water will continue to enter and leave the Dhands freely through the gaps in the breached embankments.

16. However, with respect to the Committee's recommendation concerning modification of the LBOD-DPOD weir to increase disposal of saline drainage water through DPOD into Shakoor Dhand, the mission is of the opinion that such a decision should be deferred until a complete technical and environmental assessment is made on the basis of the proposed comprehensive monitoring program.

Comments on the Risks.

17. LBOD drainage water is still flowing through the tidal link to Shah Samando creek with a noticeable velocity in the downstream direction during low tide. Thus there is no immediate or short-term danger of impeding the disposal of drainage water from the LBOD to the sea. However, it should be noted that drainage flows have been generally low because the Project is not yet fully developed and the drought conditions have prevailed over the past two years. Hence, the Tidal Link has not yet had to operate at full capacity in its present damaged condition.

18. The analysis of the longitudinal profile and cross sections taken along the Tidal Link at different periods covering before and after the cyclone damages indicates that in the long run the Tidal Link can evolve into a natural tidal creek. But it is very uncertain when and how that would happen. The superimposition of cross sections taken at different locations in 1997 and 2000 shows [15, 20] that there is a trend of localized scour and deposition of sediments at several sections of the tidal link. It is expected that the straight man-made Tidal Link may turn gradually into a more stable but meandering channel within a very wide and shallow section.

19. There could also be a more pronounced back up of the drainage flow as sedimentation progresses, resulting in a damping effect to the overall fall of the groundwater table in the LBOD area, particularly around its downstream reaches.

20. Due to the ongoing active channel processes, there is scouring and deposition of the sediments. Meanwhile, due to the active channel processes in the Tidal Link, the water is heavily laden with suspended sediments of brown color apparently a result from continuing bank erosion and bed scour.

21. The uncertainty about the future outcome of the active channel processes in the Tidal Link, the cost and viability of various rehabilitation options, and the environmental risks associated with the conditions developing in the Dhands strongly indicate the need for an effective monitoring program that would help to understand the trends and help to define feasible and sustainable mitigation measures.

Monitoring: Past, Present and Future.

22. Shortly after commissioning the Tidal Link, physical monitoring was carried out by WAPDA during 1996 to assess the erosion situation in the berms and channel of the drain, and to identify necessary remedial measures. Longitudinal profiles and cross sections published in 1997 [9] provide a base line of the early erosion as well as analysis of the water balance, water salinity and morphology of the tidal link. A bed level survey of the tidal link and the KPOD downstream reach was carried out by the National

Institute of Oceanography (NIO) in September 1998 [15] according to an agreed TOR with Directorate O&M, WAPDA (South).

23. The current monitoring and survey have been carried out by WAPDA's Scarp Monitoring Organization (SMO) for the water table and salinity while the National Institute of Oceanography has been carrying out bathymetric and hydrographic survey in the Tidal Link. A memorandum of understanding between SCARP Monitoring Organization (SMO) WAPDA and NIO signed in March 1999 included a TOR for NIO to conduct comprehensive hydraulic monitoring of the Tidal Link under the NDP Drainage-I (IDA Credit 2999 Pak) for the period 1999-2003. The TOR initially covered the area including the Tidal Link Drain, the Dhands, the tidal mud flats, parts of Shah Samando Creek and adjacent areas. After the May 1999 tropical cyclone, which struck the entire area, the TOR was revised based on a proposal by NIO in September 1999 to account for the morphological changes caused by the storm. The revised TOR excluded the monitoring of any site downstream RD-125 including the Shah Samando Creek and the tidal mud flats. The first Annual report (1999-2000) of LBOD-I Physical monitoring was published in December 2000 by WAPDA [20].

24. The monitoring program as it is being implemented is not strictly complying with either TOR in terms of the specified sites or the frequency of measurements apparently due problems of site accessibility. Extensive discussions with the NIO Monitoring Team Leader and his associates confirmed the need to continue monitoring through the downstream reach of the Link, to comply with the TOR and to identify trends in physical and morphological changes within the monitored area. Future measurements must build on the base line information available from previous monitoring and surveys. It should also continue to track the sediment transport through the Shah Samando Creek that could be detrimental to the performance of the drainage function of the Tidal link if the huge sediment load is depositing somewhere near the mouth of the link to the creek. Year-round monitoring of surface water in the Dhands, particularly near the outlets of Karo and Fuleli drains, is equally important to ensure the effectiveness of the drainage from this part of Kotri system.

ENVIRONMENTAL SITUATION IN THE TIDAL LINK AREA

Environment setting of the Tidal Link.

25. A broad and complex coastal zone lies between the terminus of LBOD and the Arabian Sea. Three distinct zones can be identified:

- the Rann of Kutch, a vast, highly saline wetland, that also includes large open bodies of saline water, salt pans in shallow depressions, land covered by a layer of crystalline salt, and numerous small, often interconnected saline lakes;

- a broad, extensive mud flat, that is temporarily covered by a thin layer of saline and silt laden water at high tide, particularly during the monsoon season; and

- a series of tidal creeks along the coast connecting the mud flats and wetlands with the sea.

26. The Rann of Kutch, which extends across the border between Pakistan and India includes a perennial, large and shallow body of water weakly connected by tidal creeks to the sea. Mangroves, which are generally limited in extent, specie diversity and productivity (because of the persistent high salinity), are found in places on the margins of the Rann of Kutch and among the tidal creeks. The land along the margins and extending some distance upland of this wetland is very saline, and the vegetation is very sparse to absent.

27. The wetlands of Sindh especially those east of the Indus River form an important component of a major migratory route for waterfowl known as the "Indus Flyway" [10]. They are important wintering, nesting and staging grounds for a large number of locally and globally[6] important bird species (55-70% of all waterfowl found in Pakistan winter in Sindh), including some endangered species such as the Dalmatian Pelican. Two species of marine turtles inhabit the area, including the green turtle (frequently seen in KPOD and Tidal Link canal) and the loggerhead turtle. The wetlands, channels and creeks are also a productive fishery including several species of commercially valuable shrimp, prawns and crabs.

28. The western margin of the Rann of Kutch, where the drains enter the coastal zone, consists of a number of small, interconnected lakes called Dhands in Sindh, and a number of small lagoons some of which are dry during the late dry season or during drought periods. The surface area of the Dhands varies seasonally and from year to year but averages about 700 sq. km.. At low water levels, flow between the Dhands is limited and sometimes prevented by low ridges, but at high water particularly during the monsoon season or a wet year, they form a shallow, large and continuous wetland with the Rann of Kutch. The Dhands are generally oligotrophic[7], with highly variable salinity (depending on stormwater and drain inflows), ranging from 15ppt to over 45ppt depending on the amount of mixing with drainage inflows whose salinity is generally less than 10ppt (principally from the Kotri drainage system). The Dhands and the surrounding lands, which are also saline, are nearly devoid of vegetation (except along the margins that are consistently fresh as, for example near a drain outfall). Biodiversity is nevertheless high with numerous specie of fish, crustaceans and mollusks that constitute a very productive fishery including several varieties of prawns, and high quality water fowl habitat.

29. Nearly all the villages near the Dhands depend on the fishery since the saline soils in the upland areas surrounding the Dhands support almost no agriculture except where water from the Kotri Barrage is available for irrigation. There are about 30 small fishing villages around the four Dhands and Serani Drain (which enters directly into KPOD) [11]. Only one of the villages, *Karo Ghangro* located on Sanhro Dhand, is a permanent

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[6] The concentration of 22,500 Great White Pelican in Lake *Jabho* in Badin District in the winter of 1989 was the largest number ever recorded in Asia. In that same year 47,000 Greater Flamingo were observed in the Rann of Kutch, Pakistan. The breeding colony of Greater Flamingo in the Rann of Kutch is estimated to comprise over half the total world population and the largest assemblage anywhere in the world.

[7] Except possibly in small areas where circulation is extremely limited

settlement of about 250-300 huts. The remaining villages are temporary, occupied seasonally when fishing in the immediate vicinity is good. In total there are about 5-6000 people, but the number varies year to year [11]. The socio-economic condition of these people is very poor: average incomes are about 6-800 PRs/month; there is no drinking water supply or health facilities; morbidity is high; education facilities are poor and participation rates are low [11].

30. Ramsar[8] status has been officially requested by the Government of Pakistan for two areas near to where the drains enter the coastal zone. One is the *Narr-ri* Lagoon (2540 ha) near the outfall of the *Fuleli* drain in *Mehro* Dhand[9], and the other is the *Jubho* Lagoon (700 ha) located on the western side of Mehro Dhand. If these sites are accepted (expected in 6-9 months), the surrounding Dhands will be designated as a Protected Area. Under the current regulations for Protected Areas in Pakistan, a management plan would then be prepared for this area by the GOS Department of Wildlife Conservation, and the use of this area regulated (not necessarily prevented).

Disposal of the Drainage Outflow.

31. Carrying the LBOD baseflow and stormwater across the coastal zone to the Arabian Sea was considered important for several reasons:

- the drainage outflow from the system could not be emptied in the Rann of Kutch because it is an international wetland shared by India and Pakistan
- while the salinity of the drainage outflow is quite moderate compared to the Rann of Kutch it would likely contain a number of agricultural chemicals, nutrients, and industrial and domestic pollutants, and hence could not simply be disposed of in such a valuable wetland without possible risk to its important environmental values
- the left bank drainage system in Sindh is the first stage of an as yet undefined but necessary national drainage system for the left bank of the Indus river. Hence, an even greater volume of saline drainage and storm flow would have to be disposed of in the future, and a feasible and sustainable direct outlet to the sea developed

Specific Measures To Protect the Dhands.

32. Before implementation of the LBOD project, the highly variable water balance in the four Dhands consisted of the relatively small Kotri drains that discharged directly into

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[8] The Ramsar Convention is an international treaty which came into force in Pakistan in November 1976. The main obligation of the government under the treaty is to ensure the wise use and conservation of wetlands defined in the convention as "an area of marsh, fen, peat land or water whether natural or artificial, permanent or temporary, with water that is static or flowing fresh, brackish, or salt including areas of marine water the depth of which at low tide does not exceed six meters".

[9] The *Karo* drain, which is much smaller than *Fuleli* in terms of flow (in an average year, 4.5 mcf/d versus 45.8 mcf/d from the latter in the monsoon season) , discharges into the adjacent *Sanhro* Dhand.

Sanhro, Mehro and Pateji Dhands, seepage, rainfall and surface runoff in the monsoon season, evaporation, and inflow to or outflow from the Rann of Kutch[10]. The drain inflow, evaporation and flow to or from the Rann of Kutch are thought to be predominant, but with the construction of the Tidal Link, flow from the Rann of Kutch in wet years would be prevented, and drain inflow reduced by directly connecting the largest drain, KPOD, to the Tidal Link canal. There appeared to be two key concerns that required mitigation:

- first, permanent separation from the Rann of Kutch, and elimination of the KPOD drain inflow, could lead to one of two scenarios, both with possibly adverse consequences: (i) if these two flows dominate the water balance, then such a change could cause a significant long term decrease in the normal surface area of the Dhands resulting in adverse impacts on both the fishery and waterfowl habitat; or (ii) if stormwater inflows and the remaining Kotri drains dominate the water balance, then such a change could result in the long-term increase in Dhand water levels increasing water logging and salinity intrusion in the surrounding lands and impairing the effectiveness of the drains;

- second, if the Dhands are left intentionally open to the canal (uncontrolled), the large tidal water level fluctuations in the canal would cause large diurnal water level fluctuations in the Dhands (the surface area of the Dhands would vary by an estimated 70% [12]). This effect would be enhanced if the head differences between the canal and the Dhands caused a network of drainage channels to develop within the Dhands. Water levels in the Dhands normally vary seasonally and from year to year but generally within a limited range of 1 to 2ft.

33. The 1989 EIA for the Left Bank Outfall Drain Project – Stage 1 determined that the most important effect of the Tidal Link on the Dhands would be excessive drainage due to the tidal fluctuations. Moreover, it was determined that additional, temporary inflow of drainage water from KPOD would not have an adverse effect and could offset the loss of water from the Rann of Kutch in wet years further stabilizing the water balance in the Dhands. It is important to note however, that at that point in time there was little or no data on the present and future kinds and levels of pollutants (pesticides, heavy metals, etc.) and nutrients that would be in the water flowing into the Dhands from the Tidal Link, nor what the biological and limnological fate of these substances would be (for example how much would be retained in the Dhands, would they be concentrated in the food chain, etc.).

Current Situation At the Cholri Weir.

34. Since the complete destruction of the weir in 1998-99, water now flows freely in and out of the Dhands in response to tidal fluctuations in the canal through the opening left by the absent weir, and through a major breach in the canal bank. North of the weir

[10] Even at high water levels in the Rann of Kutch inflow to the Dhands is restricted by the generally northwest to southwest sloping topography

opening, and the large breach in the embankment observed by the mission, a network of channels has quickly formed in the Dhands through which a significant portion of the Dhands are drained at low tide twice a day. The network of channels forming in the Dhands has the appearance of a typical tidal creek and appears to be progressing (deepening and extending) into the Dhands.

35. Anecdotal evidence suggests that local people are fearful of the changes taking place. They are reported to be concerned that because water is coming from all directions waterlogging will increase, that the strong tidal influence is bringing sea water to the Dhands, and that the sea, once far away, is now very close.

Environment and Social Risks and Issues.

36. GOS has appointed a second high level Committee to assess the environmental consequences of the Tidal Link damage, but it has not yet completed its review and made its report. The failure to implement the project EMP, which placed particular emphasis on monitoring and study of the area, makes it very difficult to evaluate impacts and assess risks. Nevertheless, it seems clear that there are several important long term risks that stem from the present situation and the course of action recommended to the Government of Sindh by the Technical Committee (paragraphs 11-13).

37. The first major risk is that the outcome anticipated by the Technical Committee, i.e. that the Tidal Link stabilizes and functions adequately but the uncontrolled connection between the canal and the Dhands remains, results in substantial and irreversible damage to the ecosystem, habitat and fishery in the Dhands. The large diurnal fluctuations in Dhand water level may change conditions in the Dhands sufficiently to cause severe degradation to the ecosystem and loss of biodiversity and key qualities of the waterfowl habitat. The great extent of the Rann of Kutch wetland may be sufficient to provide alternative habitat for breeding, feeding and resting by key waterfowl species, but it is not known if there is sufficient equivalent habitat elsewhere in the wetland, nor how the waterfowl will respond.

38. The changes in biodiversity and habitat noted above could adversely affect the fishery reducing yields particularly of commercially important species. Hence the second major risk is the loss of livelihood by the poor fishermen who depend on the Dhand fishery, and farmers whose lands could be adversely affected by high water levels in the Dhands (either temporary or persistent). Fisherman have been heavily fishing the canal since its completion, but there has not been any systematic monitoring of yields in the canal, and presently in the Dhands, in comparison to before project conditions.

39. Just as systematic and scientific monitoring is needed to observe and understand the evolution of the Tidal Link channel and its effectiveness and functioning, similar and perhaps more extensive monitoring and study is needed to understand, anticipate and respond to ecological changes occurring now and in the future in the Dhands.

Status of Implementation of the EMMP.

40. In 1998, an update of the 1995 Environmental Management and Monitoring Plan (EMMP) was prepared for the LBOD – Stage 1 Project including the Tidal Link area [12]. The key mitigation measures identified in the 1989 EIA [2] for the Tidal Link were incorporated in its design – but the critical issue concerning future management of the Tidal Link and the surrounding impacted communities and wetlands was (and still is) the lack of a complete baseline and continuing, systematic, scientific and well coordinated monitoring and study of the area. As issues were identified in project planning and design, the lack of an adequate knowledge base to understand this dynamic system and its response to various interventions and changes, and to support decision making in the future, became clear. In 1997 the first series of baseline studies were carried out covering, avifauna [10], fisheries [11], water quality [20], and comparative land use [13].

41. The 1998 EMMP update outlined a comprehensive program of baseline surveys and studies covering the social setting and economy of affected people, fisheries (biology, productivity, techniques), water quality and limnology, and ornithology. These studies were to continue for the foreseeable future at appropriate intervals to be determined as the knowledge base developed and needs and priorities were identified. The development of an institutional framework for this program with specific responsibilities assigned to different agencies who possessed the experience and qualifications to do the work, was rightly seen as critical to its success. A newly organized Environmental Cell (WECS) was established at WAPDA (South) to coordinate and lead the work.

42. However, from 1998 to the present a variety of disagreements between WAPDA and the Government of Sindh over who would lead and be responsible for the overall program including related elements of the National Drainage Program (NDP, financing of drainage activities in Sindh shifted to this project when LBOD-Stage 1 closed), has essentially prevented any further action on implementation of the EMMP program. No follow-up surveys and studies have been carried out since 1977to complete the baseline, nor has an institutional framework to implement and coordinate the continuing environmental monitoring program been put in place.

FRAMEWORK FOR ACTION.

Institutional Arrangements

43. The performance of the Tidal Link as the major outlet of drainage water from the Indus Left Bank to the open sea and its impact on the coastal wetlands is of strategic national and provincial interest.

44. The monitoring program should be continued as an enormous amount of past data and institutional memory have been invested in these organizations. However, the mission noticed that the analysis part of the monitoring task is weak. There is no permanent institution to constantly following up the analysis of the collected monitoring data of both organizations in an integrated manner, and to make the necessary interpretation of the on-going phenomena. The mission therefore suggests that a core

scientific group comprising multidisciplinary specialists should be formed solely for the purpose, and assigned the task. This core group will function as a counterpart body to any international and local panel of expert. Before thinking of engaging a Panel of Experts the core scientific team should accomplish the task of consolidating the existing date and information.

45. Two priority actions are urgently needed to address the environmental risks:

(i) Those elements of the program of social and environmental monitoring, surveys and studies initially outlined in the 1998 EMMP that are most relevant to the Tidal Link impact areas should be reviewed, updated and converted into a series of TORs and the revised program launched on an urgent basis;

(ii) Equally important, and perhaps more difficult, is for the Government of Sindh to establish a clear and stable institutional framework for the management and coordination of the program. As noted earlier it is not sufficient to arrange to contract for isolated data collection and surveys. The adopted approach should:

- provide an effective institutional mechanism to not only coordinate activities by different organizations and specialists, but also to ensure that data are compiled, analyzed, interpreted in an integrated manner, trends identified, and the program adjusted accordingly;

- ensure that all the concerned and capable organizations in Sindh are appropriately involved. It should be noted, for example, that the key agency responsible for management of these valuable wetland resources (the Department of Wildlife Conservation) is not a member of the GOS Committee to review the environmental situation in the Tidal Link area;

- provide an effective mechanism, and appropriate incentives, to share and disseminate data and information. Modern information management tools such as computers, GIS and other information technology hardware and software are now widely available in Pakistan. GOS should give this issues priority attention – timely sharing of data and coordination of activities is perhaps the least expensive way to expand knowledge.

46. Within Sindh, and certainly within Pakistan, there are a sufficient number of specialists with appropriate experience and advanced training to do the required work. Additional training to fill gaps can be mobilized quickly. Many experienced specialists can be found with in the specialist agencies, institutes and universities, and NGOs. What is needed is an institutional framework to mobilize and coordinate this capacity, and leadership.

47. The physically complex and environmentally sensitive coastal zone should be of special interest to the scientific community in Pakistan. Scientists from universities and research institutes should have the opportunity to develop more understanding of the area characteristics and the changes happening due to the construction of the Tidal Link. This approach would provide better vision and innovative solutions to mitigate adverse effects and sustain safe flow of drainage effluent to the sea. The research sub component of NDP provides appropriate window for engaging the scientific community in the future Tidal Link monitoring and studies.

48. An important consequence of the failure to implement the EMMP is the lack of public awareness of the need to sustainably manage both the fishery and the ecosystem of the Dhands. Over-fishing, poaching, and disruption of habitat were highlighted in a number of studies done in 1997 [10, 11]. When these unsustainable practices are combined with the present threats caused by the damages to the Tidal Link, the risk of an irreversible loss is magnified. WWF indicated to the mission that there are good examples in Pakistan of successful efforts to mobilize stakeholders and communities and their adoption of new practices to sustainably manage their local natural resources and ecosystems. Community mobilization and the creation of local mechanisms to sustainably manage the Dhand ecosystem resources in collaboration with local authorities should be a central element of the implementation of the new EMMP. Enlisting local communities to participate in the monitoring program (both the physical and environmental monitoring programs) would significantly enhance such a program.

49. The record in Pakistan and in Sindh in regard to sharing data and information, and coordination of activities among different agencies even when the they are working on the same general problem is not encouraging. Neither is the awareness or capacity of government organizations to work with local communities and stakeholders to achieve sustainable development objectives. The economic, social and environmental issues and risks in the Tidal Link area are of strategic importance to Sindh. A major effort should therefore undertaken to overcome these past problems, simply because the risks are so high.

Panel of Experts (POE).

50. Once such a comprehensive technical, environmental and social report is ready (one based not only on compilation of data but on analysis and interpretation), a high level Panel of Experts (POE) could be engaged in the future phase of monitoring and studies on annual basis. The POE formed from local and international experts could start by reviewing the state of developments up to the moment and recommending necessary adjustments to the program and the various TOR for monitoring including those for environmental monitoring, if necessary. The POE would continue its annual reviews each time an annual monitoring report(s) is/are prepared. The Panel of expert will be in a position to see the appropriate course of actions leading to definite conclusions and recommendations appropriate to deal with the findings of this program.

Attachment 1

PERSONS WITH WHOM THE MISSION HELD DISCUSSIONS

Meeting at the Secretariat, GOS, Karachi (03/12/2001)

1.	Mr. Khadim Ali Memon	Additional Secretary, IPD, Government of Sindh
2.	Mr. Tariq Masood	General Manager, National Drainage Program, WAPDA
3.	Dr. Izhar Ul Haq	General Manager, Tarbela Dam, WAPDA
4.	Mr. Riasat Ali	Chief Engineer Central Design Office (W) WAPDA
5.	Mr. Mahboob A. Ansari	Conservator, Wildlife Department, GOS
6.	Mr. Syed Rajhib Abbass Shah	Chief Engineer (W) South, WAPDA
7.	Mr. Mohamad Izhar Khan	Chief Engineer, Kotri Barrage, WAPDA
8.	Dr. Salam Memon	Provincial Coordinator, NDP, P&D
9.	Mr. P.S. Rajani	Chief (W&P), P&D
10.	Mr. Faizullah Khatri,	Senior Engineer, P&D
11.	Mr. Rehan Hyder	Assistant Director, NDP P&D
12.	Mr. H. Ali Din Mohammad	ACC, P&D

Meeting at Hyderabad Field Visit (03/14/2001)

1.	Mr. Syed Nasim Hender	Director General, EPA, GOS
2.	Mr. Tariq Masood	General Manager, National Drainage Program, WAPDA
3.	Dr. Izhar Ul Haq	General Manager, Tarbela Dam, WAPDA
4.	Mr. Riasat Ali	Chief Engineer CDO (W) WAPDA
5.	Mr. Mahboob A. Ansari	Conservator, Wildlife Department, GOS
6.	Mr. Syed Rajhib Abbass Shah	Chief Engineer (W) South, WAPDA
7.	Muhammad Yasin Shaikh	Director, SCARP Monitoring (South) WAPDA
8.	Mr. Nazi Hussain Moghul	Superintending Engineer, LSDC, Kotri Barrage Region, 9.
	Dr. Ahmad Hadi Shaikh	Planning Engineer, PDC, GOS
10.	Mr. Rehan Hyder	Assistant Director, NDP P&D
11.	Mr. Saeed Akhtar Baloch	ASSH Conservator, Wildlife, GOS
12.	Mr. Akbar Ali Khatain	Environmental Officer, LBOD, WAPDA
13.	Mr. Abdul Khalifer Memon	Member Cholri Weir Community, Badin

Meeting at NIO, Karachi (03/15/2001

14.	Mr. S.H. Niaz Rizvi	Team Leader, Tidal Link Monitoring Team, NIO

Meeting at Department of Wildlife Conservation, GOS, Karachi, 3/16/2001

15.	Mr. Mahboob Alam Ansari,	Conservator of Wildlife
16.	Mr. Abdul Munaf Kaimkhani,	Assistant Conservator of Wildlife
17.	Mr. Saeed Akhtar Baloch	Assistant Conservator of Wildlife

Meeting at IUCN, Karachi, 3/17/2001

17.	Mrs. Nargis Alavi,	Head, Karachi Office, IUCN
18.	Mr. M.Tahir Qureshi,	Director, Coastal Ecosystems Unit, IUCN
19.	Mr. Ahmad Saeed,	Deputy Programme Director, IUCN
20.	Mr. Syed Ali Hasnain,	Project Manager, WWF
21.	Mrs. Rahat Jabeen,	Wetland Conservation Officer, WWF

Attachment 2

Documents Consulted

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19. Committee Report on Damages to Cholri Weir in June 1998 and Tidal Link During May 1999 Cyclone to the Additional Chief Secretary, Government of Sindh, Chief Engineer and Project Director (South) WAPDA, October, 2000

20. Physical Monitoring Left Bank Out Fall Drain Stage I Project Under National Drainage Programme, (Two Volumes), SCARPs Monitoring (South) WAPDA, Hyderabad, December 2000.

21. Project Completion Report, Left Bank Outfall Drain Project (ADB Loan No. 700-PAK), January 2001