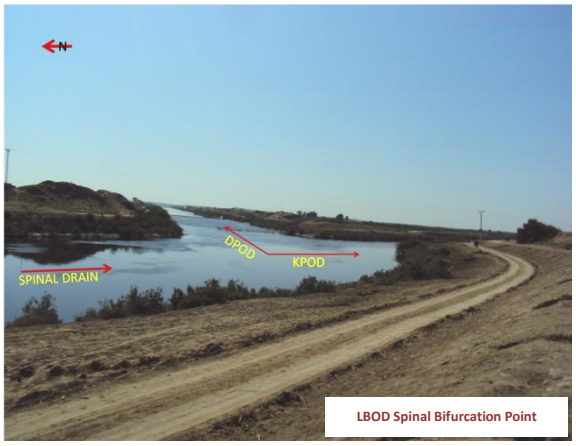
SINDH IRRIGATION AND DRAINAGE AUTHORITY
Sindh Water Sector Improvement Project Phase-I (WSIP-I)

PREPARATION OF REGIONAL PLAN FOR THE LEFT BANK OF INDUS, DELTA AND COASTAL ZONE

Phase - I Final Report

Preparation of Inventory, Assessment of Existing Conditions, Identification of Issues, and Methodology and Plan for Consultations and Stakeholder Participation


Weir at DPOD



LBOD Spinal Bifurcation Point


Disposal of Sewage Water in Phuleli Canal


Consultation with Women

ANNEX

Volume – II

The Louis Berger Group Inc.
In Association with
Indus Associated Consultants (Pvt.) Ltd.

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Table 4.1.1: Inventory, Summary and Assessment of Available Studies

<table>
<tr><th>Date of Study</th><th>Project Name</th><th>Agency Responsible (Donor)</th><th>Summary of Project</th><th>Comments/Assessment</th></tr>
<tr><td>1966</td><td>Lower Indus Project</td><td>WAPDA (World Bank)</td><td>Lower Indus Project investigations were started in 1959 to provide a plan for the optimal development of the water resources. As a result of these investigations extending over a period of six years, the Lower Indus Report was prepared in 1966 by Hunting Technical Services Ltd and Sir M. MacDonald & Partners for WAPDA which provided benchmark data as well as comprehensive plan of intensive development of the land and water resources of the province to ensure that agricultural production meets the growing internal demands and export targets. The plan envisaged interrelated projects for both additional water supplies and drainage to be carried out in a program phased over a period of 25 years. The Lower Indus Report covers the irrigated area from commands of three barrages of Sindh viz Guddu, Sukkur and Kotri. The Consultants drilled 142 exploratory bore holes and 42 test wells. The investigations that carried out pertained to:

Table 1Format of Investigation for Lower Indus Project
<table><tr><td>Soils</td><td>Physical/ chemical characteristic soil fertility</td></tr><tr><td>Ground water</td><td>Present levels, trend of rise of water levels, water logging and salinity problem, quality of water and its suitability for irrigation use.</td></tr><tr><td>Surface supplies</td><td>Present position losses, possibilities of future development</td></tr><tr><td>Agriculture</td><td>Land use, cropping pattern, intensities yields, water requirement under different climatic conditions, implements, agriculture inputs and supporting services.</td></tr><tr><td>Human resources</td><td>Population, work labor, socio-economic condition.</td></tr></table>The plan provides for extensive remodeling of the canal systems and pumping of</td><td>Lower Indus Project investigation conducted in 1959 was an important task under taken by WAPDA through consultants for optional development of the Region and prepared comprehensive plan of intensive development of land and water resources. Later on the specific projects SCARPS and LBOD Stage 1 as indentified under plan have been implemented. The report, maps have provided good guidance for planning for phase II and III of Regional plan.</td></tr>
</table>

Table 4.1.1: Inventory, Summary and Assessment of Available Studies

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			fresh ground water for the increased supplies for the intensified cropping. The increased water applications to the land in turn make the planned provision of drainage essential even where salinity and water logging is not a prevailing problem. Where there is suitable aquifer and the ground water is fresh, increased irrigation supplies are provided by the installation of Tubewells pumping directly into the irrigation systems, these provide the required drainage where the ground water is saline and can not be reused for irrigation, Tubewells still provide the most economical method of drainage. The whole area was divided into four parts in following categories: 1. Perennial fresh ground water. 2. Non-perennial fresh ground water. 3. Perennial saline water. 4. Non-perennial saline water. Priority was recommended for the projects in fresh ground water areas, where Tubewells can be easily installed which will provide additional water for irrigation and drainage facility that can bring about large and early increase in agricultural production. The main objectives of the projects were to control the twin menace of water logging and salinity by lowering the water table.	
1984	Left Bank Outfall Drain\Stage 1 Project Preparation	WAPDA	Under Phase 1 of the LBOD works, an outfall was provided through remodeling a section of the existing Dhoro Puran, outfalling into Shakoor Dhand, a shallow depression of the Ran of Kutch. This outfall channel named KPOD was completed in 1979. At that time work on te spinal had reached RD203, the outfall of the LBOD Branch Drain, which in conjunction with its surface drainage network provided drainage for 226,000 acres of the Kotri irrigation command area.	Important document that provides an insight panorama of the design criteria and assumptions followed during the preparation of LBOD Stage 1.

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			Shortly after completion a severe local storm occurred in the catchment area; this was recorded at Badin as 241 mm in 24 hours. The DPOD discharged at a maximum of about 2000 ft^3/s and filled the Shakoor Dhand in about 30 days. Overspill into the Rann occurred at about 10.3 ft, but at this outfall level severe backwater problems developed in the DPOD and flow virtually ceased. Subsequently the DPOD was further enlarged to a rated capacity of 2,000 cfs under the Core Program. This discharge was however based on an outfall level of +6 feet and assumes a channel of greater hydraulic efficiency than that provided. Backwater analysis indicated that the drain would not be capable of passing 2,000 cusecs without adversely affecting the levels in the spinal drain upstream RD159. Under the Core Programme it was additionally proposed to build a bifurcation structure at RD159 in order to direct flows up to 2000 ft^3/s down the DPOD outfall and anything in excess of this into the existing SBBD/KPOD. This was, however, inconsistent with the Stage 1 requirements where it was considered necessary to prevent the saline base flow from the component project, from being discharged down the DPOD into India. In the case, it would be the DPOD which would receive the non-saline excess due to storm-water flows while the saline base flow would be confined to a remodeled SBBD/KPOD channel, enlarged to accept flows of approximately 2000 ft^3/s from the LBOD spinal drain. Under these circumstances drainage water entering DPOD would be maintained at a comparable salinity level and flow at a similar frequency to the original Dhoro Puran. The ecological and potential political problems of discharging highly saline waters into Shakoor Dhand and hence into Indian Territory would thereby be avoided. Bifurcation of the flows as envisaged under Stage 1 would be accomplished by constructing fixed weir head works structure across the Dhoro Puran Link channel,	Hydraulic and hydrology computations are presented and the assumptions and estimates –at that time- of the tides effects and discharges on the water level and hydraulic parameters used to predict the final water levels. The document also presents substantial topo survey information (cross sections, bench marks, L-sections, etc.) of LBOD, including the Tidal Link. Data about the water electric conductivity at different RDs was also measured and reported.

Table 4.1.1: Inventory, Summary and Assessment of Available Studies

Date of Study	Project Name	Agency Responsible (Donor)	Summary of Project	Comments/Assessment
			at the head of the DPOD outfall. This weir had been designed and would be included as part of the first year's construction. Construction should not commence however until the remodeling works on the SBBD/KPOD channels have been completed and the Pateji Dhand outfall was operational. The present SBBD, channel joins the KPOD at the point where the Fuleli Escape aqueduct crosses the drain alignment. As this location its design capacity was approximately 1051 ft^3/s. The KPOD continues to an outfall into Pateji Dhand, another shallow depression of the Rann, where its design capacity was increased to 1731 ft^3/s to account for drainage inflow from the Kotri command area. The Pateji Dhand is entirely within Pakistan and was estimated to overflow into the Rann at a level of about +3.5 ft. It was believed that the water level in the Dhand could rise to +8ft under severe monsoon conditions, but even under these circumstances the outfall would be more effective than the DPOD, where the level had to rise to about +10.3ft before spill into the Rann occurs. Both the Pateji & Shakoor Dhands lie within the western lobe of the Rann of Kutch, a vast area (20,000 km^2) of mudflats, with a general elevation ranging from 0-5ft, the majority of this area is in Indian Territory. The depth of water in the Rann, and its salinity level, varies depending on the season & the severity of the monsoon. Under normal circumstances the level would rise to a maximum after the monsoon, and then gradually reduce due to evaporation; in particularly dry years the Rann would be almost entirely evaporated and only a thick salt crust would remain. If during the monsoon, drainage inflows into the Rann are exceptionally high, spillage would occur into the tidal creeks bordering the SW corner of the Rann. A ridge of slightly higher ground (probably at about 6' elevation) normally severs this connection, and keeps the Rann entirely 'Land-Locked'. It was possible that monsoon spring tides spill into the Rann from time to time, but it was believed that this had little affect other than in extreme south westerly locations, and in any case was of very short duration.	

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			Under Stage 1 it was proposed that an interim outfall be provided for the remodeled SBBD/KPOD into Pateji Dhand; a bell mouth type outlet would be excavated in order to give a smooth transition between the channel & dhand bed levels and minimize backwater in the upstream channel. Drainage flows would spread out over the dhand and spill into the Rann where generally is disposed off by evaporation. When the component projects become fully operational it was intended that the remodeled SBBD/KPOD channel be extended 23.5 miles beyond the bell mouth to interconnect with an active tidal creek. Shah Samando Creek, which provided an outfall for the Jati Drain was the most suitable, lying totally within Pakistan, and the most accessible from a construction point of view. Water levels in the creek had been monitored during the study using an automatic recorder, and from the results it had been possible to predict the hydraulic behavior of the outfall channel under various conditions. Through the provision of a tidal outfall for the LBOD it was possible to make full benefit of the increased hydraulic gradient available at low tides and thereby 'flush-out' the system. The creek link would be protected from high Rann levels by bunds and could therefore function completely independent and avoid backwater problems during the monsoon season. Additionally, disposal directly into a sea creek avoided any possible ecological problems in the Rann overcoming the possibility of political repercussion.	
1986	Socio-economic Benchmark Survey1984 Ghotki Fresh Groundwater Project	WAPDA	The socio-economic Benchmark Survey of Ghotki Fresh Groundwater Project was the first survey of its kind to be undertaken by the Project Planning Organization (Southern Zone) WAPDA. The survey included the following: 1. Description of Project Area 2. Physical Infrastructure and Institutions 3. Demographic Characteristics	Important survey records documenting the conditions prevailing in 1986. The data will be used comparison purposes of the situation 25 years ago and today.

Table 4.1.1: Inventory, Summary and Assessment of Available Studies

Date of Study	Project Name	Agency Responsible (Donor)	Summary of Project	Comments/Assessment
			4. Education and Health 5. Hydrology 6. Present Agriculture 7. Land Tenure and Farm Holding 8. Typical Farm Budgets 9. Agriculture Processing Industries 10. Agricultural Credit and Co-Operatives 11. Supply of Basic Food	
1992	Lower Indus Region Right Bank Master Plan	WAPDA	The Right Bank Master Plan comprises a comprehensive regional plan for the integrated development of agriculture on the right bank of the River Indus in Northern Sindh. The study is concerned with the development of the Indus Irrigated area which at that time was 1.8 million hectare region irrigated by the right bank canals of the Sukkur and Guddu Barrages. The Master Plan is based on primary investigations and secondary data sources.	The Master Plan is specific to the Right Bank, but takes full account of National and Provincial policies, which become helpful for the WSIP-I Component C Regional Plan Left Bank Consultants.

Table 4.1.1: Inventory, Summary and Assessment of Available Studies

Date of Study	Project Name	Agency Responsible (Donor)	Summary of Project	Comments/Assessment
1994	Feasibility Study SCARP GHOTKI (Saline Zone)	WAPDA	The Study Area, located on the left bank of River Indus, in northern Sindh was defined as that part of the area commanded by the Ghotki Feeder Canal from Gudu Barrage underlain by saline groundwater. Using mapping prepared by the Consultants from SPOT satellite images at 1/ 50,000 scale the Study Area was 222,000 ha out of a GCA of 399,000 ha, the remaining 177,000 ha being considered as the Fresh Groundwater Area. Water logging and salinity were the main problems faced by farmers and which depress crop yields and farm incomes. Some 80% of the soils of the Study Area were saline and 60% require leaching. Groundwater levels were close to the surface with 82% of the area less than 1.5 m deep in October 1990 and 15% less than 1.5 m in April the same year, with 77% between 1.5 m and 3 m at the end of the Rabi season when water tables were at the lowest level. Later data shows little change. The aim of the Study was to determine the extent and magnitude of these problems and to propose methods of removing the constraints imposed by water logging, soil Stalinization, improper water management and the basic agriculture services so that the highest possible agriculture production could be achieved with the available water and other resources. The terms of reference recognized that effluent disposal would be a major development limitation and the following four alternative methods of disposal were evaluated. • The River Indus • The Nara Canal • Evaporation ponds in the Thar Desert • The Left Bank Outfall Drain in Lower Sindh (LBOD)	The feasibility study started in April 1992 and concluded in September 1993, 18 months later. It studied the needs for surface and subsurface drainage of the Ghotki area. Even though the study was done at feasibility level, it had enough detail to be easily converted it into a final design in the early 90s. Since the study was prepared about 18 years ago it needs to be updated if it is to be implemented. In 18 years the population has substantially increased (it is said that Pakistan doubles its population about every 25 years) and the socio-economic feasibility must be thoroughly revised. The environmental impact also needs to be revised and updated since the standards have changed since the

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			With drainage from Saline Zone tube wells, the River Indus and Nara Canal alternatives were excluded since both would render the mixed water unusable for irrigation downstream. The Thar Desert evaporation pond solution met with objections of an environmental nature from Sindh Government Organizations and people in the Study Area. the Consultants considered valid this concern following experience at SCARP VI in southern Punjab and the lack of adequate research and monitoring of the method. The LBOD was not likely to be a viable alternative conveyor for the Study Area drainage water for many years but its future use had not been excluded. Tube wells although significantly cheaper at that time, [4,600 Rs/ ha than 30,000 Rs/ ha for pipe (tile) drains], were not considered further for drainage of the Saline Zone due to the lack of suitable methods of effluent disposal. The Nara Canal received surface water drainage originating in the Study Area from the Karo Naro (an improved natural drain), at an average electrical conductivity of 2,000 µS/ cm. the Study had shown that much of the Saline Zone could be surface drained by gravity to the same outlet and could in future be connected to the LBOD, north of Khaipur. Disposal to the River Indus near Rohri would have added greatly to the capital costs and incurred the cost of continuous pumping of the Karo Naro flow from near Sanghar to the Indus and therefore was discarded. While discharge of drainage water to the Nara Canal would have raised the salinity of the canal water, the increase was not expected to significantly affect downstream users or wildlife. Since highly saline tube well drainage effluent from the Study Area could not be disposed of an environmentally acceptable way, the Consultants considered a number of alternatives taking the prevalent level of agricultural production to a modestly improved "with project" level of yield. Tile or horizontal pipe drainage was an effective but expensive method of lowering the water table in agriculture areas which involved pumping water from a system of buried laterals and collectors in to a surface drainage network. Two alternatives (I	early 90s. Due to the population growth, some of the land use might have also changed. The cropping pattern needs to be updated as well. The water table depth fluctuations need to be investigated, but the hydro-geological parameters should remain unchanged, as well as the soils and general topography of the terrain. The information provided about the water salt content is important to better predict the conditions that might prevail 18 years from now.

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			and II) were presented using this approach. Alternative I was to provide tile drainage over 140,000 ha but since this was unlikely to be affordable, a more modest, Alternative II, which concentrated the drainage effort on the area most affected by high ground water levels (25,000 ha) was recommended (Alternative II). Alternative II includes that part of the surface drainage network, from the Nara canal to Khanpur, an OFWM and an agro-drainage component. This was the "project" Phase-I. The surface drainage under Alternative II would need to be extended and enlarged in later phases to cover the remainder of the Study Area which would then enable tile drainage to be added later should this be required. The consultants recommended Alternative II since it would have had an early effect on ground water levels and crop yields, giving time to assess of the performance of horizontal pipe drainage and possible less expensive alternatives.	
1994	Nara Canal Remodeling Panel of Experts (POE) reports	Sindh Irrigation and Power Department	**Nara Canal Remodeling Works- Action Plan** **Purpose** This Action Plan provides proposals for implementing works and monitoring/ investigations to achieve the project objectives: i. To increase the Nara Canal discharge capacity (measured at the head works) from 13500 cusecs to 20000 cusecs; ii. To control the amount of sediment currently passing to the Jamrao Canal and other parts of the Nara Canal system to acceptable levels; and iii. To secure/ safeguard the stability of the Canal. **Scope of Remodeling Works**	**Fall Structures on Nara Canal** **Studies** ACOP (1983) recommended regime equation which gave a water surface slope of 0.000105 for peak discharge of 20,000 cusecs. To achieve this four fall structures were proposed at RD_I 14.5 RD_I 140

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			The proposed remodeling works comprise: i. Construction of fall structures at Nara Canal discharges RD 25 and RD 135 (Contract Nr W70. WB1A). ii. Planning and undertaking the minimum necessary excavation/ dredging of the NARA Canal consistent with maintaining the Canal water surface at a level generally no higher than 1 to 1.5 ft above local ground level. It is, however, and recognized that lower levels at peak design discharge are desirable, that locally, and in some reaches, higher levels may prove acceptable, and in places unavoidable. iii. Undertaking appropriate monitoring and investigatory works with formal periodic review. iv. Identification of the need for any additional works arising in the light of monitoring and investigation activities, conforming if such works are justified, and implementation where required. v. Upgrading and re-sitting of inspection and non-inspection paths to improve access and, where appropriate and necessary, to allow ponding of Canal water against the path embankments. Re-sitting will be required in places to provide sufficient reservation to accommodate the meander belt-width. vi. Provision of materials (e.g. stone) and the storing of these in strategic depots along the Canal for use for emergency or other maintenance requirements of the Nara Canal. vii. Provision of protection works, as required, to banks where erosion threatens villages or, where appropriate, substantial erosion threatens and dunes or other features.	RD_I 400 RD_I 540 MMP (1984) recommended that fall structure at RD, 140 may be dropped to reduce the cost and as such other structures were repositioned at RD 14.5 RD 418.5 RD 583 LBOD Consultant Designs were tendered in the first half of 1994 as one contract (comprising dredging/ excavation, construction of six fall structures and also including the Ranto Canal Works). The impact of having variously three, four, five and six fall structures was investigated in both technical terms and regarding associated costs. Six fall structures were

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Date of Study	Project Name	Agency Responsible (Donor)	Summary of Project	Comments/Assessment
			viii. Provision of protection works to road bridges and other crossings including raising of bridge decks, provision of guide banks and other related work. **Nara Canal Action Plan** **Available Options for Excavation/ Dredging** The proposed future development of the Nara Canal is broadly along the lines of undertaking the minimum possible excavation from the channel section and allowing natural scour to remove the balance required to safely pass a 20000 cusecs peak discharge. As part of this approach, there is to be an appreciable monitoring effort aimed at obtaining a better understanding of the morphology of the Nara Canal and how this varies over time and particularly establishing the impact of changes induced by remodeling works. The later will enable the remodeling to be refined to achieve the objectives defined in the previous paragraph. In the cases which follow, it has been assumed that particular work is done in the 25 RD immediately upstream of the inlet channel to the Jamrao and Twin canal regulators. For present purposes this is a nominal distance which is to be refined. **A. <u>Option CA1: Conventional Admeasurement Approach (Biased Towards Land-based Plant)</u>** Prepare tender documents based on fully defining, through presentation on drawings, the scope of works. Prepare standard admeasurement form of Contract. ***Structure/ Components***	located at RDc 25 RDc 135 RDc 335 RDc 395 RDc 462 RDc 555 Due to cost limitation construction of two fall structures at RD 25 and RD 135 was taken up in first contract under LBOD Stage-1 Project and structures were completed for control of scouring in the upper reach of the canal. **Review by Panel of Experts (POE)** **Report No 1** POE recommended that hydraulic model studies for Nara head regulator Railway Bridge RD 13 and Fall Structures at RD 25 and RD 135 should be carried out.

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			Dredge/ excavate to previous design profile (as for 6-fall tender drawings) reach of length 25 RD terminating at junction with feeder channel to Jamrao/ Twin canals. Upstream limit called PTE (pond top end). Using land-based plant widen channel upstream of PTE, excavating sufficient material to raise embankments to desired levels. Any additional excavation upstream of PTE to be dredged; Dredger to be stationed downstream of PTE to remove material deposited accruing from disturbance and normal morphological processes upstream. **B. <u>Option CA2: Conventional Admeasurement Approach (Biased Towards Dredging)</u>** Broadly as CA1, except emphasis on dredging rather than land-based plant. ***Structure/ Components*** Dredge/ excavate to previous design profile reach of length 25 RD terminating at junction with feeder channel to Jamrao/ Twin canals as for CA1. Using dredgers upstream of PTE to excavate sufficient material to lower design water surface to desired level. Emphasis will be on dredging in the central portion of the channel. Dredged material to be placed in temporary stockpiles and then used in construction of embankments, using additional material excavated by land based plant to provide engineering needs. **C. <u>Option DQ1: Defined Quantity Approach</u>**	**Report No. 2** POE reviewed the progress and fixed priority to the fall structure RD 25 and to be followed by the study of the fall structure RD 135 **Report No. 3** POE reviewed the progress of fall structure RD 25 and RD 135 and finalized the revised design and noted very slow progress. **Report No.4** POE recommended that important factors to reconsider in the option of eliminating the proposed fall structure at RD 139 will be the redesign of fall structure at RD 26, which is already under construction. The proposed structure at RD 139 is an integral part of Nara remodeling scheme and it

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			Object is to define a minimum quantity of material requiring excavation by dredging. Location of excavation will be broadly defined and subject to review during period of excavation. ***Structure/ Components*** Dredge/ Excavate to previous design profile reach of length 25 RD terminating at junction with feeder channel to Jamrao/ Twin canals. Upstream limit called PTE (pond top end). Upstream of PTE, material will be removed from a pilot channel following the central portion of the existing channel. A minimum volume to be excavated (by dredging) will be defined by reference to providing a general channel section of nominal capacity. This will be less than the total estimated excavation quantity required to provide an initial capacity of 20 000 cusecs. The intention is that natural and induced erosion will further remove material during the period of dredging thus minimizing the volume of material removed by mechanical means. Land-based plant would remove additional material as required to form the inspection/ and non-dredger to be stationed downstream of PTE to remove material deposited accruing from disturbance and normal morphological processes upstream. **D. <u>Option SR1: Schedule of Rates Approach</u>** Predominantly dredging, with possible some land-based plant. Works measured under a Schedule of Rates. ***Structure/ Components*** Dredge/ Excavate to previous design profile reach of length 25 RD terminating at junction with feeder channel to Jamrao/ Twin canals as for CA1.	should be built as designed. Two fall structures at RD 26 and RD 139 were completed under LBOD Stage – 1 project. **Present Status** SIDA has awarded contract for construction of Fall Structure at RD 335 under PSDP Scheme financed by Government of Pakistan Under WSIP procurement in process for award of contract for construction of fall structure at RD 550 Two fall structures on RD 26 and RD 139 has been effective to control scouring in the upper reach of the canal. Construction of other fall structures at RD 335 and RD 550 would improve canal performance and reduced problem of silt

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			Using dredgers upstream of PTE to excavate sufficient material to lower design water surface to desired level. Dredged material to be placed in temporary stockpiles and then used in construction of embankments, using additional material excavated by land based plant to provide engineering needs. **E. <u>Option PC1: IPD to Procure Dredger and Engage Operator</u>** IPD to purchase one or more dredgers (4 maximum) and to engage a contractor to operate the dredgers. Works would be predominantly dredging, with possibly some land-based plant. Works measured under a Schedule of Rates plus time-based component. ***Structure/ Components*** Procurement of dredgers. Dredgers to be operated by a contractor undertaking specified works. Contractor would be responsible for purchase of all consumable items, spare parts and for providing a major overhaul to the dredgers prior to handing over an IPD at the end of their contract. Land-based plant would be provided by the contractor. Physical works to be as described under DQ1. Because of need to do both dredging work and land-based activities, work could be let us two separate contracts, or substantial sub-contracting may be necessary. Possibly a joint venture might be the most appropriate arrangement.	load in the Nara Canal system

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1995	Feasibility study National Drainage Program	WAPDA	Chronic problems of implementation, operation and maintenance, management, fiscal, social and environmental were experienced in the Drainage Sector. To tackle these problems more effectively with involvement of end beneficiaries and all stakeholders a program approach was introduced under National Drainage program (NDP), a new approach was developed integrating all important factors considered to contribute for realization of objectives. New interventions proposed were 1. Shift from project formulation to program approach to allow freedom of re-adjustment. 2. Improve O&M through farmer and private sector participatory management. 3. Improve monitoring and evolution of drainage Schemes and long term research in drainage. 4. Undertake policy and institutional reforms including strategic review of key drainage institutions. 5. Promote investment in drainage to rehabilitate the existing facilities expedite completion of priority works. 6. Revisit completed projects and remove short falls in order to improve efficiency. 7. Endeavour to achieve a desirable salt balance in the root zone. And more towards achieving balance between the salt coming into the System and going out to the Sea at basin level. 8. Improve knowledge base of Water Sector institutions through research and training.	A very comprehensive analysis of the drainage situation in Pakistan during the early 90s. It contains a good analysis of the institutional/administrative structure of the drainage component of the different agencies that deal with drainage. Includes a chapter on the private sector participation in drainage, where emphasizes the need of consultation for drainage systems beneficiaries involvement. The report identifies and estimates the cost of implementation of a number of potential drainage schemes in Sindh, which should be very useful for the Regional Plan Consultants Phases II & III.

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1996	PC-1 Form (second Revision) Left Bank Outfall Drain Stage-I	WAPDA	PC-1 document that originated the LBOD Stage-I Umbrella Project. It contains the Tidal Link; KPOD & DPOD Remodeling; Nara System Remodeling and; Chotiari Reservoir	Important document that helps understand the concepts and ideas that conceived LBOD.
1998	Chotiari Reservoir Project	Independent Study	The Chotiari Reservoir Project was part of the Left Bank Outfall Drain Stage-I (LBOD), located near Sanghar in the Province of Sindh. Financial assistance was provided by a group of donors led by the World Bank that included IDA, ADB, ODA (now DFID), OPEC, Swiss Development Corporation (SDC), Saudi Fund for Development, Islamic Development Bank (IDB) and CIDA. The Chotiari Reservoir was designed to increase the storage capacity of lakes in the area in order to increase the irrigation drainage for agriculture in the Umerkot district, further southeast to the site. This would be achieved by constructing Makhi-Farash link which will allow restoration of the original 1932 design supplies to the areas lying east of Mirpurkhas fed from the tail of lower Nara Canal. The capacity of the reservoir would be increased to retain 0.95 MAF (million acre-feet) of water, flooding an area of approximately 100 square miles. At full supply level, the surface area of the reservoir would increase 2.5 times its present capacity, inundating 46 villages and 45,000 acres of land. The rough calculation revealed at that time that more than 50% of total affectees would have been women. Vast tracts of grazing land would be affected after the construction of this reservoir. The loss of productive cultivated land would not only cause a significant impact on the agricultural output of the area but would also severely disrupt the socio-economic lifestyle of the communities.	The report analyzes the environmental, social and economic impacts of Chotiari Reservoir Project. One important issue the report mentions is the problem with the land compensation to the affected farmers and the suitability of the resettlement site.

2000	Proceedings National Seminar on: Drainage in Pakistan	WAPDA MUET IWASRI IIMI	Thirty six papers related to drainage in Pakistan were presented in the seminar: 1. On-Farm Tile Drainage With Farmers Participation: Past Experience and Future Strategies 2. Institutional Reforms in Water Management 3. Farmer's Participatory Drainage (Pilot Programme) in Fordwah Eastern Sadiqia South (FESS) Project, Phase-I 4. Participatory Drainage and Groundwater Management Unit Punjab Private Sector Groundwater Development Project 5. Farmer Organization's Potential for Reducing Water logging and Salinity Through Improved Equity and Reliability of Irrigation Water: Evidence from Hakra 4-R Distributary in Southern Punjab 6. Sustainability of Community Tubewells: An Experience of SCARP-I 7. Farmer's Participation in the Irrigation and Drainage Management: A Case Study of SCARP North Rohri Transition Pilot Project in Sindh 8. Biological Drainage Prospects of Trees as Biological Pumps in Saline and Waterlogged Environment 9. Groundwater Management and Areas in Need of Drainage: Modeling Approach 10. Impact of Surface Drains on Watertable Behavior 11. Bio-Drainage: An Option for Control of Water logging in Pakistan 12. Operation and Maintenance Cost of Drainage System: The Case Study of Bareji Distributary, Mirpurkhas, Sindh, Pakistan 13. The Role of Farmer Organizations in Operation and Maintenance of	The papers presented provide excellent background and opinions to be considered by the WSIP-I Component C Regional Plan Left Bank Consultants.

			Irrigation and Drainage systems 14. Drainage Effluent Disposal and Its re-Use in Agro-Forestry 15. Utilization of Brackish Waters for Reclaiming Different Textured saline-Sodic Soils Having Different EC to Sodium Adsorption Ratios 16. Reuse of Drainage Water for Irrigation 17. Using Municipal Wastewater For Irrigation: Environmental Hazard or Opportunity 18. Freshwater Lens Behavior Under Scavenger Well Operation 19. Calibration of Computer Model for Management of Saline Water Use for Irrigation 20. Perspective on Cropping Pattern and Soil of the Baregi Distributary Command, Mirpurkhas Component, LBOD, Project 21. Concentration of Cd, Co and Mn in Soils and Vegetables Irrigated With City Effluent 22. Surface Drainage Outfalls in Lower Sindh Area 23. EM bio-Generator for Amending Sodic Groundwater 24. Use of Brackish Drainage Water Effluent For Agriculture and Forestry 25. Variation in Water Quality Assessment of River Indus from Kotri Barrage to Arabian Sea 26. Use of Brackish Drainage Water Effluent for Crop Production 27. Measures to Control, Improve and Live With Soil Salinity in Irrigated Areas 28. Effect of Shallow Drainage on Crop Water Requirements	

			29. Evaporation Ponds: Drainage Effluent Disposal Experience 30. Environmental Study of Sea Water Intrusion Around Tidal Link 31. Field level Surface Runoff Process in Irrigated Rice Areas 32. Performance Evaluation of Surface Drains in LBOD Project Area: A Case Study of Spinal Drain 33. Analysis of Environmental Land Degradation in the Semi-Arid Region of Faisalabad using Remote Sensing and GIS 34. Chemical Assessment of Water Quality of Rbod Project From Shahdadkot-Mirokhan Drains to Kotri Barrage 35. Impact of Scavenger Wells on Agriculture Around Khadro 36. Options to Reduce Drainage Requirements In Pakistan	
2001	Rehabilitation/ Remodeling of Fuleli Guni Surface Drainage Project (Off-Farm Component) Feasibility Report	SIDA	Fuleli Guni Drainage System is primarily meant for providing drainage facilities to a major part of Fuleli Guni Canal command which carries a discharge of about 425 cumec (15,000 cusec). The system was commissioned in the early 1960s and expanded thereafter, in accordance with the new requirements and public demands. At the time the study was conducted, the network comprised a main outfall drain having three major systems and five sub-drains directly falling into the main channel. The entire system comprised over 50 drainage channels with a total length of 537 kilometers which drain an area of nearly 2,102 sq km. It was concluded that regardless of the existence of a large drainage network, the area was not being drained satisfactorily. This indicated that either the system was insufficient or inefficient. As the surface drainage system had been designed for disposal of surface runoff from rainfall as its major component, possible reasons and factors affecting the drainage system were examined. Reasons for Remodeling:	Fuleli Guni Surface drainage system has been rehabilitated under National drainage Program. System has been restored in original condition to provide drainage facility for command area 2, 102 sq km. The efficiency of the system will depend on the operation and maintenance arrangement. Disposal of effluent from sugar mills in the Fuleli Guni system is the major

			• Drainable Surplus from Irrigation System • Addition of New Drains & Extensions • Siltation of Drain Channels • Weed Growth/Vegetation • Low Level Structures • Improper Outfall Condition • Water Levels in Mehro Dhand • O&M Constraints - Lack of O&M Funds - Lack of O&M Staff - Logistic Problems Base cost of the project (earthwork and structures), based on the GOS 1995 schedule Rates, was Rs 302.48 million, whereas the total project cost comes to Rs 343 million. The annual operation and maintenance cost was estimated at Rs 6.05 million (2% of civil works cost) for first year, and Rs 12.10 million (4% of civil works cost) per annum thereafter through its active economic life which is assumed to be 30 years.	concern affecting aquatic life in the Dhands. This issue will be addressed by the Regional plan consultants.
2001	National Drainage Programme Sub-Project Appraisal Rehabilitation/ Remodeling Of East Kadhan Pateji Outfall Drainage	SIDA	Sindh Irrigation and Drainage Authority (SIDA) identified a surface drainage scheme in Kadhan area of District Badin, Sindh in October 1998. Initial screening was made in April 1999 and thereafter a concept paper was prepared. The concept paper proposes the sub project to be bifurcated into two separate schemes, the West Kadhan Pateji Outfall Drain (WEST KPOD) and the East Kadhan Pateji Outfall Drain (EAST KPOD). This appraisal of East KPOD consisting of six surface drains and two link drains and including brief agricultural, environmental, social, engineering and economic studies, is prepared to evaluate the feasibility of the scheme as per NDP eligibility criteria.	Rehabilitation of East Kadhan Pateji outfall drainage system has been completed under National drainage program. Original capacities of drains have been restarted to provide drainage facility. Tidal effects in the drainage system are major concern that will be addressed by the Regional plan consultants under

	System District Badin		The project was formulated to provide efficient drainage to the project area. This would reduce water logging and salinity problems and would improve crop production. Socio-economic and environmental conditions were also expected to improve. The project consists of six drains (3-R, 4-R, 5-R, Khadan, Bahadmi and Jhanjhli) flowing parallel to the irrigation canals, from North to South and with outfall into KPOD. The command area of East KPOD lies within that of the Akram wah (lined channel). The catchment area of Bahadmi drain lies between Ganj wah and Mor minor. The catchment of 3-R drain is within the command of Raj wah and some portion of the command of Kazia wah. The catchment of 5-R lies between Suni Guni and Sher wah. The details are shown in the layout map Figure 1.2. The KPOD was remodeled in 1990 with a design discharge of 2,120 cusecs inflow from the spinal drain and 1,000 cusecs discharge from the existing drains, as against the previous design discharge of 1,217.5 cusecs. Before the remodeling of KPOD, the overall flow was out falling into the Pateji Dhand. It then spread over a large area towards the Rann of Kutch. The KPOD is now linked with the Arabian Sea at Shah Samado Creek through the Tidal Link. During the remodeling of KPOD the existing outfall drains were not remodeled to accommodate new discharge conditions. KPOD was widened to about 170 ft from 80 ft. (top width) while the depth increased from 7 to 13 ft. Hence the water level was disturbed and the gravitational flow mechanism of the system changed, resulting in back flow in most of the drains. Seawater intrusion extends up to RD 85+00 of KPOD as stated by WAPDA. The drainage scheme was designed so the drains are capable of conveying the design discharge (probability of occurrence from 1 to 5 years) with a coefficient of 2.9 cusecs/ sq. mile. During the design of the drains the value of the roughness coefficient (n) is taken as 0.025 and the maximum water level of the KPOD was considered as the controlling point i.e. slope(s), bed width (B) and depth (d) of the drains have been adjusted accordingly.	phase II and III.

Economic costs of the project include the biological drainage component, social mobilization cost, engineering and administration cost and physical contingencies. Total Economic Cost amounts to Rs. 40.33 million. Details are given below :

Economic Cost of the Project	Amount (million Rs)
Base Cost	37.14
Biological Drainage Component	0.75
Social Mobilization Cost	0.37
O & M Cost	0.74
M.E @ 2.5%	0.93
Sub-Total	39.93
Physical Contingencies 1%	0.40
Total Project Cost	40.33

2001	Rehabilitation of LBOD Branch Surface Drainage System District Badin	SIDA	The Sindh Irrigation and Drainage Authority (SIDA) / Irrigation and Power Department (IPD) proposed Improvement of LBOD Branch Surface Drainage System for appraisal, design and supervision of implementation under the NDP. During the study it was observed that while some sections of drains are in good condition others are 30% or more silted up and require remedial action. The condition of the drains was in general poor. Because of lack of maintenance. The condition of structures was also very poor, especially of those in the sub-drains. Because of the proximity of the sea, the weathering effect was severe. The drainage system comprises LBOD Branch drain and 18 No. sub drains. It was constructed and maintained by WAPDA from 1975 until 1984, when it was handed over to IPD. IPD maintained the system from 1984 until 1995; it also extended the LBOD Branch Drain from RD 132 to 144. The system was once again transferred to WAPDA in 1995, to be re-taken again by IPD in February 2000. Project Cost Rs. 77 million (Off-farm component) O&M Cost Rs. 4.53 million p.a.	Appraisal report was prepared by the consultants however it was not cleared by World Bank due to incomplete study of the environmental aspects as such the rehabilitation of drainage system was not completed under National drainage Program. Scheme would be taken up under phase II and III of Regional Plan.
2001	Rehabilitation / Remodeling of West Kadhan Pateji Outfall Drainage System District Badin	SIDA	In 1967 the Govt. of West Pakistan approved a surface drainage scheme Phase-I which included the entire area of Kotri command as well as the area lying below the Hunting line. Under this scheme, the construction of surface drains started in different stages and was completed up to June 1998. The network of surface drains in the Kotri Barrage command area were constructed in the year 1968-69 in order to prevent water logging and salinity problems in the area. The existing drainage system identified as West Kadhan Pateji Outfall Drainage (KPOD) system, comprises two drains; Sirani Branch drain (120 RDs) and 2R sub-drain (52 RDs) which ultimately dispose of surplus water into the sea through the Tidal Link constructed under LBOD Stage-1 Project. These drains are located between the command of two major canals of Kotri Barrage i.e. Phuleli canal and Akram wah. The existing system in 2001 required rehabilitation and remodeling of the drains and pertinent structures. It was proposed	Rehabilitation of west Kadhan Pateji outfall drainage system has been completed under National drainage program original capacities of drains have been restored to provide drainage facility. Tidal effect is major concern that issue will be addressed by Regional Plan consultants under phase II & III.

			that the open surface drains would be remodeled in order to meet the drainage requirements of the area. It was also proposed to construct a new gated structure at the outfall. New storm water inlets will be provided at natural depressions to drain the surface run-off efficiently. The rise in water level of KPOD due to the tidal effect caused back flow water into Sirani drain and 2R sub-drain, which resulted in the intrusion of saline water into the drain. To overcome this problem it was proposed that the embankments would be raised above the design backwater levels and gated drain inlet structures will be provided at low areas. The project consists of two drains (Sirani and 2-R) flowing parallel to canals, from North to South and with outfall into KPOD. The command area of west KPOD lies between Mir wah and Qazia wah (lined channel) .The catchment area of Sirani drain lies between Mir wah, Qazia wah and its off taking channel Guraho wah. The catchment of 2R sub-drain is within the command of Qazia wah and located between Guraho wah and Noor wah. The drainage scheme is so designed that the drains are capable of conveying the design discharge (probability of occurrence from 1 to 5 years) with a coefficient of 2.9 cusecs/ sq. mile. At present, the water levels in Sirani and 2R drains at the outfall are 3.95 ft. and 2.4 ft. During the design of the drains the value of the roughness coefficient (n) is taken as 0.025 and the maximum water level of the KPOD is considered as the controlling point i.e. slope(s), bed width (B) and depth (d) of the drains have been adjusted accordingly. The “Rehabilitation of West Kadhan Pateji Outfall Drainage System” envisages provision of a rehabilitation facility to the project area with a base cost of Rs 19.17 million. The total capital project cost is Rs 20.33 million. The annual recurring operation and maintenance cost is estimated to be Rs 0.41 million throughout the sub-project’s active economic life which is assumed to be 30 years.	

2002	Bed Level Survey of LBOD Tidal Link, KPOD, DPOD and Shah Samando Creek at Outfall of Tidal Link by Echo-Sounding	WAPDA	The area around Tidal Link Drain of LBOD in general and Shah Samando Creek in particular is part of Indus Deltaic Region. The morphology and hydrodynamic conditions of the Tidal Link Drain and adjacent areas has changed considerably since the area was hit by the devasting "Cyclone 2A". The major morphological changes effected by the "Cyclone 2A" include damage to the embankment by opening of the passage (through several breaches in the Tidal Link Drain, both at the Northern and Southern embankments). The main objective of Bed Level Survey of Tidal Link Drain LBOD, KPOD, DPOD and Shah Samando Creek at the outfall of Tidal Link Drain was to re-evaluating the Drain depth and its bottom configuration. This was achieved by determining both the X-Sections between the predetermined RD's and longitudinal bathymetric survey. The high tidal ranges (~4.0m) during the south west monsoonal period in the LBOD system, coupled with fast ebb and flood currents, may caused excessive erosion of not only the bottom topography of the drain but also scouring of the embankments. The present bed level survey would help better understand the dynamic processes involved in evaluating the deterioration of the bottom configuration of the Drain and the erosional process that occurs during the fast moving high energy ebb and flood tides. The erosional forces compounds by the impact of "Cyclone 2A" on the Tidal Link Drain and Dhoro Puran Drain have played havoc with the tidal link system.	The study observed that the embankments, both Northern and Southern were severely eroded. It reports that in some places the width of the drain had increased to 100 m. Severe scouring was reported at the Tidal Link bed, from 3 to 8 meters. The report mentions that the DPOD width had also increased about 30 m.
2003	Pre- feasibility Study National Surface Drainage System	WAPDA	A Pre-feasibility study was carried out under NDP to study the technical, economic and environmental aspects of the National Surface Drainage System (NSDS). The objective of the NSDS was to collect and dispose surplus saline effluent, primarily from the upper Indus Basin to the sea. It envisaged an interconnected system of outfall drains traversing the entire Indus Basin Irrigation System (IBIS). Total length of drains as proposed in the pre feasibility was around 910 miles (1,464 km), and total discharge of Systems 2,004 cusecs and the area served was 2.1 Ma. The estimated construction cost was Rs 33 billion. An international Panel of Experts (IPOE) was constituted jointly by the World Bank and Netherlands Water Partnership Program (BNWP) to carry out a careful review of the Pre-feasibility study of the NSDS before proceeding to the envisaged next phase of preparing a feasibility report. The plans for this Out Fall Drain were reviewed by IPOE, which concluded that need	Under pre-feasibility study Trans Boundary outfall Drain was recommended for safe disposal of drainage effluent collected from upper Indus Basin. The alignment of the drain was proposed to pass through Thar desert and outfall in KPOD. IPOE recommended postponement of feasibility study.

			was not urgent. This conclusion was widely shared and the data provided in Drainage Master Plan provided even stronger support to this conclusion. There fore IPOE recommended that Trans Boundary Out-Fall Drain (TBOD) may not be considered any more.	Stakeholders rejected the proposal and accordingly IPOE recommended that TBOD should not be considered any more. Due to severe deficiencies in LBOD outfall systems addition of any other outfall drain would increase the problems in LBOD outfall system.

2003	Diagnostic Study Water Management of the Left Bank AWB	SIDA	The IRC Consultants carried out a 'Diagnostic Study Water Management of the Left Bank Canal AWB' which included recommendations with respect to water management practices at AWB level, compliant with the Water Reforms currently implemented in Sindh. The study includes an analysis of the current situation in the AWB; recommendations to adjust the irrigation and drainage infrastructure to the needs of the FOs and the new AWB; improved water management functions of the AWB With the infrastructure and water management functions redefined; necessary changes of the organizational structure of the AWB and very tentative estimates for investment - and recurrent costs. The principal findings of this study relating to irrigation and drainage infrastructure are summarized below: 1. Insufficiency of canal capacities: This is caused by the heavy sediment load especially during Kharif and the deferred of maintenance. 2. Impact of direct outlets and tampering of structures: Direct outlets escape from any control through rotations and are mostly tampered to increase discharge way beyond the authorized level. This makes it very difficult to supply irrigation water to tail end users. 3. Insufficiency of drain capacities is caused through lack of maintenance. 4. Tidal influence occurs along the downstream reaches of the KPOD. 5. Lack of drainage infrastructure in the area irrigated through the Matli and Murad Wah branches. 6. Funds available for maintenance are insufficient. 7. The available funds are not allocated under objective allocation criteria. 8. Routine maintenance gives insufficient results. 9. Office equipment (computers, printers, faxes, copiers, etc.) are insufficient 10. Water management equipment (flow meters, EC-meter, etc.) is insufficient 11. Transport facilities and POL are insufficient 12. Communication facilities are insufficient 13. Funding of operations is insufficient.	Very important studies which address the issues of irrigation water management, reforms in AWB and suggest changes in organization structures of AWB. The finding of study provides very important input regarding the problems of operation and maintenance of irrigation and drainage infra structure which provides good guidance for addressing issues and problems in left bank canal AWB.

2004	Physical Monitoring Left Bank Outfall Drain Stage I Project Under National Drainage Programme	WAPDA	WADA collected from 1999 to 2004 the following data: 1. Groundwater Table Monitoring 2. Hydrologic Monitoring of Drainage and Scavenger Tubewells 3. Interceptor Drains Monitoring 4. Tile Drains Monitoring 5. Soil Monitoring 6. Water Quality Monitoring 7. Performance Test of 444 Drainage Tubewells installed in Mirpurkhas Component of LBOD Stage I Project area. 8. Water quality of the above said tubewells 9. Soil sampling of the above area. 10. Observed depth to Water table for installing piezometer pipe of the said area. 11. Detail monitoring and survey of Chotiari Reservoir discharge, water quality and environmental studies of the area. 12. Depth to water table survey of the Chotiari Reservoir area for installing lines of piezometers. 13. Detailed Monitoring of Tile Drain by installation of piezometers close to the drain to find of the impact of filter efficiency of the tiles. Soil type and its physical chemical characteristic considerably affect the design and drainage efficiency of the drain. 14. Detailed Monitoring of Interceptor Drain by installation of piezometers close to the drain to find of the impact of filter efficiency of the interceptor drain. Soil type and its physical chemical characteristic considerably effect the design and drainage efficiency of the drain.	Very important information collected by WAPDA from 1999 to 2004. The data will be used by the WSIP-I Component C Regional Plan Left Bank Consultants.

2004	Review Report: International Panel of Experts (IPOE) on Drainage System	World Bank	The draft report of DMP was reviewed by an International Panel of Experts (IPOE) in September 2004. The IPOE did not support the concept of Trans Basin Outfall Drain (TBOD) presented in the DMP IPOD recommended that TBOD may not be considered any more. The IPOE recommended the DRAINFRAME approach to provide a structuring mechanism for integrated analysis of water resource management issues in drainage basins, and as a means to establish linkages to socioeconomic values and consequently to stakeholders. The IPOE concurred with the preparation of the separate Drainage Development and Water Management Plans (DDWMPs) proposed in the DMP for the 20 identified drainage basins, and recommended Kotri Left Bank Drainage Basin (KLBDB) in Sindh and the Chaj Drainage Basin (CDS) in the Punjab as the first two basins for the development of these plans through the application of DRAINFRAME concepts. During the visit to Sindh, the IPOE held meetings and workshops at Karachi, Hyderabad and Badin. The area of Kotri Left Bank Drainage Basin was visited. Based on these activities the following observations were made by the POE: (i) drainage issues play an important role and are heavily debated in the area; (ii) there are surface irrigation and drainage systems throughout more or less the whole area. However, the density of the drains is relatively low to meet the demands; (iii) the drainage system does not include on-farm drainage and has not been designed for multifunctional use (e.g. cattle drenching, reuse); (iv) a number of the drainage systems are being rehabilitated under the NDP; (v) a good record is available of the alignments, dimensions and design criteria of the irrigation and drainage systems; (vi) there is a considerable potential of drainage water reuse; (vii) the water sector reform is accepted, but the implementation will need more time than originally envisaged. The new organizations: Area Water Boards (AWB) and Farmers Organizations (FO) would have to play an important role in the water management in their areas, but their capacities are still weak; (viii) the importance of an integrated basin approach is broadly accepted; (ix) Sindh Province wants to take the lead in the preparation of the DDWMP for Kotri Left Bank Drainage Basin; (x) plans need to be developed in intensive consultation with the local communities, and need their consent prior to implementation. The IPOE recommended development of a DDWMP for the Kotri Left Bank Drainage Basin on a DRAINFRAME-type of approach. In the development of this plan the Provincial Irrigation and Power Departments (IPD) would have to play the leading role jointly with the Sindh Irrigation and Drainage Authority (SIDA) as the	Drainage Master plan of Pakistan suggested three drainage Basins an left Bank side of Indus River, Guddu, Sukkur and Kotri Barrage left Bank commands. IPOE recommended that for Kotri Barrage left Bank command, plans may be prepared through application of Drain frame concept. Following important issues regarding drainage were pointed out by IPOE. – Drainage issues play important role in the area. – Density of drains very low to meet the demands. – There is considerable potential for drainage water reuse. The issues pointed by IPOE provide important guidance for planning of Region plan.

			implementing agency. However, the IPD/SIDA would have to develop the plans in close cooperation with the other involved departments, especially Provincial Agriculture and Environment Departments, the Area Water Boards (AWB), the Farmers Organizations (FO) and the concerned Municipal Authorities. In the development of the plans intense consultation with the local government and the range of local stakeholders would be required. The DMP will have to reflect the issues, problems and developments at National and basin level and to address issues that cannot be addressed at basin level and need a decision-making or management at federal or provincial level. The interaction between the DMP and the DDWMPs requires that these plans be developed in cooperation with WAPDA and IWASRI. The IPOE gave the following recommendations on the DDWMP for Kotri Left Bank Drainage Basin: (i) apply an integrated approach in developing the plan, including strong stakeholder participation (DRA1NFRAME); (ii) use the opportunities of the water sector reform; (iii) improve irrigation management - including rethinking the high irrigation duties; (iv) include in the role of drainage also water quality and flood management; (v) locate outfall structures in the main drains at carefully selected places and apply outfall structures that are suited to the local tidal conditions; (vi) consider coastal protection works; (vii) respect international biodiversity and wetland conventions; (viii) apply where reasonably possible rainwater harvesting techniques and sustainable reuse of drainage water; (ix) promote that wastewater is treated and/or reused, before it is disposed in drains and canals, particularly since the drains and canals are often the source of drinking water supply; (x) develop options for drinking water supply in tail-end areas; (xi) take care that in the design of the coastal road due attention is being given to drainage aspects as well as to its possible additional function for coastal protection. The IPOE concluded that the new organizations formed in the Kotri Left Bank Drainage Basin, in particular the Left Bank AWB and the FOs, provide, in principle, a good basis for integrated water management, because they combine both irrigation and drainage and provide the platform for water management at the lowest appropriate level. The new organizations in theory may be able to generate the revenue that is required for adequate O&M. The capacity building and political support to these new organizations, however, needs much more emphasis than what has been given so far. The IPOE suggested that the preparation of the DDWMPs for Kotri Left Bank should	

			be prepared and that this would require the action: (i) the Secretary Irrigation and the Managing Director (MD) SIDA should establish a multidisciplinary plan development team, preferably consisting of representatives of the related sectors, in particular IPD/SIDA, Agricultural Department, Environmental Protection Agency (EPA), Public Health Engineering Department (PHED), Department of Industries, Fisheries Department and the concerned municipalities. Based on an integrated approach the task of this team would be to lead the planning process, organize the stakeholder consultations, identify problems, priorities and solution packages, obtain approval within the concerned Departments, and coordinate with the WAPDA and IWASR1 DMP team; (ii) IPD/SIDA/Provincial Government provide the necessary resources and logistics (e.g. budget, office facilities, transportation); (iii) IPD/SIDA appoint a technical secretariat to carry out day-to-day work, field investigations, preparation of reports and working papers; (iv) the plan development team prepares a detailed work plan for completing the DDWMP in about a year.	
2005	Drainage Master Plan of Pakistan	WAPDA	Need for preparation of Master plan was based on the experience gained from implementation of previous projects which were mainly subsurface drainage projects and surface drainage was not emphasized in SCARPs. Due to inefficient surface drainage, recharge to groundwater was excessive which placed huge burden on the operational Cost of Subsurface drainage. Disposal of Saline effluent created severe environmental implication to adjoining areas as such holistic approach was adopted to provide facility for disposal of saline effluent generated from Indus Basin to Sea. **Objectives of Master Plan** 1. To encourage and sustain, increased agriculture production and improve agriculture productivity. 2. To alleviate poverty and improve quality of life. 3. To ensure equitable sharing of benefits accruing from investment and as far as possible, to target these benefits towards the disadvantaged. 4. To encourage beneficiary participation in project formulation, operation and Maintenance. 5. To reduce O&M liability of the government to minimum level. 6. To minimize and mitigate adverse environmental impacts.	The Drainage Master Plan of Pakistan provides a good summary about the agricultural drainage situation during 2005 and identifies specific drainage schemes to be improved and/or developed. The Plan proposes improved surface drainage, pipe drainage, bio-drainage and bio-saline solutions and private tubewell development. The institutional analysis and participation of stakeholders in the operation and maintenance

7. To improve knowledge base of the planners, designers, executives and operators of projects.

Drainage works have been proposed for each drainage basin for Saline Water logged areas Surface drainage, pipe drainage and Bio- saline technologies have been proposed and for fresh water logged areas Subsurface drainage with private Tubewells is proposed. Six drainage Basins 2 in each barrage on Left and Right side commands have been proposed for Sindh. The works proposed in Study area Left Bank of River Indus in Left Bank Command areas of Guddu, Sukkur and Kotri Barrages are illustrated in following table.

Table 2Proposed works under Master Plan in Study area (1,000 acres)

Barrages			Proposed Works				
Barrages	Water Logged Area (0-150 cm)		Surface Drainage	Pipe Drainage	Bio Saline Agricultures	Private Tube Well Development	No of Tube Wells
	Total Area	Saline					
Guddu Left Bank	41.070	25.820	16.009	8.263	1.549	15.249	610
Sukkur Left Bak	1083.057	461.793	286.312	147.774	27.708	576.264	23051
Kotri Left Bank	1067.054	882.209	546.970	282.307	52.933	184.845	7394

of drains requires further analysis.

The information contained will be utilized y the Regional Plan Consultants WSIP-I in the identification of schemes in Phases II & III.

2005	Final Report: International Panel of Experts (IPOE) on Left Bank out fall Drain System	World Bank	International Panel of Experts (IPOE) appointed by the World Bank visited Pakistan from March 6 to21, 2005 to review issues related to the Left Bank out fall Drain system. The main conclusion of the report confirmed that outfall system has considerably evolved since it was initially designed and built and its functionality was altered by successive storm events, tidal dynamic and erosion. Mission recommended combination of "hard" Structural and non-Structural "Soft" actions to address the issues. The IPOE recommended implementation of following actions. 1. Develop and agree on a Flood Management Plan to complement the emergency contingency plan proposed by the Badin District Coordination officer. 2. Establish a professional O&M program for the main drains and outfall System. 3. Examine alternative proposals identified by the mission to reduce flood risk problems and impact of the discharge of the saline effluent. 4. Post pone implementation of LBOD –II and III unless and until the existing problems with the sustainability and performance of outfall are solved. 5. Implement the Banks proposed Concept for the livelihoods relief and improvement program in the Coastal areas of Badin and Thatta. The mission held extensive discussions with concerned Federal, Provincial agencies, and Stakeholders during meetings and field visits. The mission recommended a Strategy for improvement of the present condition and performance of the outfall System. 1. Adopt an adaptive that emphasizes learning by doing, 2. Prioritize actions according to cost efficient solutions, 3. Encourage people's participation, 4. Carefully apply sound engineering practice, 5. Undertake more coordinated efforts among all agencies, 6. Provide clear definition of responsibilities, authority and accountabilities, 7. Strengthen coordinated international cooperation.	The Panel of Experts was composed by a water management expert; a coastal engineering expert; a social and institutional expert and; an environmental and water resources expert. The experts conducted a hydrology study within the limitations of the data available, to determine the precipitation and flood frequencies. They also conducted a hydraulic simulation of the KPOD-LBOD under different scenarios. The Panel concluded that the storm registered in 2003 had a 6.6 years return period with a 56% probability (risk) that it might happen within 5 years. In relation to the Tidal Link's embankment and weir structures failure, the Panel commented that it was mainly due to the silty loam soils of the area. The Panel fell short in their analysis of the subsurface geotechnical conditions.

			The mission also recommended the establishment of crisis management unit. The unit should be established and empowered to provide a coordinated timely response to the concerns from the consequences of flood events. The unit will be responsible for preparation, updating and implementation of a Flood Management program and organizing and supporting the local development of preparedness and response plans and effective warning System and requisite training, awareness building at all levels. The issues and actions to be addressed by the Crisis management unit are as under. 1. Disaster management policy and planning (with special reference to contingency plans), 2. District –specific hazard and vulnerability mapping, 3. Linking disaster management plans and strategies with periodical development planning aiming at disaster preparedness at village, Nazim and district level, 4. Local-specific disaster preparedness and response plans, 5. Integrated disaster preparedness planning at the district level, 6. Promotion of collaborative arrangement between government line departments, local institutions, NGOs, media and at-risk communities for coordinated and supplementary counter-disaster measures, 7. Promotion of community level groups to address disaster preparedness and relief related activities, and 8. Promote training for communities and local officials and organizations in risk areas, NGOs, and in line department at Nazim, District and provincial levels to build the disaster response capacity. The IPOE recommended re-design of the outfall system considering the alternative proposals identified by mission to reduce the flood risk problems and impact of the discharge of Saline effluent. 1. Reinforcement of the LBOD right embankment, and the construction of escape from the left bank of the Spinal Drain and KPOD in the direction of the Thar using to the extent possible the ancient Dhoro Puran river bed. Install flap-gates in the drains discharging into LBOD Drain. 2. Diversion of the Seerani drain and other Kotri drains into the dhands.	

			3. Possible connection of the Pateji and Mehro dhands 4. Construct a gated structure at the DPOD and KPOD to control the flows in both directions. 5. Analyze the location of the tidal control structure in the KPOD and possible control structures in the drains. The IPOE recommended inclusion of the provisions for the actions such as monitoring actions, Studies and investigations design and capacity building initiatives. Preparation of Regional Plan on Left Bank of River Indus, Delta and Coastal zone is a follow up activity as response to the IPOE recommendations.	
2005	FAO Studies Rapid Appraisal Survey Report of Ghotki, Nara and Left Bank Canal AWB	SIDA	A Rapid Appraisal Process (RAP) diagnostic evaluation was performed in the Mirpurkhas and Kot Ghulam Muhammad Sub-Divisions of the Jamrao Division of Nara Canal Irrigation System, Sindh, Pakistan and later in Ghotki Feeder and Left Bank AWB in Feb 2005 by different FAO teams to help identify the problems. The results of the RAP are briefly mentioned. The internal indicators of RAP assess the inputs (resources used) and the outcomes (services to downstream users) of the management set up. In both sub divisions despite indicators ranking average for hardware the actual water delivery services are very low which are indicative of: severe inequities in the distribution of irrigation water to Farmer Organizations (FOs) and watercourses, no flexibility and sometimes unreliability of the service with more than two weeks without irrigation. There were numerous physical modernization improvements needed before good water delivery service and good efficiency can be obtained. However, first there must be resolution of basic social problems such as (1) the discrepancy between stated performance versus actual performance, and (2) the unauthorized withdrawal of large flows by large landholders. If those problems cannot be resolved, Irrigation Training and Research Center (ITRC) believe that physical improvements will not be designed, installed, operated, nor maintained properly as such. Project investment will be wasted. **The key findings from the Mirpurkhas RAP** 1. The current mode of operation of the Jamrao Canal (East) results in severe inequities in the distribution of irrigation water to Farmer Organizations (FOs) and watercourses. The cross regulators and head gate structures are in good	A Rapid Appraisal Process (RAP) diagnostic evaluation conducted by the Irrigation Training and Research Center (ITRC) provides very important information about the performance of three canals, giving an insight of the irrigation management conducted by SIDA and the irrigation situation in Sindh in general. The RAP does not provide new information, but it measures and documents the weaknesses of the irrigation sector. Among the more important conclusions are the withdrawal of large flows by the large landholders; that there are water shortages at the tail end and; that the water

			condition, but they are not operated to provide a steady and reliable flow to the FOs at the distributary canal level. In the entire Nara Canal System, the cross regulators are not used properly to maintain upstream water levels; instead, the canals are operated using staff gauges downstream of the cross regulators as a proxy for flow rate control. 2. Improvements in irrigation efficiencies, widespread crop diversification, and the adoption of modern on-farm water management practices in the Nara Canal System will only be possible after the successful implementation of a modernization program that addresses existing operational constraints with effective water control and monitoring throughout the system. 3. The prerequisites for a sustainable modernization program must be addressed including a well-trained and properly motivated staff, adequate maintenance budgets, a focus on the service attitude (the irrigation project exists to serve the farmers), a sound technical plan to deal with the major drainage problem, and the use of the RAP to diagnose project performance prior to formulating modernization plans. 4. Given the long travel times from the Sukkur Barrage to the start of the Jamrao Division (and the Mithrao and Lower Nara Divisions), a regulating reservoir is necessary to buffer the variable inflow for high efficiency and flexibility. The Chotiari Reservoir would be an ideal point for re-regulating the flow from the Upper Nara Canal. Operations in each division could also be made much simpler and the service to farmers improved substantially by installing several more re-regulation reservoirs further downstream in the system (about 2/3rds the distance down a canal). An engineering analysis for locating and designing re-regulation points in the system should be a high priority in the modernization planning process. 5. Irrigation modernization plans should suit local conditions in each of the subdivisions. For example, the different stages of canal rehabilitation in each system should be addressed, but they must also be part of an overall strategy for the entire command area. 6. There are large uncertainties in the water balance and production-related	measurement is not appropriate due to the lack of calibration of different structures and outlets.

			datasets (irrigated acreage, crop types, cropping calendar) analyzed as part of the RAP that should be refined as part of an enhanced monitoring program. A water balance using recent and verified data should be completed for each of the main canal systems. The service area of each canal system needs to be verified, identifying cultivable and irrigated areas. 7. Inflexible designs and operations are limiting crop production (yields), cropping intensity, and contributing to the serious problems with water logging and salinity in extensive parts of the command area. An example of an inflexible and outdated design is the Adjustable Proportional Module (which ironically isn't 'adjustable'). 8. The subsequent addition of a large number of direct outlets (DOs) and private pumps in upper portions of the command area has exacerbated water shortages and tail ender inequities in the project. It has also undermined the ability of the Area Water Board to cooperatively develop and implement water allocation plans that are seen as fair by a majority of farmers. The DOs need to be managed as part of the rest of the system, especially during the rotation schedule followed by the distributary canals. There are approximately 96 DOs in the Mirpurkhas Sub-Division. Each DO should be equipped with a gate to shut off or regulate the flow being delivered. 9. The physical hardware in the Jamrao Canal (East) is in fairly good shape. However, the control structures in other portions of the Mirpurkhas Sub-Division (and in other places in the Nara Canal System) are severely deteriorated and not in acceptable working condition. Past rehabilitation efforts have been fragmented and did not address the system in a comprehensive manner. Some cross regulator gates require total replacement. 10. An RAP evaluation should be conducted in each sub-division by trained staff members who participate in the FAO/ITRC modernization workshops. Managers and field staff face a daily struggle to manage a large and complex system, which is made much more difficult by the fact there are no re-regulation reservoirs, many broken structures, uncontrolled direct outlets, very few functional spill points (escapes), poor coordination with other	

			divisions/sub-divisions, and severe reductions in the conveyance capacity of the canals due to siltation. 11. The canals turned over to Farmer Organizations (FOs) have not always undergone rehabilitation prior to the turnover, and some FO canals are in very poor shape. 12. Managers and operators of the system focus a great deal of attention on "design discharges" and "full supply water levels" even though the channel conditions have changed considerably since the system was built in the 1930s. The proper design and operation of control structures must recognize the unsteady nature of flows in the system and utilize modernization tools such as re-regulating reservoirs. In particular, the very low density of regulation structures in the distributary canals and minor canals contributes to water level fluctuations at the outlets to watercourses. One possible solution is to install long-crested weirs at key points to be identified by the RAPs, but the design must include large silt-flushing gates. 13. Improved flow control and measurement at the main canal level are required before any volumetric pricing pilot projects are introduced. Irrigation deliveries to the FOs must be done in a well-controlled and flexible manner in order for volumetric pricing to be implemented. This means the flow at the head gate of the distributary canals is kept constant and farmers have the ability to request a reduction in the flow or closure of the head gate. Installing accurate flow measurement devices at the start of the distributary canals and demonstrating their use for several seasons would be helpful with canal operations and allow FOs to raise their management capacity. 14. The Area Water Board does not have the technical capacity at present to develop strategic modernization plans that use sophisticated modem designs or management practices. A major training effort will be required to introduce modernization concepts and teach practical design and construction techniques. Emphasis should be put on proper flow measurement technologies and modem water control in large canal systems. 15. The low salaries and lack of proper incentives for irrigation staff at all levels of	

			the system is seriously undermining not only the efficient operation of the system, but also hampering the ability of the institutional reforms to improve agricultural production. The majority of farmers have suffered from inattention and neglect in favor of large landlords and those with political connections who can pay superfluous fees for better service. 16. Expensive rehabilitation projects such as lining of watercourses and re-building outdated Adjustable Proportional Modules (APMs) should be rejected in place of simple, robust structures and operational policies that have a high likelihood of success. The outcomes of modernization should be aimed to provide perceptible and sustainable benefits to farmers, which the APMs have not been able to deliver. 17. Previous rehabilitation activities have not been effective in raising the level of equity among distributary canals. Other studies by IWMI have estimated that the difference between the relative water supplies (irrigation deliveries/irrigated area) received by APMs along distributary canals is as high as 50% in many places. 18. There needs to be clarity at all levels of the system, including the Farmer Organizations (FOs), about exactly what the roles and responsibilities are for operations and maintenance. For example, the details of preventive maintenance plans (actions, timelines, etc.) need to be clearly agreed upon and sufficiently funded either by the Area Water Board or through fees collected from farmers. 19. The radio system needs to be upgraded, including additional repeater stations. 20. A realignment of the irrigation charges and revenue collection is needed that will provide sufficient funds to the FOs and the Area Water Board for preventive maintenance and modernization improvements. The existing maintenance budgets are grossly inadequate. Broken items are not being fixed. 21. A great deal of time and budget has been put into calibrating various structures such as head regulators, head gates, and APMs, even though the accuracy of such calibrations is inaccurate. If regular calibrations were done at the start of	

			the main canals, by qualified staff, it may be possible to have reasonably accurate rated sections established. At present, local staff does not have either the technical training or the equipment (current meters) needed to properly calibrate rated sections. In addition, the heavy silt load in the canals presents special difficulties for producing accurate and reliable rating tables. More emphasis should be placed during the modernization planning and training on proven flow measurement devices and technologies. 22. There is apparently a large discrepancy between stated and actual performance in the project. In general, ITRC believes that investments in rehabilitation and modernization will have little-to no long-term beneficial impacts unless the upper project management explicitly recognizes the true conditions.	
2005	Water Stress Quantification in Sindh Province Pakistan	SIDA	A Water Stress Quantification Study was conducted a part of WSIP preparation. The objective of the study was to provide a neutral and unbiased diagnosis of agricultural water management practices occurring in the Province of Sindh and in particular for three Area Water Boards, i.e. Nara, Ghotki and Left Bank AWB. This remote sensing study contributed to the preparation of WSIP in the following ways: 1. Provision of an overall assessment of the degree of water related problems in the entire Province of Sindh that adds the agenda of the newly established AWBs. The overall assessment include water shortage, water logging and agricultural production issues 2. Provision of a coarse irrigation and drainage performance assessment for all Area Water Boards and other canal commands in the entire Province of Sindh 3. Provision of a fine resolution irrigation and drainage performance assessment for all secondary and tertiary irrigation units within selected three AWBs; 4. Provision of indirect information on base line crop production (through biomass yields) in the entire Province of Sindh	The report does not follow international convention of concepts and definitions. The report refers as “evapotranspiration from lakes and other open water bodies”. In the case of open water bodies no transpiration can/should be considered and it might be referred only as evaporation. The study mentions reference evapotranspiration, but does not specify the “reference”, as it could be grass or alfa-alfa, nor the method used to calculate it. The “deficit

			5. Provision of inputs for benchmarking under WSIP and define a proper zero-situation before institutional changes and water management improvements are introduced at a large scale. **Conclusions** Given the Scarcity of Water in Sindh there are some important conclusions from the Water Stress Quantification Study that have bearing on rural prosperity in the province. 1. Water productivity in Sindh is lower than comparable figures elsewhere in the world, especially for rice. Water productivity in Rabi is considerable (+ 45%) better than in Kharif in Sindh. 2. Within Sindh the best performing Canal Commands in terms of Water productivity are in upper Sindh Khairpur West and East Canals, Rice canal, Rohri and Ghotki, The underperformance are in Lower Sindh, Specially Pinyari and Kalri. The difference are Staggering. The same amount of water in a well performing Canal command produces three times more Crops than in Lower performing Canal command. The difference between areas is explained largely by way water is supplied. On as annual basis the low performing and high performing areas receive comparable amount of Water, but the erratic supplies to the tails depress crop growth. 3. The emphasis should be very much on re- considering and drastically improving water management – especially in the Kharif is Lower Sindh and through reconsidering water allocations. One can possible even increase the area served in this season. A comparison of drought year with a normal year indicates that during several areas – especially the Canal Commands of Lower Sindh - are better off during drought than a normal year. 4. The detailed analysis makes it possible identity focus areas for improvement in WISP. The low performing area are located is Left Bank, in Southern part of Nara (especially in Rabi) and in Southern part of Ghotki. The difference with the better performing areas within the Canal commands may be as much as 50%	evapotranspiration" is calculated as the difference between the reference evapotranspiration and the actual evapotranspiration. Since each of these parameters has been calculated for a different crop, subtracting/mixing them does not seem to provide a "deficit", but perhaps an index. The conclusions are within what would be expected.

			indicating how much can be gained with improved Water management in Sindh.	
July 6, 2006	Inspection Panel Report on NDP	World Bank	Pakistan National Drainage Program Project (Credit No. 2999- PAK) On Sept 10, 2004 Inspection Panel received a request for inspection (The Request) related NDP Project from requesters. **Requester Claims** 1. Disposal of saline effluent. 2. Construction of NSDS under original NDP Project design. 3. NDP project is fault of and unsustainable. 4. Proposed drainage network will badly affect the already degraded environment of Indus Delta. **Bank Response** The report examined the merits of the claims made requesters. Panel reviewed the relevant project documents, and other material from Requesters, Bank Staff, the national and local authorities of Pakistan, individuals and communities living in the area affected by the project, nongovernment organizations and other sources. The panel interviewed Bank Staff in Washington and bank office in Islamabad. Panel visited project area on two visits in November 2004 and May 2005 The panel assessed whether Bank complied with the applicable operational policies and procedures. Panel observations on LBOD and Tidal Link as under 1. Alignment of Tidal Link was technically and environmentally risky 2. Significant technical mistakes were made in design of the Tidal Link embankment and the Cholri weir. 3. Designers did not evaluate the likelihood that, under prevailing meteorological conditions, high surface run- off from upstream area would coincide with high water level in the Arabian Sea.	The report concentrates in the lower Sindh, mainly discussing the LBOD scheme. It is a very good report that analyzes in depth technical, environmental, social, cultural, economic and political aspects of drainage in Sindh. The document was found very useful for the Regional Planning Consultants Phase-I report. The Panel also mentions that from 1988 to 1994 the inspections were made mainly by irrigation engineers, which might have been sufficient for the upstream drainage works, but not for the downstream area. The Inspection Panel apparently reviewed the technical aspects of the Tidal Link embankments and the Cholri Weir, including hydraulic calculations, geotechnical testing and bed protection for the weir. It falls short in

			4. The design assumption failed during July 2003 rain fall. 5. Penal finds that the main drain should have been designed with a higher safety margin. 6. The Penal finds that the LBOD designers under-estimated the risk of extreme meteorological events and made insufficient arrangement to deal with storms of higher intensity 7. Section of Cholri weir Collapsed on June, 1998. 8. Cholri weir totally destroyed in 1999 cyclone. 9. Fifty four breaches occurred in Tidal Link at different locations bringing devastation and loss of life to the adjacent communities. 10. The LBOD System combined with the partial destruction of the Tidal Link has heightened the risk to local people from flooding. The situation in particularly bad when heavy rainfall inland and high tides and Storm at Sea coincided. During rains in 2003 led to loss of many lives. 11. Increased salinity has affected large tracks of agricultural lands and the Tidal Link failure has led to major harm to the dhands eco system, wild life and fisheries, upon which many people depend for their livelihoods. People in this area also face sever problems of drinking Water have lost grazing lands. Over all morphology is being changed. 12. Panel evaluated the environmental compliance, Environmental assessments, environmental screening and Level of analysis, analysis of alternatives, environmental Management plan mitigation and compensation, environmental monitoring plan and social compliance and mentioned in the report regarding compliance or non- compliance status and pointed out deficiency in observing compliance as per rules and procedures.	their observations of the geotechnical aspects, because the scour depth observed in the Tidal Link is much larger than the depth explored.

			13. The report under Annex-A describe Findings. Table comprising of Issues, management response and Panel's finding for 29 issues. **Conclusions** Downstream effects, including those on the local populations of southern Badin, did not feature in any significant way either in the design or supervision of the project. To a very large degree, the damages suffered by people in the project-affected areas have not been redressed, and many of the same conditions that led to these harms are still in place. The penal notes that Bank recently become engaged in preparing a Sindh Coastal Areas Development Program. If carried out successfully, this has the potential to bring some form of support to the areas and people affected by the events described in this Report. Panel also appreciates recent initial actions by the Government to address the structural problems causing harms to the affected population. Panel notes importance of implementing effectively actions addressing needs of affected populations.	
2007	PC-1 Mirpurkhas. Restoration of Dhoro Puran, Mirpurkhas.	Nara Canal Area Water Board	The PC-1 describes the intention of the Government of Sindh to improve the Dhoro Purna Outfall Drain, and reuse the water 92,000 acres of land for irrigation the desert area of Deh Ali Bander, Kahyari, Singhalo and Charbet Taluka Deplo District Tharparkar. The Spinal is diverted in DPOD at RD 327+000 and also parallel to RD 306+000 crossing at the same RD and again outfall at RD 286+000 then at RD 272+000, at these locations parallel drain is proposed to be constructed to restrict the effluent of spinal drain in the DPOD and one underpass is proposed to be constructed at RD 272+000 for this purpose. **The Project Area** The project area is situated between longitude 69° 07' to 69° 04' and latitude 25° 15' to 24° 16' on the national grid. It is located in between the command of Taluka and District Mirpurkhas. The project lies north of the Rann of Kutch Thar Desert in Taluka Deplo District Tharparkar. The Gross Project Area (GPA) identified was about 640000 acres (1000 sq. miles). The Cultivable Command Area (CCA) about 480000 acres; additional 192000 acres	The document is not clear however, provides useful data about cropping patterns, yields, water quality, environmental, soils, socio-economic and other parameters. It also provides some analysis about DPOD. A general or an schematic map would help understand the study. The gross water requirements at watercourse head are estimated, but nothing is said about the conveyance efficiencies upstream from the outlets. The monthly availability of

			were to be irrigated through new channel. Rice was the dominant crop with a cropping intensity of 25.9%. Other major crops were sugarcane, wheat and fodder having cropping intensities of 16.8%, 3.9% and 19.4% respectively. **Proposal about DPOD** The drains outfall in the Shakoor Dhand then to the Arabian Sea. Options considered to prevent back flow or backwater effects from DPOD into the outfall drains included:- – Construction of weir at RD 30+000. – Construction of parallel drain and underpass on Dhoro Puran to restrict the flow of drainage effluent of Spinal Drain. – Raising drain embankments above predicted backwater levels, provision of control drain inlets to prevent backflow into low lying areas and provision of local on-farm drainage systems and pumped discharges to drain local low lying areas. – Construction of 60 miles channel upstream of the weir. Due to the fact that DPOD collects base drainage flow from a catchment of some 4 million acres and can operate at or near its design capacity for long periods the provision of gated tidal regulators or outfall structures not feasible solutions. Construction of a new parallel outfall drain out falling into the Shakoor Dhand to restore the overall local drainage system back to the pre LBOD situation may be technically feasible but would not be economic. Such a solution may have to be considered in the future if the LBOD is further extended and the capacity of the DPOD further increased. Raising drain embankments above the maximum predicted flood levels with gated inlet structures is concluded to be the only feasible solution. On farm drains will be required to drain local depressed areas.	water is not given, so it is not clear if the scheme would be able to fulfill its purpose. The on-farm application efficiency is on the higher side.

			Existing drains and structures will be rehabilitated and some new storm water inlets and road bridges will be provided. Outlet structures will be provided for channel with the lift irrigation arrangements.	
2008	Transition of SCARP Tube Wells to Private Sector	Irrigation & Power Department Sindh	The Government Sindh in the light of the successful transition of Moro-Sakrand unit of SCARP North Rohri project decided to privatize 3692 freshwater public Tubewells of Six SCARP divisions namely Ghotki division (1091), Rato Dero (530), Khairpur (275), Nowshero Feroze (576) North Rohri Project, Hala-I(480), Hala-II (740) South Rohri Project. Government of sindh through Irrigation and Power Department engaged consultant M/s B.M Consulting Engineers for preparation of feasibility Report. Contract agreement was signed on 27.5.2007 with completion date January 15, 2008. There were 24 Terms of References given to the consultants for this Study. Some of the more important highlights of the TOR included. 1. Suggest the mode of transition i.e. replacement of SCARP Tubewells (3692) by construction of private Tubewells of 0.5 cusecs and 1.0 cusecs capacity equivalent to the capacity of 3692 SCARP tube wells with machinery to communities and transfer of bore holes to the farmers. 2. Suggest suitable incentive package for the farmers so that they come forward and install their private Tubewells. 3. Carry out tube well to tube well survey for preparing complete inventory. 4. Provide estimated cost of installation of PTWs and determine Operation and maintenance cost. Collect agriculture data, carry out initial environmental examination, prepare implementation schedule for transition and carry out socio-economic survey etc.	The document is a good reference about SCARP wells in Sindh. It concentrates in the technical component of SCARP wells, but covering only superficially the social and institutional aspects, paramount in the transition of tube wells to the private sector. The document was found very useful for the Regional Planning Consultants for Phases II & III. In relation to the transition, the document should be complemented with further studies about social and institutional issues, concentrating in consultation work and reaching consensus before the transition is completed. SCARP tube wells

			The consultants carried out detailed survey and collected necessary data from field as well reviewed the available reports, record and made analysis of the data. Consultant recommended action plan for the transition of 3629 fresh water public Tubewells to private Sector mainly the end users/ farmers.	transition programs should involve at least three conditional strategies: improvement of support services (water delivery and drainage); empowerment of farmers users organizations and; irrigation and drainage long-term financial viability.
2010	Feasibility Report: Re design of LBOD Stage-1 Badin Area Drainage System.	WAPDA	Feasibility Study for Re-design of LBOD Stage -1 Badin Area Drainage System was conducted by WAPDA through consultants M/S NESPAK-ACE-DMC (JV) under directive of President of Pakistan as "WAPDA in consultation with Government of Sindh should carryout feasibility Studies for re-designing of the system for the benefit of people of Badin district and adjacent low lying area, which were badly affected during unexpected extraordinary rainfall in 1994 and 2003 monsoon with intensity between 200 mm to 304 mm" . The reports submitted by the Consultants were reviewed by the SIDA and the Stakeholders and extensive interaction was maintained among the WAPDA, SIDA, Stakeholders, NGOs and the concerns were recorded by the Consultants. A committee comprising representative of Irrigation Power Department, WAPDA, NGOs, and Stakeholders was constituted with Managing Director SIDA as Chairman of the committee meeting of the committee were held at Hyderabad, Badin. Following works were recommended by the stake holders during meeting held on June 29, 2009. 1. Rehabilitation of Spinal Drain and KPOD. 2. Remodeling of DPOD to carry 4000 cusec storm water. 3. Strengthening and stone pitching of the selected reaches of Spinal Drain. 4. Increasing the capacity of weir located at RD 126 of DPOD to convey 4000 cusec discharge.	The report compiles general data about LBOD stage-1 and Badin area drainage and provides useful information for the Regional Planning Consultants Phases II & III. Among the more important contributions are the consultation and stakeholders' workshops reports. The document proposes increasing the design flowrate from 5 years return period to 10 years. It analyzes two alternatives; the first one widening the canal bed and raising the embankments but keeping the same water level inside LBOD and the second, one raising the embankments and raising

5. Construction of an outlet at RD 52 of KPOD.
6. Construction of four flood protection bunds.
7. Plugging of Tidal Link near RD (-) 145 to check sea water intrusion.
8. Reconstruction of the southern bund along Tidal Link from RD (-)80 to RD (-) 154.
9. Construction of access road up to RD (-) 145 of Tidal Link.
10. Flap gate Structure near RD (-) 5 of KPOD to check sea water intrusion.
11. Rehabilitation of surface drains in Badin, Mirpurkhas, and Sanghar and Nawabshah areas.
12. Provision of two community centers, facilities for fishing boats and mobile pump stations.

Master/Regional Plan consultants reviewed and evaluated the work done by WAPDA-LBOD consultants. The following was recommended by WAPDA.

Alternative-1	**Alternative-2A, 2B & 2C**		
	2A	**2B**	**2C**
Improvement of Drainage System			
Remodeling of Spinal Drain DPOD Keeping water level of the remodeled drains equal to the last design water level	Remodeling of spinal Drain DPOD Widening and raising the water level of the remodeled drains 2 feet above the last design water level	Remodeling of spinal Drain DOPD Widening and raising the water level of the remodeled drains 2 feet above the last design water level	Remodeling of Spinal drain DPOD Widening and raising the water level of the remodeled drains 2 feet above the last design water level

the water level inside the drain.

The first option was discarded due to the high remodeling cost. The second option was further divided into three options. There seems to be a contradiction among the options, because options 2A and 2C recommend a bund on the Southern side (Indian border) to protect the Tidal Link and nothing on the Northern side, which means that there is no need of protection on the Northern side. Option 2B recommends a bund on the Northern side and nothing on the Southern side, which implies that there is no need of protection on the Southern side.

The Tidal link L-section was observed by the NIO under the WAPDA/NESPAK study and is presented among the results. The maximum scouring reported is about 60 to 70 feet.

Alternative-1	**Alternative-2A, 2B & 2C**			
	2A	**2B**	**2C**	
Control Tidal Effect and Sea Water Intrusion in Dhands & drainage System				
Plugging of creeks and the reconstruction of embankment along the Southern side (Indian border side) of Tidal Link.	Plugging of creeks and the reconstruction of embankment along the Southern side (Indian border side) of Tidal Link.	Plugging of creeks and the reconstruction of embankment along the Northern side of Tidal Link.	Plugging of creeks and the reconstruction of embankment along the Southern side (Indian border side) of Tidal Link.	
Plugging of Tidal Link near RD -140 of Tidal Link. Top plug top elevation = 0.0 feet arnsl	Plugging of Tidal Link near RD (-) 140 of Tidal Link. Plug top elevation = 0.0 feet arnsl	Plugging of Tidal Link near RD -140 of Tidal Link. Plug top elevation = 0.0 feet arnsl	Plugging of Tidal link near RD -140 of Tidal Link. Plug top elevation = 3.5 feet amsl	
Provision of a structure with flap gates near RD -13 of KPOD.	Provision of a structure with flap gates near RD -13 of KPOD	Provision of a structure with flap gates near RD -13 of KPOD.	No structure on KPOD	
Alternative 1	**Alternative 2A**	**Alternative 2B**	**Alternative 2c**	
Protection of Cropped Area and Villages				

Despite this important data, no other geotechnical investigation was found (it is unknown if there were any subsurface explorations or not).

WAPDA recommends a plug at RD (-) 145 of Tidal Link which in view of the scouring reported (60 to 70 feet deep) is highly questionable without detail geotechnical investigations. Any structural solution to Tidal Link must be supported by soil mechanics explorations at least 100 feet below.

The recommendation of including a flap gate Structure near RD (-) 5 of KPOD needs to be supported by proper geotechnical investigation.

The original LBOD design was for 5 years return period flow, which implies a probability of 50% of having at least one similar or greater storm to occur in a period of 3 years. The chances that the maximum

			Flood protection bund for villages and cropped areas in the north of Achh, Sainhri and Addah dhands	Flood protection bund for villages and cropped areas in the north of Achh, Sainhri & Addah dhands	Flood protection bund for villages and cropped areas in the north of Achh, Sainhri & Addah dhands.	Flood protection bund for villages and cropped areas in the north of Achh, Sainhri & Addah dhands.	capacity will be reached or exceeded every three years are the same as tossing a coin into the air every three years and hoping for it to fall head up. The 2003 storm experienced has a return period of 6.6 years. This implies a probability of 56% of having at least one similar or greater storm to occur in a period of 5 years. The flowrate proposed by WAPDA/NESPAK corresponding to 10 years return period implies a probability of 52% of having at least one similar or greater storm to occur in a period of 7 years and 80% in a period of 15 years. Increasing the capacity of LBOD has significant implications and is rigorously opposed by some of the stakeholders. If this is the case, some measures will be needed for the people to be prepared to react during flood events, because flooding will be part of their lives.
			Flood protection bund for village Khan Bahadur Lund located near RD 28 of KPOD.	Flood protection bund for village Khan Bahadur Lund located near RD 28 of KPOD.	Flood protection bund for village Khan Bahadur Lund located near RD 28 of KPOD.	Flood protection bund for village Khan Bahadur Lund near RD 28 of KPOD	
			Flood protection bund between RD (-) 15 of KPOD and the tail of Mirwah Minor	Flood protection bund between RD (-) 15 of KPOD and the tail of Mirwah Minor	Flood protection bund between RD (-) 15 of KPOD and the tail of Mirwah Minor	Flood protection bund between RD (-) 15 of KPOD and the tail of Mirwah Minor	
			Flood protection bund between the tail of Mirwah Minor and the outfall of Fuleli Guni drain	Flood protection bund between the tail of Mirwah Minor and the outfall of Fuleli Guni drain.	Flood protection bund between the tail of Mirwah Minor and the outfall of Fuleli Guni drain.	Flood protection bund between the tail of Mirwah Minor and the outfall of Fuleli Guni drain.	
			Alternative 1	**Alternative 2A**	**Alternative 2B**	**Alternative 2c**	
			Other Works				

			Access road cum bund in between dhand system and the sea.	Access road cum bund in between dhand system and the sea.	Access road cum bund in between dhand system and the sea.	Access road cum bund in between dhand system and the sea	
					Construction of new drain parallel to KPOD.	No new drain	
					Construction of a new structure in place of Cholri weir but at a different location.	No new weir.	
						No Northern bund along Tidal Link.	

Table 4.1.2: Peak Discharges recorded at Guddu Barrage

GUDDU BARRAGE						
YEAR	**DATE**	**U/S**	**D/S**	**GAUGE U/S**	**GAUGE D/S**	**LAG GUD/SUK**
1962	26-08-62	441,908	425,640	255.4	252.55	1
1963	6/8/1963	547,938	501,535	255.7	253.15	14
1964	27-08-64	733,552	701,700	255.55	255.2	2
1965	5/8/1965	660,303	571,444	255.3	254.4	2
1966	16-08-66	613,158	559,136	254.95	254.6	2
1967	12/8/1967	677,657	650,949	255.5	254.7	3
1968	21-08-68	651,447	626,197	255.5	254.5	2
1969	20-08-69	683,212	653,416	255.8	254.9	3
1970	8/9/1970	349,292	325,237	255.5	251.9	2
1971	17-08-71	613,242	584,513	255.5	254	2
1972	15-08-72	407,586	375,561	255.5	252.4	2
1973	19-08-73	1,083,742	1,062,954	258.7	257.5	3
1974	4/9/1974	324,271	294,768	255.6	252.1	2
1975	30-08-75	1,002,496	987,943	257.25	256.5	2
1976	15-08-76	1,199,290	1,176,450	259.3	258.4	2
1977	12/8/1977	541,400	519,800	256.7	254.45	1
1978	18-08-78	1,155,873	1,138,272	258.2	257	2
1979	11/8/1979	523,719	503,423	256.15	254.9	1
1980	16-08-80	652,045	622,958	257	255.9	2
1981	6/8/1981	729,122	693,524	258.1	256.15	2
1982	19-08-82	486,119	463,561	256.5	254	1
1983	10/9/1983	758,655	736,248	257.9	257.1	9
1984	4/9/1984	647,753	625,512	257	256.1	2
1985	15-08-85	425,835	393,724	256.5	254.2	1
1986	13-08-86	1,173,292	1,172,010	258.8	257.8	2
1987	3/9/1987	343,067	315,711	257	252.4	2
1988	31-07-88	1,162,653	1,138,676	259.3	258.4	1
1989	9/8/1989	944,888	914,485	258.2	256.9	2
1990	6/7/1990	589,430	555,544	257.5	254.9	2
1991	26-06-91	606,211	567,612	258.6	255.3	1
1992	1/8/1992	709,838	700,148	258.8	258.15	1
1992	18/9/1992	1,086,919	1,069,268	259	258.8	2
1993	31-07-93	626,412	590,421	258.6	256.9	2
1994	29-07-94	773,300	739,901	259.15	257.85	4
1994	17-08-94	738,439	718,930	258.1	257	2
1995	3/8/1995	988,410	970,156	259.7	259	4

GUDDU BARRAGE						
YEAR	**DATE**	**U/S**	**D/S**	**GAUGE U/S**	**GAUGE D/S**	**LAG GUD/SUK**
1996	14-08-96	588,461	553,842	258.8	257.3	1
1997	5/9/1997	786,612	763,093	258.9	257.15	3
1998	23-07-98	667,493	631,585	258.8	256.5	2
1999	16-08-99	418,975	390,225	259	255.3	2
2000	6/8/2000	208,090	171,635	259.1	252.6	3
2001	30-07-2001	253,215	219,803	258.7	252.75	1
2002	21-08-2002	284,241	255,102	256.9	251.15	1
2003	4/8/2003	396,194	365,355	259.7	251.9	1
2004	1/8/2004	146,506	116,524	258.9	252.6	2
2005	23-07-2005	548,147	515,870	259.6	258.1	2
2006	14-08-2006	596,390	569,431	258.9	253.9	2
2007	22-08-2007	347,407	322,587	258.2	251.8	2
2008	13-08-2008	279,476	256,189	259.6	251.95	1
2009	24-08-2009	263,342	231,132	258.6	253.6	2
2010	8/8/2010	1,145,738	1,148,200	260.6	260.3	2

Table 4.1.3: Peak Discharges recorded at Sukkur Barrage

Sukkur Barrage						
Year	Barrage		Abutment		23th Pier	
	U/S	D/S	R/B	L/B	U/S	D/S
	cusecs	cusecs	ft		ft	ft
1973	1,117,246	1,065,712	202.3	203.4	201.8	201.7
1974	296,126	241,210	196.7	197.6	196.65	195.85
1975	1,051,316	1,024,882	201.25	202.25	201	200.9
1976	1,200,574	1,160,984	203.05	204.05	202.85	202.75
1977	575,826	523,892	198.7	199.6	198.7	198.6
1978	1,116,430	1,092,770	201.95	202.3	201.6	201.5
1979	501,334	458,766	197.5	198.7	197.6	197.4
1980	615,778	560,301	197.7	198.9	197.65	197.45
1981	631,359	582,995	198.3	199.3	197.9	197.7
1982	449,931	399,788	197.5	198.4	198	195
1983	760,621	708,387	199.5	201.1	199.25	199.1
1984	608,883	560,069	197.35	198.45	197.35	197.15
1985	390,380	336,533	197.5	198.5	198.5	195
1986	1,166,574	1,122,874	199.8	200.95	199.5	199.4
1987	316,245	263,771	197.4	198	197.7	194.7
1988	1,118,850	1,068,920	200.75	201.75	200.55	200.45
1989	872,134	828,639	197.8	198.5	197.5	197.4
1990	551,867	498,791	198.8	199.7	199.5	196
1991	517,200	458,825	198.5	199.5	198.5	196.5
1992	1,068,072	1,025,937	199.4	200	199.3	199.2
1993	569,160	515,500	198.8	199.3	199.4	197.1
1994	757,481	738,481	201	201.2	200.1	200
1995	986,003	939,978	200.1	201	199.7	199.6
1996	757,340	697,520	199.3	200	199.3	197.45
1997	801,170	747,690	198.8	199.2	198	196.4
1998	628,755	572,530	198.8	200	199.8	196
1999	390,020	334,030	199.5	200	199.9	194.3
2000	170,715	117,675	199	199.4	199.5	190.3
2001	222,021	168,935	198.6	199.6	199.4	190.9
2002	242,690	186,440	198	198.6	199	191.7
2003	335,933	297,663	199	199.4	199.6	196.4
2004	126,130	64,780	198.3	198.8	199	188.5
2005	508,937	447,407	198.7	199.5	199.7	197.2
2006	554,088	511,898	198.5	199.5	199.3	197.7
2007	297,840	253,950	199	199.4	199.8	195.1
2008	250,040	196,010	199	199.4	199.9	194.3
2009	195,717	134,620	199.3	199.6	199.9	194.8
2010	1,130,220	1,124,720	202	201.8	202	201.8

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Table 4.1.4: Peak Discharges recorded at Kotri Barrage

Kotri Barrage							
Year	U/S	D/S	Gauge	Year	U/S	D/S	Gauge
	cusecs	cusecs	ft		cusecs	cusecs	ft
1955	804,536	791,221	24.7	1984	371,171	384,895	16.85
1956	982,771	980,529	26.4	1985	186,019	156,489	13
1957	561,488	542,156	20.5	1986	502,940	471,369	19
1958	764,094	743,749	24.5	1987	152,790	122,639	12.5
1959	679,391	658,268	24.5	1988	660,618	649,594	23.5
1960	502,258	483,171	20	1989	309,088	282,615	16.25
1961	446,097	441,554	19.2	1990	307,818	274,840	15.9
1962	300,908	276,792	15.2	1991	300,766	270,917	15.7
1963	322,341	299,982	16.1	1992	555,965	549,972	20.3
1964	536,278	524,349	20.3	1992	689,309	673,809	21.8
1965	410,012	381,315	16.6	1993	420,417	389,477	18.1
1966	619,373	587,145	17.8	1994	800,381	793,522	23.6
1967	519,884	505,238	16.8	1994	825,177	817,749	24
1968	561,604	544,696	17	1995	799,435	771,365	24.4
1969	553,247	529,145	17.7	1996	412,917	384,462	18.8
1970	260,448	255,495	15.4	1997	321,180	301,979	16.5
1971	294,915	266,502	15.4	1998	295,986	263,998	15.9
1972	210,988	186,346	14	1999	220,680	189,294	13.3
1973	811,648	785,829	25.4	2000	66,471	47,845	8.3
1974	164,262	133,472	14.8	2001	95,205	61,670	8.2
1975	490,468	476,436	19.2	2002	105,972	78,648	9.6
1976	791,992	765,392	25.3	2003	240,907	231,417	16
1977	349,532	323,107	17	2004	30,648	23,188	4.3
1978	722,139	710,739	24.3	2005	310,495	274,283	16.8
1979	301,078	293,562	16.75	2006	371,870	356,516	17.9
1980	283,037	253,857	15.8	2007	157,340	136,081	13.5
1981	316,246	302,172	16.2	2008	138,204	103,139	11.8
1982	249,260	219,661	13.9	2009	120,498	115,473	12.1
1983	493,163	474,311	19.3	2010	964,897	939,442	26.8

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Table 4.1.5: Peak Discharges recorded at Dadu- Moro Bridge

Dadu Moro Bridge						
Year	Sukkur Barrage		Kotri Barrage		Bridge	Lag Time
	U/S	D/S	U/S	D/S	Gauge	Suk
	cusecs	cusecs	cusecs	cusecs	ft	days
1955	804,760	765,270	804,536	791,221		7
1956	998,112	979,377	982,771	980,529		4
1957	707,260	661,230	561,488	542,156		7
1958	1,097,624	1,049,869	764,094	743,749		7
1959	948,817	906,000	679,391	658,268		7
1960	684,858	646,000	502,258	483,171		7
1961	648,619	601,349	446,097	441,554		6
1962	432,457	390,385	300,908	276,792		2
1963	522,552	478,902	322,341	299,982		12
1964	710,010	682,793	536,278	524,349		8
1965	664,573	515,166	410,012	381,315		4
1966	665,028	618,240	619,373	587,145		5
1967	656,945	610,382	519,884	505,238		5
1968	585,896	537,215	561,604	544,696		5
1969	658,157	606,963	553,247	529,145		8
1970	326,043	281,551	260,448	255,495		6
1971	581,600	527,372	294,915	266,502		5
1972	374,971	320,685	210,988	186,346		9
1973	1,115,576	1,076,542	811,648	785,829		8
1974	306,387	275,431	164,262	133,472		1
1975	1,051,316	1,024,884	490,468	476,436		7
1976	1,200,132	1,161,472	791,992	765,392		7
1977	521,950	484,140	349,532	323,107		5
1978	1,116,430	1,092,770	722,139	710,739		7
1979	501,334	458,766	301,078	293,562		4
1980	615,778	560,521	283,037	253,857		3
1981	631,359	582,995	316,246	302,172		18
1982	465,000	414,857	249,260	219,661	125	9
1983	754,943	719,293	493,163	474,311	129	
1984	608,883	560,609	371,171	384,895	127	8
1985	387,238	333,391	186,019	156,489	124	3
1986	1,166,574	1,122,874	502,940	471,369	131	10
1987	316,245	263,829	152,790	122,639	123	5
1988	1,118,856	1,069,426	660,618	649,594	132	18
1989	910,295	866,800	309,088	282,615	128	6
1990	551,526	498,791	307,818	274,840	128	15
1991	567,165	511,288	300,766	270,917	128	10
1992	703,200	693,600	555,965	549,972	129	22
1992	1,064,200	1,022,065	689,309	673,809	130	10
1993	564,348	506,313	420,417	389,477	128	4
1994	757,350	738,050	800,381	793,522	131	11

Table 4.1.5: Peak Discharges recorded at Dadu- Moro Bridge

Dadu Moro Bridge						
Year	Sukkur Barrage		Kotri Barrage		Bridge	Lag Time
	U/S	D/S	U/S	D/S	Gauge	Suk
	cusecs	cusecs	cusecs	cusecs	ft	days
1994	670,381	625,381	825,177	817,749		7
1995	985,929	939,554	799,435	771,365	131	12
1996	552,503	493,333	412,917	384,462		14
1997	831,280	807,772	321,180	301,979	130	5
1998	628,874	572,564	295,986	263,998		8
1999	389,260	334,030	220,680	189,294	125	6
2000	170,775	117,675	66,471	47,845	120	6
2001	222,021	168,935	95,205	61,670	120	6
2002	242,690	186,440	105,972	78,648	121	6
2003	333,340	297,663	240,907	231,417	127	8
2004	101,419	42,449	30,648	23,188	116	6
2005	508,427	447,407	310,495	274,283	128	21
2006	554,078	511,898	371,870	356,516	128	12
2007	303,610	258,660	157,340	136,081	124	5
2008	250,040	196,010	138,204	103,139	124	6
2009	195,717	134,620	120,498	115,473	123	7
2010	1,130,995	1,108,795	964,897	939,442	132	17

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Water Resources and Water Usage for Drainage and Flooding

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Figure 4.2 1: Rati



Figure 4.2 2: Ghotki

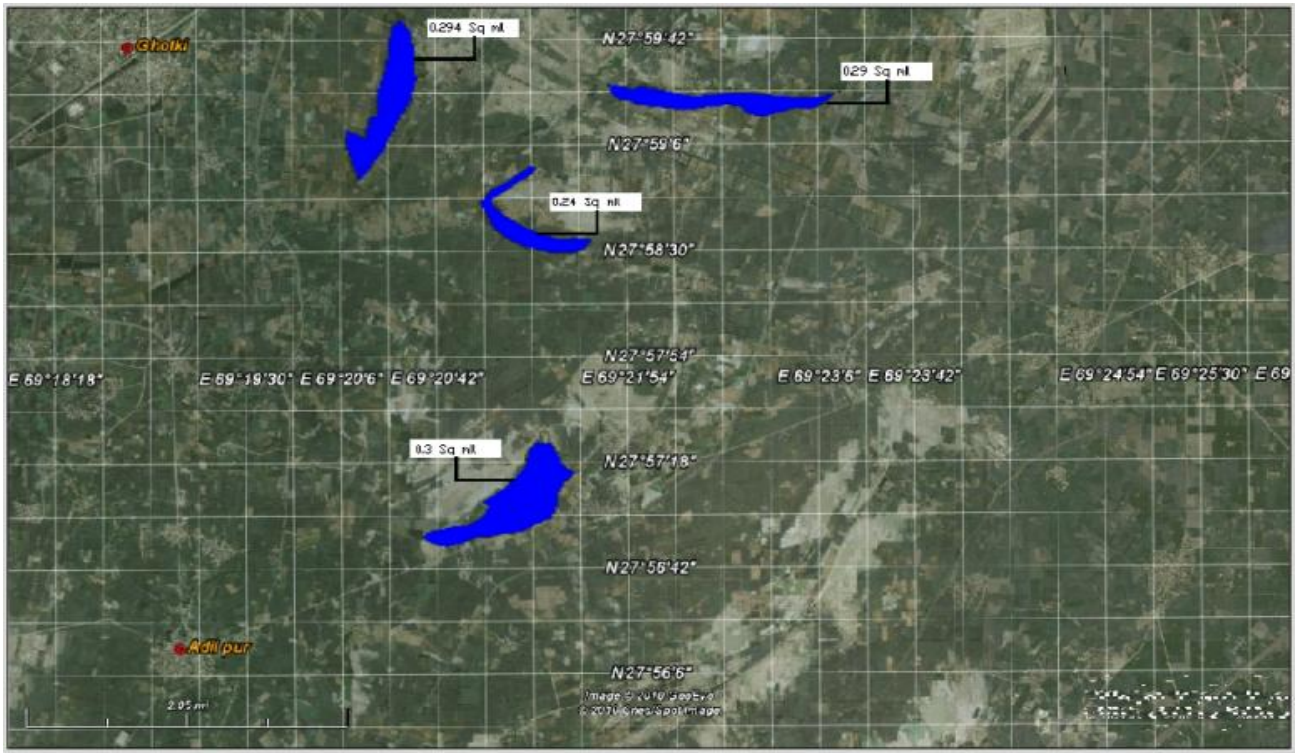


Figure 4.2 3: Gambat, Jiskani, Talpur Vada



Figure 4.2 4: Behlani

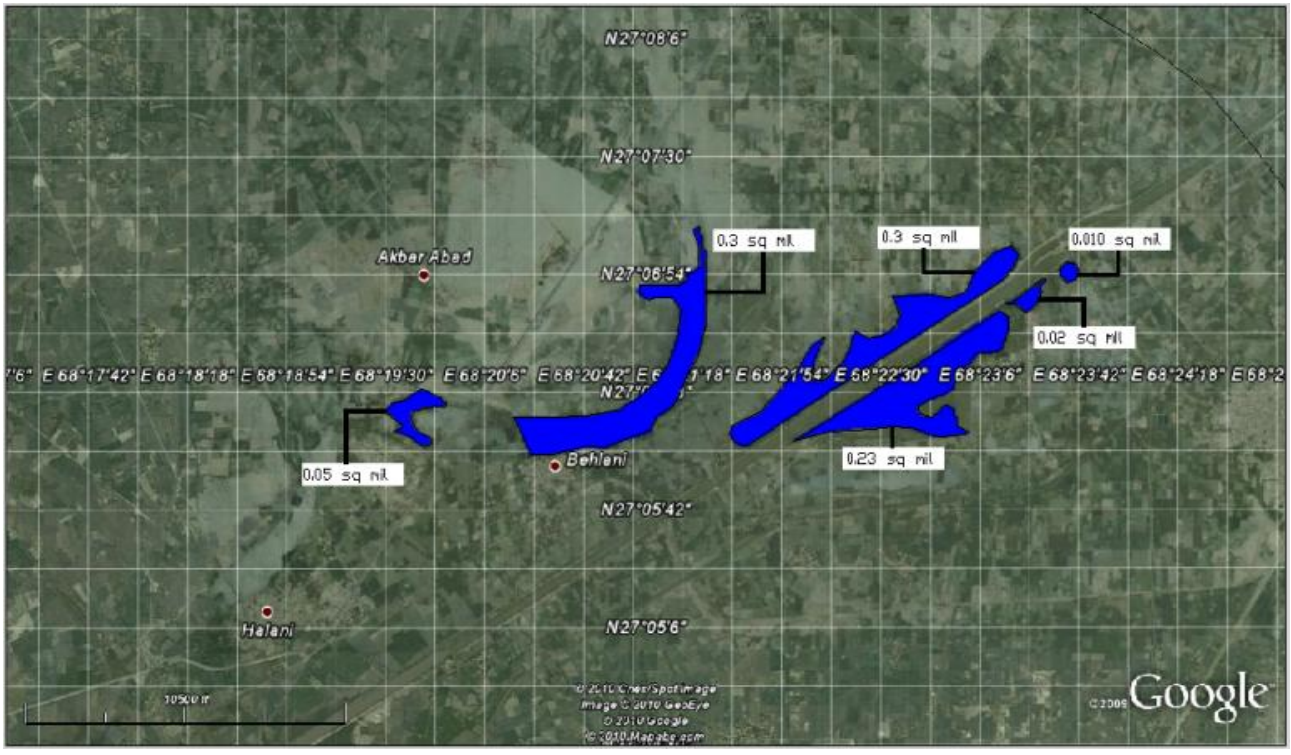


Figure 4.2 5: Phul Town Area



Figure 4.2 6: Bandhi Area

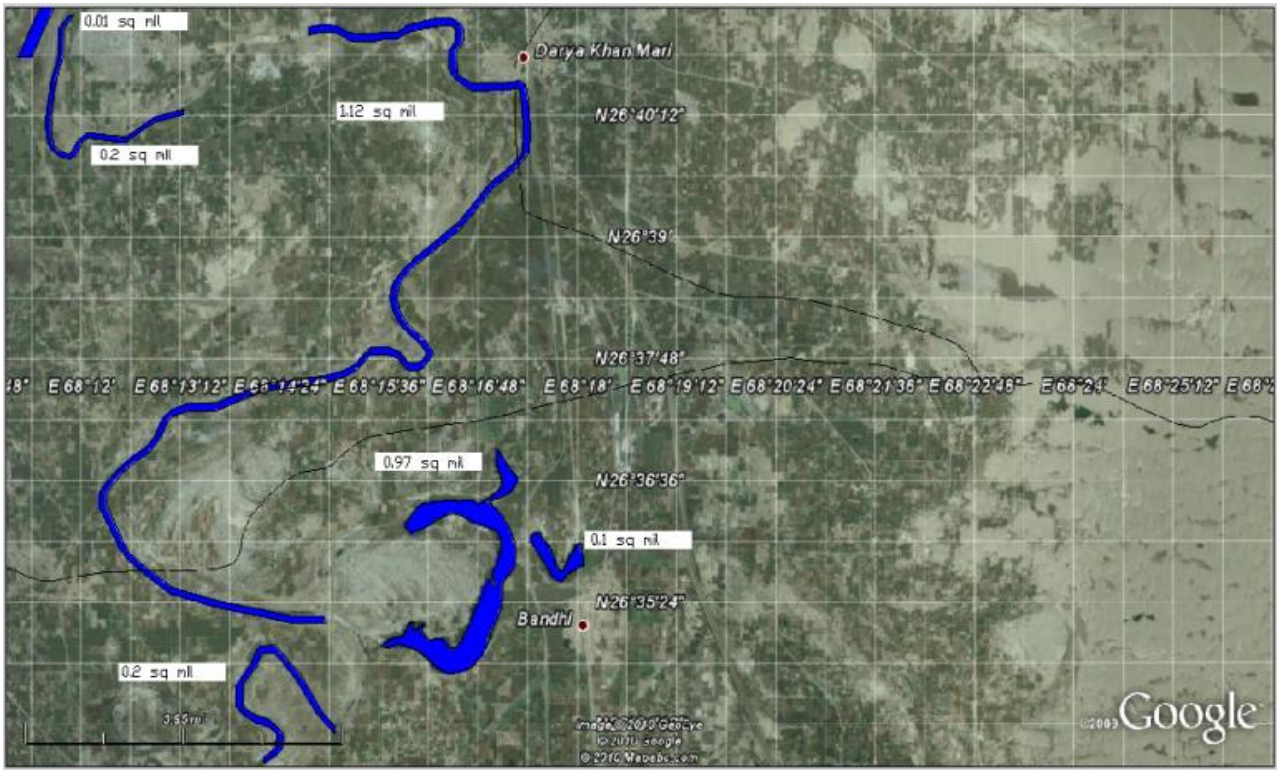


Figure 4.2 7: Daur

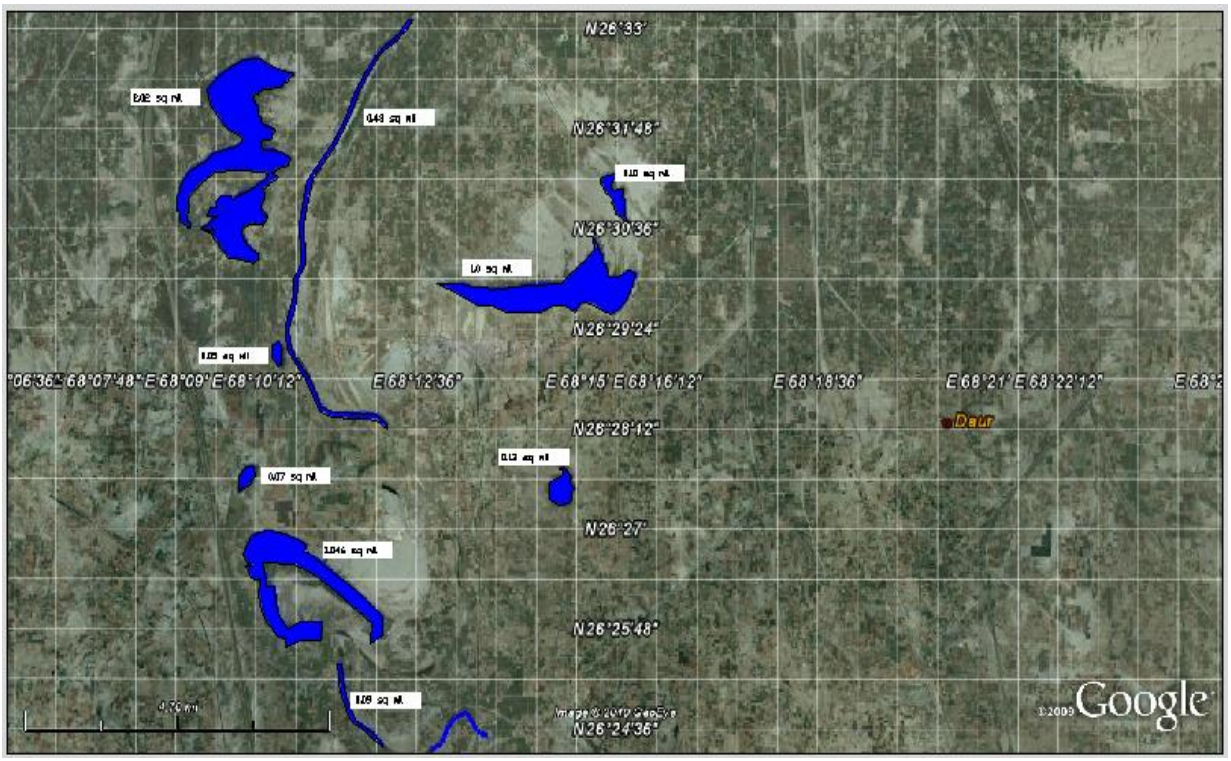


Figure 4.2 8: Bucheri Area



Figure 4.2 9: Bachal Raho And Din Muhammad Zardari

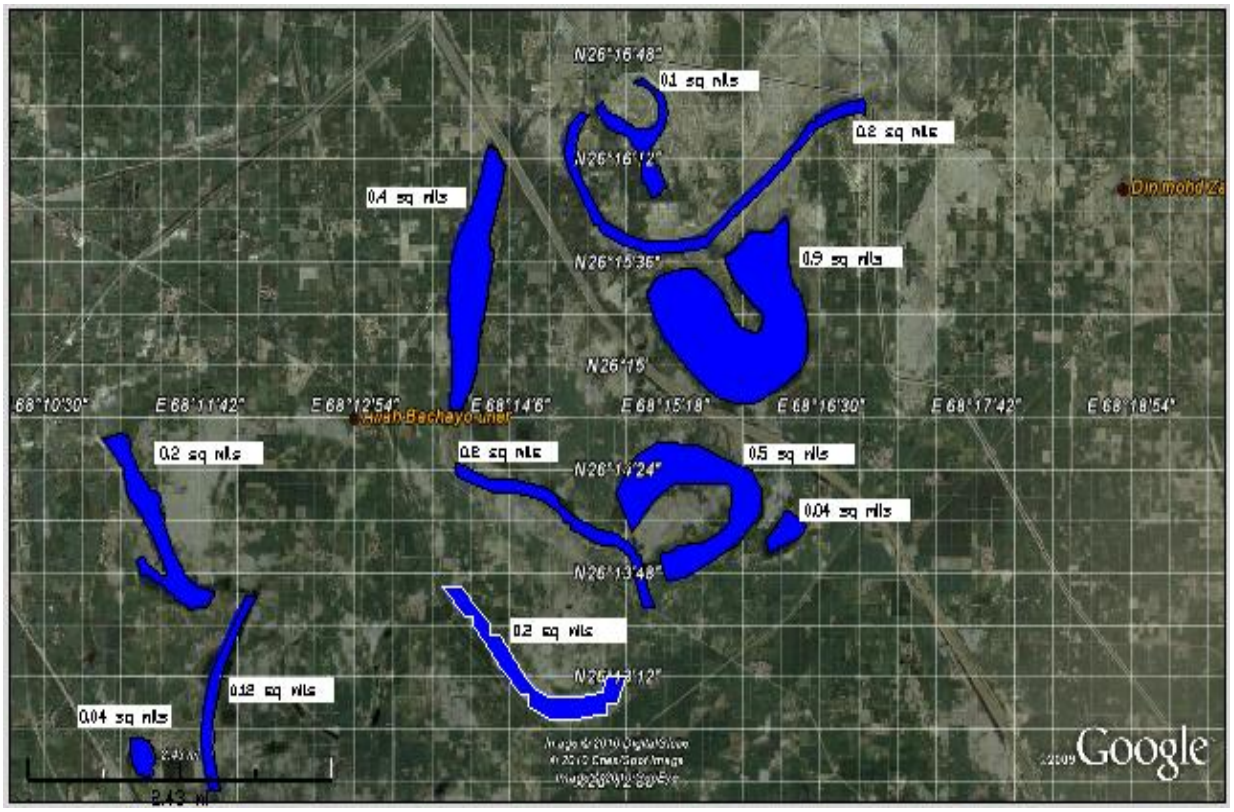


Figure 4.2 10: Sakrand Area

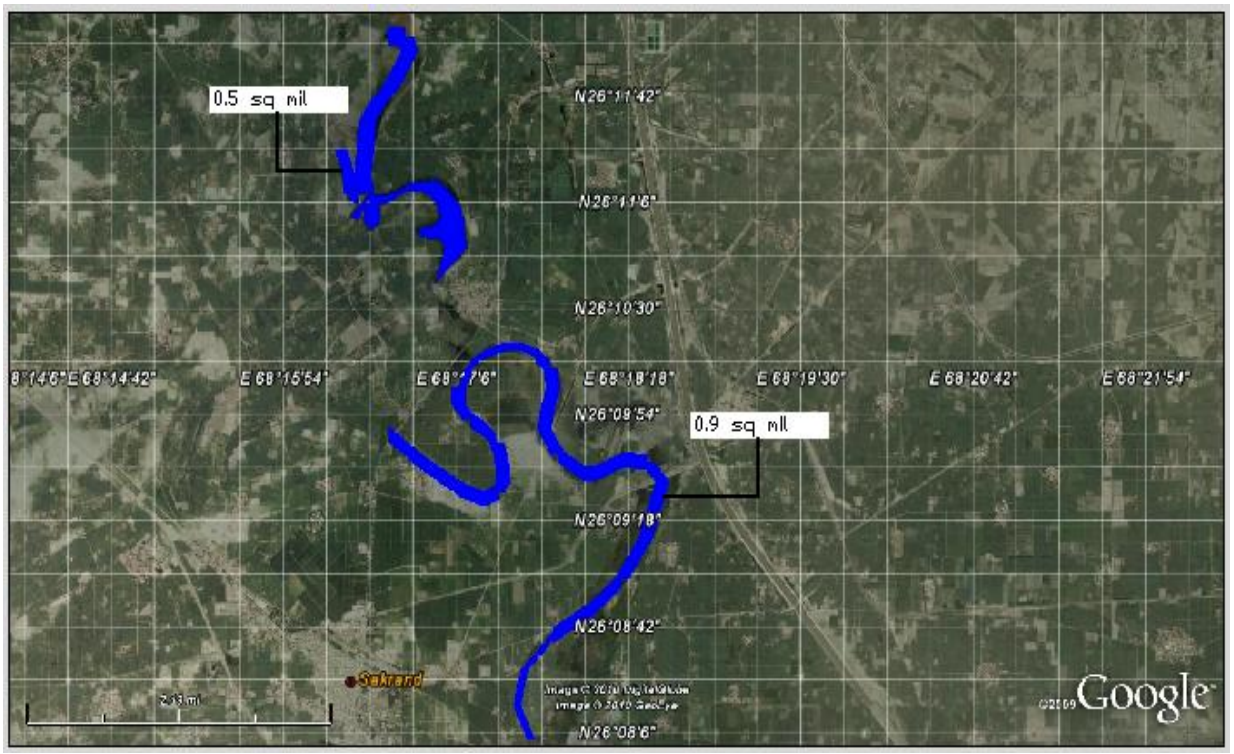


Figure 4.2 11: Tando Adam, Shahdadpur, Mansoora

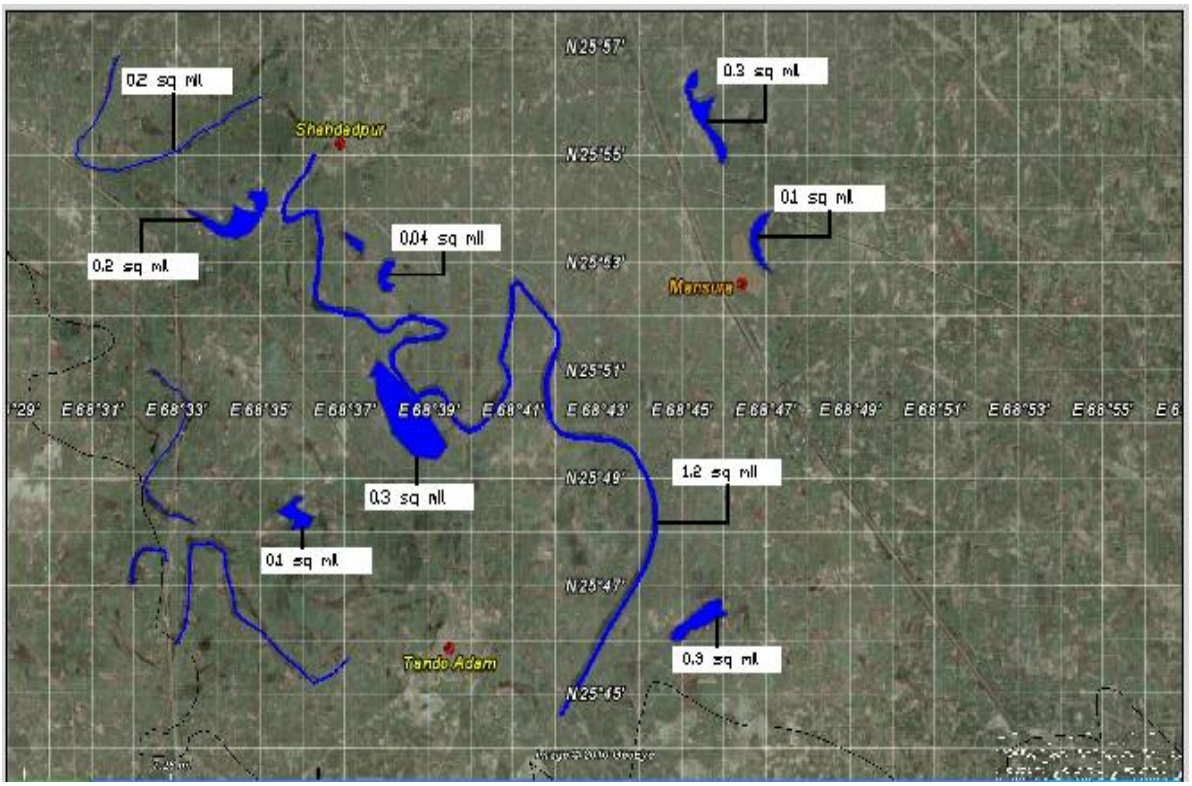


Figure 4.2 12: Dhoro Naro

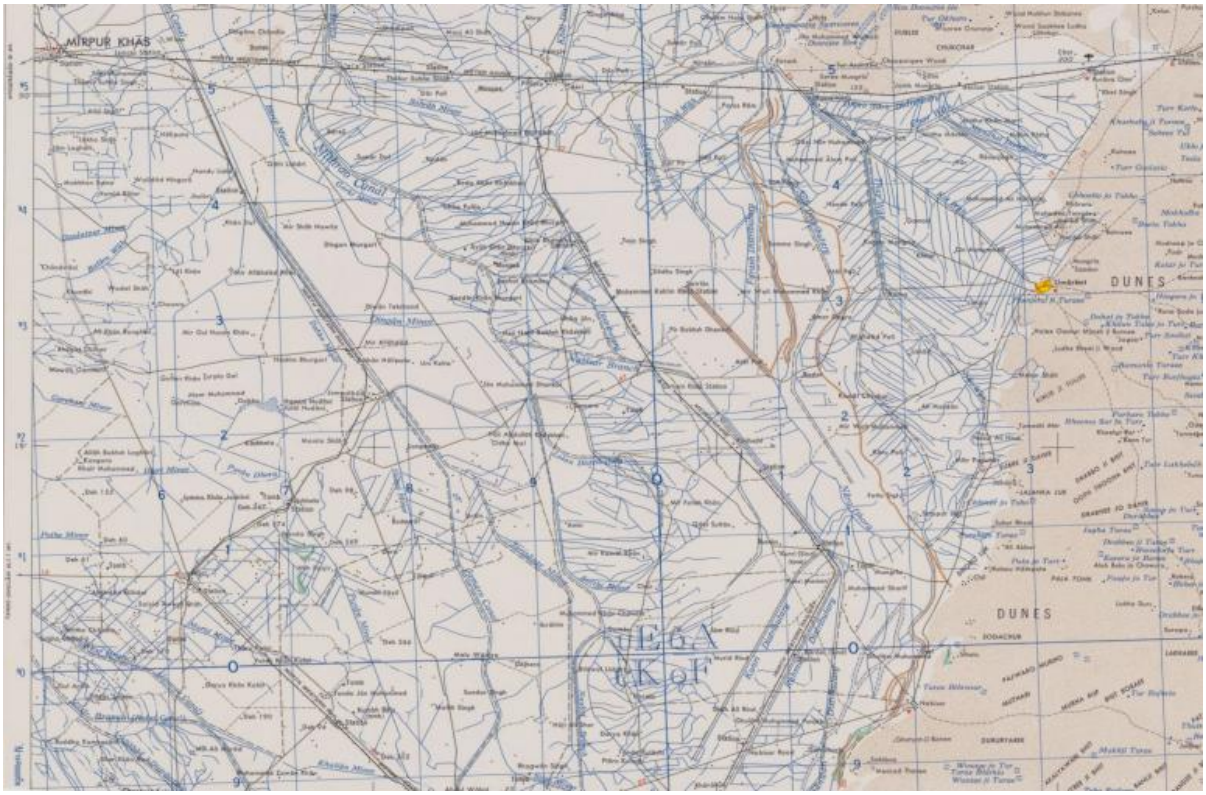
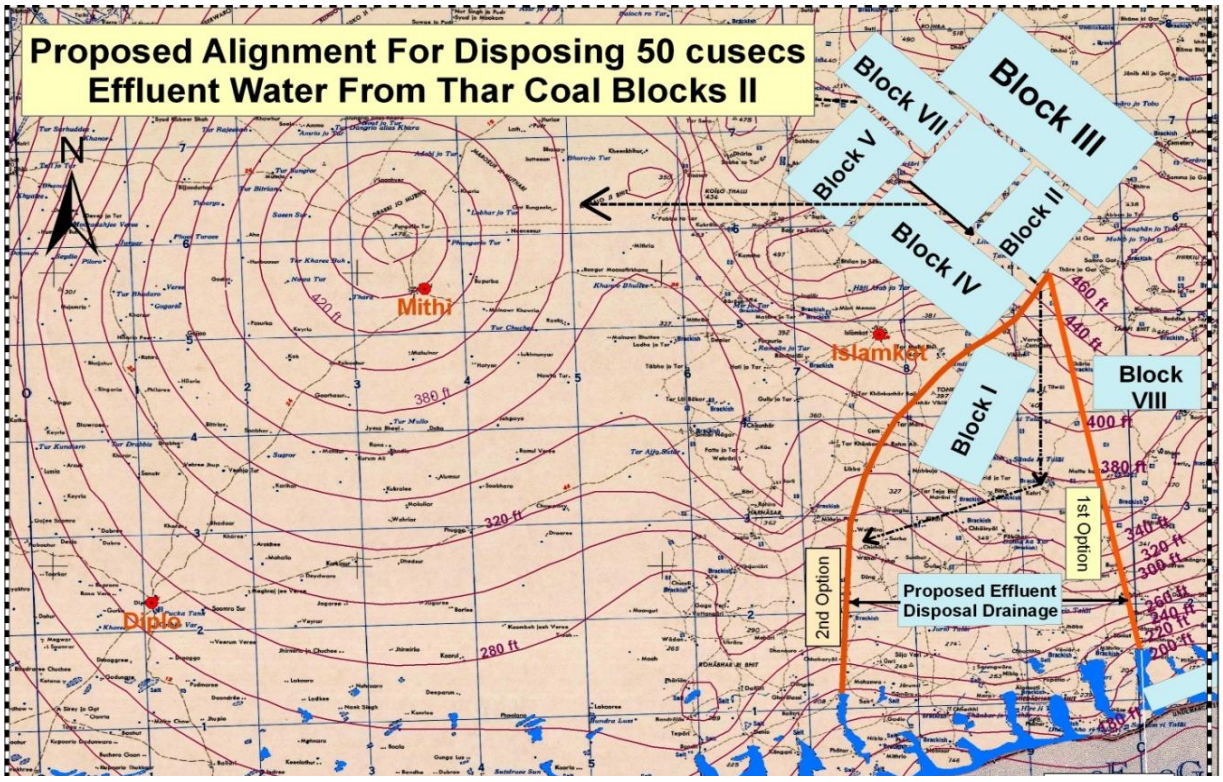


Figure 4.2 13: Dhoro Puran



Figure 4.2 14: Layout Plan for Proposed Wastewater Drain Under Options 1 And 2.



Thematic Area – 4.3

Environment and Biodiversity

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Table 4.3 1: Sources of Irrigation Supplies, Sanctioned Discharges and Actual Receipt for Irrigated Plantations Located on Left bank of Indus

Guddu Barrage Irrigation System

District	Main canal	Name of distributary	Sanctioned discharge (Cusecs)	Actual receipt (Cusecs)
Ghotki	Ghotki Feeder	Dingro Wah	108.8	95.5
		Jam Wah	21.9	15.6
		Mahesro Wah	23.5	19.5
		Sabani Minor	5.8	4.5
		Sultanpur Minor	12.5	7.5
		Kandhair Minor	47.8	40.5
		Kazi Wah	18.2	17.5
		Lundi Minor	24.9	21.4
		Bago daho Minor	22.3	20.5
		Bund Minor	8.0	4.8
		Mirpur Minor	11.8	11.5
		Mirpur Forest Minor	68.6	67.5
		Mahro Wah	23.4	18.5
Total			397.5	344.8

Sukkur Barrage Irrigation System

District	Main canal	Name of distributary	Sanctioned Discharge (Cusecs)	Actual receipt (Cusecs)
Khairpur	Main Nara Canal	Main Nara Canal	29.5	21.8
Total			29.5	21.8
N. Feroze	Rohri Canal	Mithiani Minor	3.5	3.0
		Keti Abubakar Minor	2.5	2.3
		Bakhari Minor	0.2	0.2
		Siyal Minor	0.2	0.2
Total			6.4	5.7
Nawabshah	Rohri Canal	Rahib Shah Minor	30.0	4.8
Total			30.0	4.8
Sanghar	Nara canal	Ex-Nara Canal	2.0	2.0
		Ex-Nara Canal	2.3	2.3
		Khakhro W.C	4.2	4.2

District	Main canal	Name of distributary	Sanctioned Discharge (Cusecs)	Actual receipt (Cusecs)
		Khori-I Minor	15.2	15.2
		Khori-II Minor	11.2	11.2
		Warian Minor	11.1	11.1
		Wadhal Minor	5.0	5.0
		Keti Minor	27.3	27.3
		Bhopi Minor	29.5	29.5
		Ex-Nara Canal	2.0	2.0
		Siranwari-I Minor	6.0	6.0
Total			115.8	115.8
Hyderabad	Rohri Canal	Saeed Khan Distry	11.5	6.4
Total			11.5	6.4
UmerKot	Khipro Canal	Thar Branch	10.5	10.5
Total			10.5	10.5
G. Total			203.7	165.0

Kotri Barrage Irrigation System

District	Main canal	Name of distributary	Sanctioned discharge (Cusecs)	Actual receipt (Cusecs)
T. M. Khan	Akram Wah	Akram Wah	35.0	33.0
	Pinyari Canal	Mulchand Forest Minor	30.2	11.5
		Ex-Mulchand Wah	13.3	10.5
	Daro Branch	Penah Minor-I	27.5	21.0
		Penah Minor-II	27.0	9.0
		Old Huderani minor	23.7	20.2
		New Huderani Minor	32.9	8.5
		Ladakho Minor-I	2.8	2.0
		Ladakho Minor-II	4.9	2.0
	Pinyari Feeder	Noor Wah	6.3	4.0
	Miranpur Distry	Hassan Ali Wah	2.9	1.0
Total			206.5	122.7
Badin	Pinyari Canal	Boharki Minor	23.8	9.5
		Rari Minor	28.3	8.7
Total			52.1	18.2

District	Main canal	Name of distributary	Sanctioned discharge (Cusecs)	Actual receipt (Cusecs)
Thatta	Daro Branch	Hazari Forest Minor	33.6	17.3
		Surjani Forest Minor	11.6	1.0
		Gang Forest Minor	4.2	3.5
Total			49.4	21.8
G. Total			308.0	162.7

Source: Forest Management Plans, 2001 and SFD records

Table 4.3 2: Discharge Volume of Indus River Water Downstream Kotri from 1938 to 2010.

Year	Kharif	Rabi	Annual	Year	Kharif	Rabi	Annual
1937-38	66.00	8.21	74.21	1975-76	37.76	1.44	39.20
1938-39	81.84	8.22	90.07	1989-90	16.85	0.37	17.22
1939-40	73.32	6.49	79.80	1990-91	38.20	4.21	42.41
1940-41	53.49	4.10	57.58	1991-92	50.05	4.09	54.14
1941-42	57.18	10.77	67.95	1992-93	69.20	12.30	81.50
1942-43	88.73	15.67	104.40	1993-94	28.46	0.64	29.10
1943-44	82.25	8.82	91.08	1994-95	88.19	3.64	91.83
1944-45	74.92	8.42	83.34	1995-96	62.86	1.71	64.57
1945-46	79.32	10.61	89.93	1996-97	44.62	0.67	45.29
1946-47	59.00	5.87	64.87	1997-98	16.98	3.80	20.78
1947-48	48.64	14.42	63.06	1998-99	32.50	2.65	35.15
1948-49	84.28	10.92	95.20	1999-00	8.75	0.11	8.86
1949-50	79.18	10.24	89.42	2000-01	0.72	0.02	0.74
1950-51	106.61	16.32	122.93	2001-02	1.92	0.00	1.92
1951-52	48.77	5.18	53.95	2002-03	2.11	0.04	2.15
1952-53	72.11	5.06	77.17	2003-04	20.10	0.07	20.16
1953-54	69.93	10.70	80.64	2005-06	0.13	0.00	0.13
1954-55	65.60	8.84	74.44	2006-07	0.11	0.01	0.12
1955-56	65.33	19.09	84.42	2007-08	0.09	0.00	0.09
1956-57	106.95	14.88	121.83	2008-09	0.03	0.00	0.03
1957-58	81.33	11.72	93.05	2009-10	0.02	0.00	0.02
1958-59	73.08	19.59	92.67				
1959-60	108.11	20.88	128.99				
1960-61	72.56	6.21	78.77				
1961-62	69.96	8.55	78.51				
1962-63	30.31	5.57	35.89				
1963-64	49.82	2.32	52.14				
1964-65	58.59	4.87	63.47				
1965-66	48.01	0.38	48.39				
1966-67	56.95	1.59	58.54				
1967-68	63.89	4.93	68.82				
1968-69	49.64	0.79	50.43				
1969-70	42.52	0.49	43.01				
1970-71	25.39	0.25	25.64				
1971-72	23.08	0.00	23.08				
1972-73	21.03	0.19	21.22				
1973-74	93.82	2.86	96.67				
1974-75	8.13	0.00	8.13				

Table 4.3 3: Soil Textural Groups

S.No	Textural Group	Soil Series	Textural Classes	Characteristic
	Coarse	Jhang	Sand and Loamy sand	Soils are excessively drained and had very low nutrient and Water holding capacity.
	Moderately Coarse	Farida	Sandy loam and Fine sandy loam	Fairly retentive of moisture for plant nutrients. Potentially productive and capable of producing normal yields crops under good management. Not advised for raising high delta crops.
	Medium	Buchiana	Loam, Silt loam and Silt	Soils are moderately permeable and well retentive of moisture for plant nutrients, these have a high productivity potential and can grow wide variety of crops.
	Moderately Fine	Chuharkana	Sandy clayloam, Clay loam and Silty clay loam	Soils are moderately permeable and retain good quantity of moisture for plant nutrients. These are suited to grow high delta crops.
	Fine	Nokhar	Sandy clay, Silty clay and Clay	These soils have low permeability and develop cracks on alternative drying and wetting and pose difficulty in workability. These are mostly used for high delta crops.

Table 4.3 4: Command Wise & Total Area of Left Bank under Different Textural Groups.

S. No	Main Canal	Area in Acres	Percent of each Textural Group					Miscellaneous	Total	Remarks
			Coarse Texture	Moderately coarse Texture	Medium Texture	Moderately Fine Texture	Fine			
1.	Ghotki Feeder	304286	8.0	11.0	26.0	46.0	-	9.0	100	The miscellaneous Land type mostly covers the urban areas, grave yards, canal, drains and other Linear features.
2.	Nara Canal	1286746	3.0	20.0	43.0	29.0	-	5.0	100	
3.	Rohri Canal	998588	5	11.0	46.0	32.5	-	5.5	100	
4.	Khairpur Feeder East	506000	18	11.0	49.0	18.0	-	4.0	100	
5.	Khairpur Feeder West	300000	1.0	44.0	25.0	18.0	5.0	7.0	100	
6.	Pinyari	548672	3.0	23.0	31.0	29.0	-	14.0	100	
7.	Fuleli	74726	1.0	14.0	38.0	42.0	-	5	100	
8.	Lined (Akram Wah)	339108	0.5	11.5	36.0	39	-	13	100	
Total Left Bank Command area		9708725	5.0	18.0	37.0	32.0	-	8	100	

Table 4.3 5: Land Use Pattern of the Study Area

S. No.	Name of Canal	Cultivated Canal Commanded Area					% of Area	Forest	% of Area	Un productive Land	% of Area	Miscellaneous Land type	% of Area	Total Area	% of Area
		Perennially Canal Irrigated Land	% of Area	Non Perennially Canal Irrigated Land	% of Area	Canal Irrigated + Tubewell Irrigation				Sand desert + under water + saline Land		Urban area + Grave yards+ Road+ Canal etc			
1	Ghotki Feeder	-	-	304286	31	392846	40	19666	2	177997	18	90000	9	984795	100
2	Khairpur feeder East	414920	82	-	-	15180	3	-	-	30360	6	45540	9	506000	100
3	Khairpur feeder West	260000	86.7	-	-	18000	6	-	-	1000	0.3	21000	7	300000	100
4	Nara	1286746	53	-	-	170000	7	18966	1	837682	32	118000	5	2431394	100
5	Rohri Canal	998588	34.3	-	-	1278217	44	1638	0.2	491180	16	158090	5.5	2927713	100
6	Lined channel (Akram Wah)	339108	64	-	-	-	-	-	-	120962	22.5	71895	13.5	531965	100
7	Pinyari	-	-	548672	56	-	-	1261	0.4	297674	30	133600	13.6	981207	100
8	Fuleli	-	-	740726	71	-	-	-	-	253925	24	51000	8.17	1045651	100
Total		3299362	34.0	1593684	16.4	1874243	19.3	41531	0.42	2210780	22.88	689125	7.0	9708725	100

Table 4.3 6: Water Logged Area (% of Surveyed Area) in Pre-monsoon (April) and Post-monsoon (October) in 8 Canal Commands of Study Area - Water Table Depth (0-150 cm)

Year	Ghotki Canal Command 0.389 Mha		Kharipur East canal command 0.231 Mha		Khairpur west canal command 0.121 Mha		Rohri canal command 1.195.Mha		Nara canal command 1.017 Mha		Akram Wah command 0.236 Mha		Fuleli canal command 0.409.Mha		Pinyari canal command 0.385 Mha	
	Pre mon-soon	Post mon-soon	Pre mon-soon	Post mon-soon	Pre mon-soon	Post mon-soon	Pre mon-soon	Post mon-soon	Pre mon-soon	Post mon-soon	Pre mon-soon	Post mon-soon	Pre mon-soon	Post mon-soon	Pre mon-soon	Post mon-soon
1979	23.9	66.32	23.37	16.43	9.09	10.4	12.8	7.48	26.64	14.99	38.13	76.8	0.97	87.04	2.33	80.98
1980	21.85	60.92	19.04	19.91	7.43	14.87	7.86	4.18	20.25	10.22	29.66	84.32	1.95	88.5	1.03	91.94
1981	28.53	64.26	25.97	17.09	17.35	29.52	9.62	6.1	19.07	11.7	28.38	91.52	2.44	96.57	3.11	90.9
1982	7.45	70.41	32.46	17.83	43.8	30.86	7.36	4.93	16.42	16.3	36.44	82.2	1.71	78.72	6.23	77.14
1983	4.37	80.64	28.13	25.19	30.57	34.54	10.12	9.12	24.18	29.05	37.71	91.61	2.6	90.46	2.33	87.74
1984	7.45	62.46	25.97	30.73	34.71	36.77	11.88	10.37	26.84	28.51	42.91	88.17	14.18	95.35	5.97	87.01
1985	20.05	72.49	25.54	37.22	35.53	35.53	11.21	11.88	32.15	23.99	50.84	89.83	2.68	98.04	0.25	88.57
1986	22.44	81.23	35.62	41.55	28.51	41.32	13.74	13.3	41.24	21.14	17.45	89.4	1	97.31	0.54	94.28
1987	12.35	66.7	32.44	37.31	33.39	35.29	16.81	13.06	27.83	16.08	32.73	64.84	7.1	88.36	1.05	83.76
1988	2.9	64.31	27.73	36.06	10.95	28.99	10.91	12.96	32.75	41.93	14.01	76.67	2.57	97	1.21	80.62
1989	68.27	68.27	52.17	52.17	52.17	52.17	21.16	21.16	43.95	43.95	30.11	72.48	93.83	93.83	88.25	88.25
1990	9.11	69.12	30.78	46.01	12.8	57.98	14.11	24.33	29.41	44.73	24.06	72.29	34.04	91.7	20.99	86.34
1991	6.85		26.73		10.58		15.73		32.34		35.87		91.93		21.89	
1992	11.08	75.79	37.87	54.95	31.15	60.36	19.76	40.81	35.89	46.4	42.91	96.52	46.85	98.58	30.41	93.77
1993	5.73	72.37	44.58	32.2	33.94	49.23	33.72	22.69	32.09	34.8	45.91	93.53	62.86	89.97	54.57	92.93
1994	3.91	76.99	24.15	51.91	25.82	40.71	13.01	35.2	29.69	50.76	27.09	93.82	36.5	99.14	45.87	96.88
1995	4.49	69.66	21.02	52.53	21.84	46.17	15.91	33.13	29.33	42.35	51.99	99.37	45.62	88.75	50.46	91.82
1996	5.88	70.03	43.96	54.12	24.26	63.42	16.32	26.22	25.03	35.29	78.79	97.03	23.83	87.04	4.93	89.09

Year	Ghotki Canal Command 0.389 Mha		Kharipur East canal command 0.231 Mha		Khairpur west canal command 0.121 Mha		Rohri canal command 1.195.Mha		Nara canal command 1.017 Mha		Akram Wah command 0.236 Mha		Fuleli canal command 0.409.Mha		Pinyari canal command 0.385 Mha	
	Pre mon-soon	Post mon-soon	Pre mon-soon	Post mon-soon	Pre mon-soon	Post mon-soon	Pre mon-soon	Post mon-soon	Pre mon-soon	Post mon-soon	Pre mon-soon	Post mon-soon	Pre mon-soon	Post mon-soon	Pre mon-soon	Post mon-soon
1997	25.92	66.46	37.26	58.68	23.45	61.21	12.87	28.31	25.03	35.94	93.88	96.65	66.1	85.36	85.4	90.4
1998	1.1	80.63	35.11	69.59	27.73	77.47	18.32	29.89	28.2	32.24	85.39	92.5	77.6	89.26	78.31	89.52
1999	1.15		34.18		19.82		24.17		26.24		99.88		90.78		95.29	
2000	0	53.14	7.45	22.16	3.61	17.28	4.81	5.99	12.25	5.15	22.83	75.77	0.56	76.07	0	78.95
2001	0	62.81	0	32.27	0	15.78	1.98	1.46	0.79	6.74	0.37	70.76	0	73.58	0	32.03
2002	0	25.72	0	22.9	0	31.09	0.21	1.78	1.18	14.28	1.79	37.44	0	41.1	0	37.27
2003	0	32.6	0	50.27	0	33.67	0	7.34	0	20.11	0	64.97	0	69.3	0	43.45
2004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005																
2006	0	51.2	8.74	26.32	0.37	35.56	8.89	19.08	7.43	26.78	0.63	81.35	0.52	83.21	0.4	59.4
2007	0	40.46	8.53	25.46	0.57	21.68	19.83	26.18	25.05	30.33	12.02	71.63	7.05	76.33	1.63	43.57
2008	0		10.87		5.6		13.72		20.66		4.55		2.89		0.54	
2009	28.2	64.64	36.12	46.98	74.57	45.25	15.98	29.5	8.44	35.42	5.82	68.84	3.9	69.58	1.89	92.03
2010	1.63		0.53		4.76		2.33		0.63		0		0.31		0.12	

Source: SCARP Monitoring Organization (SMO) South WAPDA

Table 4.3 7: Water Quality of Surface Drains Out Falling in LBOD System
(TDS=Total Dissolved Solids in '000' and SAR =Sodium Absorption Ratio)

2005 2007	1		2		3		4		5		6		7		8		9		10	
	TDS	SAR	TDS	SAR	TDS	SAR	TDS	SAR	TDS	SAR	TDS	SAR	TDS	SAR	TDS	SAR	TDS	SAR	TDS	SAR
Mar	2.1	9.9	2.1	10.1	2.5	10.9	3.8	14.5	13.0	21.6	12.5	23.0	10.4	31.5	6.3	17.8	6.9	19.4	2.5	18.5
Apr	3.2	13.9	4.1	10.5	5.6	17.0	6.1	18.0	10.0	20.3	7.0	16.0	31.6	27.2	18.5	25.9	9.8	19.8	8.7	19.3
May	0.0	0.0	0.0	0.0	7.0	17.4	6.8	18.3	10.0	20.3	7.0	16.0	31.6	27.2	31.8	25.9	13.2	19.8	11.6	19.3
Jun	0.0	0.0	0.0	0.0	10.3	20.0	10.2	14.0	8.2	20.0	5.7	14.0	33.4	34.6	30.6	25.3	10.6	21.3	9.4	18.2
Jul	0.0	0.0	0.0	0.0	5.9	11.9	7.3	9.5	6.8	12.2	5.0	7.1	9.6	15.7	15.8	21.8	9.7	16.2	7.8	14.9
Aug	0.0	0.0	0.0	0.0	4.4	9.4	4.6	11.6	3.7	17.2	3.4	18.3	2.7	11.3	2.5	6.9	3.3	8.3	2.7	7.5
Sep	3.7	17.4	3.7	18.8	4.9	13.7	7.7	11.8	6.0	14.2	6.1	14.8	4.0	6.4	4.1	4.6	4.2	11.4	5.2	11.5
Oct	2.7	10.5	4.1	11.9	5.2	14.9	5.8	13.6	6.1	11.9	10.0	21.6	4.1	9.7	3.7	12.1	4.4	9.0	5.9	15.8
Nov	2.0	7.9	3.4	11.0	4.6	7.3	4.7	8.9	5.2	12.2	8.9	15.3	2.9	8.8	4.8	8.3	3.8	11.1	4.8	8.2
Dec	3.0	10.0	4.1	11.0	4.6	9.6	5.6	18.5	6.9	15.8	5.5	12.4	4.3	9.5	5.9	9.6	5.8	11.0	5.5	9.4
Jan	5.4	9.9	12.3	19.2	7.4	13.2	7.3	13.3	14.2	25.0	11.0	17.4	14.8	20.4	19.6	29.1	11.9	20.0	13.0	25.0
Feb	5.0	6.9	3.8	12.5	4.8	6.5	7.9	13.7	6.9	12.3	5.8	8.7	2.8	10.6	4.9	10.9	4.8	10.2	4.6	5.7
Mar	2.9	7.8	3.8	10.6	3.9	5.9	5.2	6.6	7.7	15.8	12.7	22.4	5.2	9.8	6.0	10.8	4.2	6.3	5.9	6.0
Apr	5.2	11.9	5.4	17.8	3.3	14.3	6.0	11.5	9.9	21.9	16.2	29.7	8.5	22.2	14.8	40.4	5.6	10.7	6.4	11.4
May	3.2	6.9	3.5	7.5	6.2	16.7	5.6	14.2	7.3	16.8	10.7	23.6	19.0	34.1	16.4	31.8	8.6	17.2	9.1	17.6
Jun	4.3	11.3	4.8	14.4	6.9	19.3	7.1	21.9	5.2	10.5	6.0	12.3	12.0	25.7	7.5	18.0	5.9	17.0	5.1	14.5
Jul	2.8	11.7	3.9	8.1	4.8	11.1	6.4	15.4	3.7	14.8	2.9	12.6	6.2	11.0	6.2	9.9	3.2	14.1	3.8	13.7
Aug	3.1	13.6	5.4	11.9	6.2	13.2	7.6	17.9	5.1	10.2	4.8	10.0	19.7	31.5	19.5	27.8	6.2	9.6	7.0	22.0
Sep	3.1	13.9	4.6	11.3	7.0	13.2	7.5	21.1	11.0	14.3	12.0	24.9	4.7	7.8	8.8	17.1	5.6	19.0	7.0	15.0
Oct	3.6	13.9	6.6	15.3	7.6	16.9	8.0	19.8	6.1	18.0	4.8	12.6	12.3	23.5	14.5	32.6	6.5	15.6	6.8	19.1
Nov	3.3	14.6	3.2	14.0	5.8	19.0	6.4	18.4	8.0	17.6	6.2	14.5	14.9	30.8	19.7	37.0	7.2	21.0	8.1	22.6
Dec	3.3	13.8	3.0	11.5	4.9	9.6	6.2	17.2	7.2	8.9	10.2	20.9	13.9	29.7	12.4	22.5	8.1	14.8	6.5	12.1
Jan	6.1	11.6	11.0	20.2	8.4	11.1	7.8	13.5	9.0	13.6	12.6	17.8	13.3	23.1	9.9	17.5	10.1	16.7	9.4	19.8
Feb	6.5	15.2	7.7	19.9	5.7	9.3	6.9	20.7	8.9	18.0	10.0	17.2	8.9	16.5	11.4	25.9	8.2	18.0	7.4	15.9
Mar	4.7	10.2	4.8	7.6	8.0	15.0	7.8	22.5	11.0	28.5	22.3	38.9	15.7	28.1	19.7	36.3	12.0	29.6	11.2	23.9
Apr	3.3	14.6	3.8	14.9	5.5	14.5	6.0	19.2	8.8	19.6	14.9	31.7	19.3	34.9	23.6	39.3	10.4	29.8	9.4	27.3
May	3.7	14.4	6.9	9.8	7.9	17.8	7.1	14.9	6.1	12.4	22.2	39.5	22.7	38.5	25.5	37.4	11.7	19.9	10.6	21.0
Jun	3.2	12.2	5.7	7.8	7.3	13.7	7.0	16.4	2.9	12.4	6.4	11.1	17.5	35.0	18.0	36.7	8.6	20.9	5.9	10.3

1.East Nawabshah Main Drain (Zero Point)
2. East Nawabshah Main Drain (RD-70)
3. West Nawabshah Main Drain (Zero Point)
4. West Nawabshah Main Drain (RD-95)
5. Sanghar Main Drain (Zero Point)
6. Sanghar Main Drain (RD-94)
7. Mirpurkhas Main Drain (RD-44)
8. Mirpurkhas Main Drain (RD-184)
9. Spinal Main Drain (RD-159)
10.Spinal Main Drain (RD-456)

Table 4.3 8: Wastewater Produced Annually by Towns and Cities

City	Urban Population (1998 Census)	Total Wastewater Produced (million m^3/y)	% of Total	% Treated	Receiving Water Body
Lahore	5,143,495	287	12.5	0.01	River Ravi, irrigation canals, vegetable farms
Faisalabad	2,008,861	129	5.6	25.6	River Ravi, River Chenab and vegetable farms
Gujranwala	1,132,509	71	3.1	-	SCARP drains, vegetable farms
Rawalpinidi	1,409,768	40	1.8	-	River Soan and vegetable farms
Sheikhupura	870,110	15	0.7	-	SCARP drains
Multan	1,197,384	66	2.9	-	River Chenab, irrigation canals and vegetable farms
Sialkot	713,552	19	0.8	-	River Ravi, irrigation canals and vegetable farms
Karachi	9,339,023	604	26.3	15.9	Arabian Sea
Hyderabad	1,166,894	51	2.2	34.0	River Indus, irrigation canals and SCARP drains
Peshawar	982,816	52	2.3	36.2	Kabul River
Other	19,475,588	967	41.8	0.7	-
Total Urban	43,440,000	2,301	100.0	7.7	-

Source: Master Plan for *Urban Wastewater (Municipal and Industrial) Treatment Facilities in Pakistan.* Final Report, Lahore: Engineering, Planning and Management Consultants, 2002.

Table 4.3 9: Drinking Water Quality Standards by PCRWR
Physical and Chemical Standards for Drinking Water

Constituent	Unit	HDL	MPL **	Toxic Effects
Turbidity	NTU	2.5	5	Un-aesthetic, decrease in efficiency of disinfections
Colour	PCU	5	15	Un-aesthetic
Taste & Odour	-	Unobjectionable		Taste & Odour
Constituent	**Unit**	**HDL**	**MPL ****	**Toxic Effects**
pH	-	7.0-8.5	6.5-9.2	Taste, Corrosion
Fluoride	mg /l	1.000	1.500	Dental fluorosis in children, crippling skeletal flurosis
Nitrate (NO3)	mg /l	45 .000	45 .000	Infantile methaemoglobinaemia
Lead	mg /l	0.050	0.050	Children susceptible to effects of lead on central nervous system
Mercury	mg /l	0.00 1	0.00 1	Neurological effects
TDS	mg /l	500	1500	Fault or salty taste, corrosion or instruction
Iron	mg /l	0.1	1.0	Taste, discoloration
Manganese	mg /l	0.05	0.5	Taste, discoloration
Magnesium	mg /l	30	150	Stomach disturbances
Copper	mg /l	0.05	1.5	Taste, corrosion of pipes and utensils taste
Zinc	mg /l	5	15.0	Taste
Sulfate	mg /l	200	400	Corrosion, Laxative effect
Chloride	mg /l	200	600	Taste, Corrosion
Hardness	mg /l	200	500	Corrosion or scale formation
Phenolic substances	mg /l	0.00 1	0.002	Taste
*Highest Desirable Level.				** Maximum Permissible Level.

Table 4.3 10: Bacteriological Standards for Drinking Water PCRWR

Categories	Standards
A. Piped Water Supplies	
A-1 Treated water entering the distribution syste	
- Faecal Coliform	0/100 ml
- Coliform organisms	0/100 ml
A-2 Untreated water entering the distribution system	
- Faecal Coliform	0/100 ml
-Coliform organisms	3/100 ml
A-3 Water in the distribution system	
- Faecal Coliform	0/100 ml
- Coliform organisms	3/100 ml
B. Unpiped Water Supplies	
- Faecal Coliform	0/100 ml
- Coliform organisms	10/100 ml

Source: Kahlown & Azam 2004

Table 4.3 11: Drinking Water Quality Standards Drafted by PSQCA

A. Physical Requirements

S. #	Characteristics	Unit	MAC*	MAC**
1.	Turbidity	NTU	5	25
2.	Colour	TCU	5	50
3.	Taste & Odour	-	Unobjectionable	
4.	pH	-	7.0-8.5	6.5- 9.2

B. Chemical Requirements (a)

	Requirements	Characteristic	Requirements
Arsenic (mg/l)	0.01	Manganese (mg/l)	0.50
Cadmium (mg/l)	0.003	Mercury (mg/l)	0.00 1
Chromium (mg/l)	0.05	Nickel (mg/l)	0.02
Copper (mg/l)	1.0	Nitrate (mg/l)	10.0
Cyanide (mg/l)	0.07	Nitrite (mg/l)	0.02
Fluoride (mg/l)	1.5	Selenium (mg/l)	0.01
Lead (mg/l)	0.01		

C. Chemical Requirements(b)

1.	Total Dissolved Solids	mg/l	1000	1500
2.	Chloride (Cl)	mg/l	200	600
3.	Sulfate (SO4)	mg/l	200	400
4.	Nitrate (NO3)	mg/l	-	45
5.	Total Hardness (CaCO3)	mg/l	20	500
6.	Nitrite (NO2)	mg/l	Nil	Nil
7.	Magnesium (Mg)	mg/l	500	1000
8.	Total Ammonia	mg/l	0.1	0.5
9.	Hydrogen Sulfide	mg/l	Undetectable odour	
10.	Fluoride (F)	mg/l	-	1.5
11.	Iron (Fe)	mg/l	0.3	1.0
12.	Zinc (Zn)	mg/l	5.0	15.0
13.	Manganese (Mn)	mg/l	0.1	0.5
14.	Copper (Cu)	mg/l	1.0	1.5
15.	Calcium (Ca)	mg/l	75	200
16.	Magnesium (Mg)	mg/l	50	150
17.	Phenolic Substances	mg/l	0.001	0.002
18.	Alkyl Benzyl Sulfates	mg/l	0.5	1.0
19.	Carbon Chloroform Extract	mg/l	0.2	0.5

D. Limits of Toxic Substances

1.	Arsenic (As)	mg/l	0.05	-
2.	Cadmium (Cd)	mg/l	0.01	-
3.	Chromium (Cr)	mg/l	0.05	-
4.	Cyanide (Cn)	mg/l	0.20	-
5.	Lead (Pb)	mg/l	0.05	-
6.	Selenium (Se)	mg/l	0.20	-
7.	Radionaclider	Uo/l	1000	-

E. Biological Requirements (Chemical Indicators of Pollution)

1.	Chemical Oxygen Demand (COD)	mg/l	10	-
2.	Biochemical Oxygen Demand (BOD)	mg/l	6	-
3.	Ammonia (NH3)	mg/l	0.5	-
4.	Grease	mg/l	1	-

F. Limits for Bacteriological Contaminants

Acceptable bacterial standards for potable water supplies:		
i)	Standard plate count (SPC)/mls	No more than 100
ii)	Presumptive test for Coliform	Negative
iii)	Most probable number (MPN)	< 101 subject to the frequency of opportunity for water analysis.

* Maximum Acceptable Concentration. ** Maximum Allowable Concentration.
Source: Kahlown & Azam 2004

Table 4.3 12: National Environmental Quality Standards by EPA (Liquid Industrial Effluents) EPA

Sr.#	Parameter	Standards
1.	Temperature	40 C
2.	pH Value (acidicity/basicity)	6-10 pH
3.	5-day Biochemical Oxygen Demand (BOD) at 20^0C	80 mg/l
4.	Chemical Oxygen Demand (COD)	150 mg/l
5.	Total Suspended Solids	150 mg/l
6.	Total Dissolved Solids	3500 mg/l
7.	Grease and Oil	10 mg/l
8.	Phenolic Compounds (as phenol)	0.1 mg/l
9.	Chloride (as Cl)	1000 mg/l
10.	Fluoride (as F)	20 mg/l
11.	Cyanide (as Cn)	2 mg/l
12.	An-ionic detergents (as MBAS) 3	20 mg/l
13.	Sulfate (SO4)	600 mg/l
14.	Sulfide (S)	1.0 mg/l
15.	Ammonia (NH3)	40 mg/l
16.	Pesticides, herbicides, fungicides and insecticides	6.15 mg/l
17.	Cadmium	0.1 mg/l
18.	Chromium (trivalent and hexavalent)	1.0 mg/l
19.	Copper	1.0 mg/l
20.	Lead	0.5 mg/l
21.	Mercury	0.01 mg/l
22.	Selenium	0.5 mg/l
23.	Nickel	1.0 mg/l
24.	Silver	1.0 mg/l
25.	Total Toxic Metals	2.0 mg/l
26.	Zinc	5.0 mg/l
27.	Arsenic	1.0 mg/l
28.	Barium	1.5 mg/l
29.	Iron	2.0 mg/l
30.	Manganese	1.5 mg/l
31.	Boron	6.0 mg/l
32.	Chlorine	1.0 mg/l

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Table 4.4.1: Disaster Management and Related Environmental Responsibilities Assigned to SIDA in the Sindh Water Management Act of 2002

Section of Ordinance	Sub-section	Legal requirement	Comment
		Chapter II – The Sindh Irrigation and Drainage Authority	
10. Functions of SIDA	a.	Operate and maintain the parts of the irrigation system such as Barrages and outlets assigned to it	
	b.	Operate and maintain the parts of the drainage system assigned to it including spinal drains and inter-AWB drains	
	c.	Carry out river flood protection and maintain the infrastructure in the Province of Sindh	
	d.	Advise Government on any matter strategic or tactical. Related to its functions and tasks or to the water management system as a whole e.g. irrigation or drainage contribution rates, drought management and sea water intrusion	
11. Tasks of SIDA	Strategy a.	To develop, on a periodic basis a strategy statement for improvement of irrigation and drainage services, integrated water management, flood protection, prevention of sea water intrusion, water distribution in times of drought and wetland management within its command and catchment areas setting goals and objectives, formulating implementation policies and identifying priority and other actions	Requires continued updating of strategies for flood protection, prevention of sea water intrusion and drought management
	Operation and Maintenance c.	Subject to the provisions agreed with the Indus River System Authority, to receive Irrigation Water of the Barrages within the Province and/or from the inter Provincial/link canals and deliver the same in agreed quantities to various AWBs, FOs or , as the case me be to other agricultural users, local Councils, industries or wetlands, guaranteeing the minimum discharge below Kotri Barrage to prevent sea water intrusion, in the manner and on the terms and conditions as may be negotiated between the SIDA and the parties concerned and to receive drainage effluent at the designated points and convey the same to the sea	Requires minimum release of water quantity below Kotri Barrage
	d.	To maintain the irrigation, drainage and flood protection infrastructure located within its territorial jurisdiction	Requires O&M of flood protection infrastructure
	Capital Projects and Schemes g.	In consultation with the various stakeholders, to plan, design, construct improvements to the irrigation and drainage system, storage reservoirs and flood protection infrastructure including development work for irrigation of lands	Requires design, analysis and construction of new flood protection infrastructure
	Research and Development	To draft, implement and regularly update policies, studies and research programmes it considers relevant to its	Requires prevention and

Table 4.4.1: Disaster Management and Related Environmental Responsibilities Assigned to SIDA in the Sindh Water Management Act of 2002

Section of Ordinance	Sub-section	Legal requirement	Comment
	j.	functions and tasks; e.g. integrated water management, control of water logging and salinity. Prevention of sea intrusion, water distribution during drought	mitigation of disaster risks of: water logging, salinity, sea water intrusion and drought
	l.	To conduct studies into the impact of the operations and policies of the SIDA on the ecology and on the environment including protection of wetlands with a view to appraising the various available options for minimizing the adverse impact of such operations and policies and to adopt the best alternatives for further action	Requires environmental impact assessment of all operations and policies
	m.	To coordinate/regulate the measures being undertaken/required to be undertaken in the total water management system e.g. the recording/gauging of surface waters. Monitoring of the ground water table and the quantity of water, with compilation of date relevant thereto, flood protection and in this regard, to establish and regularly maintain proper liaison with the relevant authorities in other Provinces.	Requires the ability to monitor and measure ground and surface water resources; including flood water flows
	Public Disclosure and Information n.	To issue flood warnings and warnings to all parties likely to be affected, if it has cause to believe that damage or harm shall result from the use of any water flowing within it command area	Flood warning capability required for Basin
	Administration s.	To maintain records, registers and data banks as may be necessary for its effective functioning under this Ordinance	Makes necessary the development of data base and GIS capability
26. Coordination by SIDA in case of calamities	1)	In case of calamities, such as breaches, floods or extreme weather conditions such as cyclones, the SEDA shall have a coordinating role in taking all necessary measures	The nature of disaster management (coordination) is not specified
	2)	The Managing Director shall decide whether a calamity has occurred making such a coordinating role necessary and shall communicate such decision immediately to all AWBs concerned	SIDA Managing Director is focal point for disaster management
	3)	The Managing Director may request all assistance or give any instructions to the AWBs to which he has sent the communication mentioned in sub-section (2) either the purpose of contravening the adverse effects of the occurring calamity	
	4)	The AWB shall provide without delay all assistance requested for and carry out all instructions given by the SIDA	

Table 4.4.1: Disaster Management and Related Environmental Responsibilities Assigned to SIDA in the Sindh Water Management Act of 2002

Section of Ordinance	Sub-section	Legal requirement	Comment
	5)	The managing director shall report to the SIDA as soon as possible the measures that he has taken	
		Chapter III – Area Water Boards	
32. Functions of an AWB	c.	Carry out flood protection and maintain infrastructure within its command area	AWB level flood management required
33. Tasks of an AWB	Strategy a)	To develop, on a periodic basis, a strategy statement for improvement of irrigation and drainage services, integrated water management including drinking water, water distribution in times of drought, flood protection within its command and catchment areas setting goals and objectives, formulating implementation policies and identifying priority and other actions	
	Operation and Maintenance e.	To operate and maintain the irrigation, drainage and flood protection infrastructure located within its territorial jurisdiction	
	Capital Projects and Schemes o.	In consultation with the various stakeholders, to plan, design, construct improvements to the irrigation and drainage system, storage reservoirs and flood protection infrastructure including development work for irrigation of lands within its territorial jurisdiction	
	Public Disclosure of Information v.	To issue flood warnings and warnings to all parties likely to affected, if it has cause to believe that damage or harm shall result from the use of any water flowing within its command area	Regional flood warning
38. AWB's power in respect of toxic or noxious effluent	1)	To monitor the disposal of toxic or noxious effluent safely and with minimum pollution of water resources	Specifies control of water pollution
	3)	To notify the Regulatory Authority of offences in respect of toxic or noxious effluent committed with the AWB's jurisdiction	
		Chapter IV – Farmers' Organizations	
45. Functions of an FO	c.	Carry out flood protection and maintain infrastructure within its command area	FO level flood management required
46. Tasks of an FO	Operation and Maintenance e.	To operate, maintain, protect and improve the irrigation, drainage and flood protection infrastructure…	

Table 4.4.1: Disaster Management and Related Environmental Responsibilities Assigned to SIDA in the Sindh Water Management Act of 2002

Section of Ordinance	Sub-section	Legal requirement	Comment
	Public Disclosure and Information n.	To issue warnings to all parties affected if it has cause to believe that damage or harm shall result from the use of any water flowing within its command area	Local flood warning
Chapter VII - Regulatory Authority of Irrigation, Drainage and Flood Protection			
74. Functions of the Regulatory Authority	1)	The main responsibility of the Regulatory Authority shall be to ensure compliance with the statutory provisions laid down in this Ordinance	
78. Powers in respect of drought	1)	The Regulatory Authority, after consulting the SIDA, or the AWB(s) or FOs concerned, may make an order prohibiting or limiting the taking by any body (including a AWB) of water from a source specified in the order if the regulatory Authority is satisfied that the taking of water from that source shall affect seriously the volume or quality of water available to any other AWB	Specifically authorizes mitigation of drought conditions
Chapter VIII – The Transition			
95. Succession of the properties, assets, liabilities and staff	2)	Government shall transfer to an AWB irrigation, drainage and flood protection infrastructure, office premises, stores, plant and machinery situated in its command area	
97. Transfer of Barrages and other assets	1)	The Irrigation and Power Department shall transfer its barrages, outlets, existing spinal drains and flood protection infrastructure including staff, budgets and assets to the SIDA before 30 June, 2005	
98. Continuity until vesting in AWB		The Irrigation and Power Department shall continue to manage the irrigation, drainage and flood protection infrastructure in the area where no AWBs have yet been appointed	
Chapter XI - Miscellaneous			
105. Transfer of Powers		The powers conferred on Canal Officers under the Sindh Irrigation Act 1879 and the Financial Delegation of Powers Rules 1962, relating to Infrastructure, Water Management, Flood Protection and Finances, shall be exercised by the SIDA and the AWBs in their respective areas of jurisdiction	

Thematic Area 4.6

Overview of Current Agriculture, Livelihood, and Economic Aspect of Drainage & Floods

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Table 4.6 1: Sample Distribution by Subregions and Zones

Zone	Subregions			Total
	Ghotki	Sukkur	Kotri	
A	3	24	9*	36
B	3	18	3	24
Total	6	42	12	60

* Includes three villages in the delta and coastal area.

Table 4.6 2: Composition of Discussion Group by Sub-regions and Zones

Zone	Type of Attendees	Subregions			Total
		Ghotki	Sukkur	Kotri	
Zone A	Politician	0	1	0	1
	Members of AWB/FO	0	5	0	5
	Landowners (khatedars)	19	349	39	407
	Livestock owners (full time)	0	2	1	3
	Fisher folks	1	0	19	20
	Government employees	24	64	16	104
	Private employees	1	11	1	13
	Self employed	7	17	11	35
	Retired employees	0	6	0	6
	Tenants	5	48	9	62
	Subtotal	**57**	**503**	**96**	**656**
Zone B	Politician	0	1	0	1
	Members of AWB/FO	0	2	0	2
	Landowners (khatedars)	20	126	17	163
	Government employees	6	22	2	30
	Private employees	11	27	3	41
	Self employed	1	9	6	16
	Retired employees	1	5	0	6
	Tenants	3	20	0	23
	Subtotal	**42**	**212**	**28**	**282**
	Total	**99**	**715**	**124**	**938**

Table 4.6 3: Population in the Study Area (000)

Districts	Census	Projected[1]						
	1998	2005	2006	2007	2008	2009	2010	2025
Sukkur	901	1,094	1,124	1,156	1,188	1,221	1,256	1,291
Ghotki	971	1,178	1,210	1,244	1,279	1,315	1,352	1,390
Guddu Subregion	**1,872**	**2,272**	**2,334**	**2,400**	**2,467**	**2,536**	**2,608**	**2,681**
Khairpur	1,547	1,876	1,929	1,983	2,038	2,096	2,154	2,214
Naushehro Feroze	1,088	1,319	1,356	1,394	1,433	1,474	1,515	1,557
Shaheed Benazirabad	1,103	1,338	1,375	1,414	1,453	1,494	1,536	1,579
Sanghar	1,325	1,607	1,652	1,698	1,746	1,795	1,845	1,897
Mirpurkhas	1,001	1,215	1,249	1,284	1,320	1,357	1,395	1,434
Umerkot	665	807	829	852	876	901	926	952
Tharparkar	914	1,109	1,140	1,172	1,205	1,239	1,273	1,309
Hyderabad	1,499	1,818	1,869	1,922	1,976	2,031	2,088	2,146
Tando Allahyar	468	568	584	601	617	635	652	670
Matiari	515	625	643	661	679	698	718	738
Sukkur Subregion	**10,566**	**12,817**	**13,176**	**13,546**	**13,924**	**14,318**	**14,716**	**15,128**
T. M. Khan	441	535	550	565	581	598	614	631
Badin	1,104	1,339	1,377	1,415	1,455	1,496	1,538	1,581
Thatta	1,113	1,351	1,388	1,427	1,467	1,508	1,551	1,594
Kotri Subregion	2,658	**3,225**	**3,315**	**3,407**	**3,503**	**3,602**	**3,703**	**3,807**
Total Left Bank	14,655	**17,779**	**18,275**	**18,788**	**19,313**	**19,858**	**20,413**	**20,985**

1=Projections is based on a growth rate of 2.8 percent
Source: Data computed from Development Statistics of Sindh 2008

Table 4.6 4: Number of Household (HH) in the selected villages by Subregions and Zones

Zone	Subregion			Total/Overall
	Ghotki	Sukkur	Kotri	
A	215	6,834	1,786	8,835
B	140	5,975	720	6,835
Total	**355**	**12,809**	**2,506**	**15,670**
Average Number of HH Per Village				
A.	72	285	198	245
B	47	332	240	285
Total	**59**	**305**	**209**	**261**

Table 4.6 5: Per Village Average Population by Subregion and Zones

Zone	Parameters		Subregion						Overall	
			Ghotki		Sukkur		Kotri			
			Mean	%	Mean	%	Mean	%	Mean	%
Zone A	Total Population	Males	423	52.7	957	51.4	782	48.5	868	50.7
		Females	379	47.3	903	48.5	830	51.5	841	49.2
		Total	**802**	**100.0**	**1,861**	**100.0**	**1,612**	**100.0**	**1,711**	**100.0**
	Adult	Males	198	24.7	428	23.0	336	20.8	386	22.6
		Females	177	22.1	412	22.1	351	21.8	377	22.0
		Subtotal	375	46.8	836	44.9	687	42.6	760	44.4
	Children	Males	227	28.3	521	28.0	446	27.7	477	27.9
		Females	200	24.9	479	25.7	479	29.7	456	26.7
		Subtotal	427	53.2	1,036	55.7	925	57.4	957	55.9
Zone B	Total Population	Males	327	59.8	1,012	56.7	1,150	51.6	944	56.0
		Females	220	40.2	774	43.3	1,077	48.4	743	44.1
		Total	**547**	**100.0**	**1,786**	**100.0**	**2,227**	**100.0**	**1,686**	**100.0**
	Adult	Males	170	31.1	522	29.2	667	30.0	496	29.4
		Females	130	23.8	373	20.9	600	26.9	371	22.0
		Subtotal	300	54.8	895	50.1	1,267	56.9	867	51.4
	Children	Males	157	28.7	490	27.4	483	21.7	448	26.6
		Females	90	16.5	401	22.5	477	21.4	372	22.1
		Subtotal	247	45.2	892	49.9	960	43.1	820	48.6

Table 4.6 6: Average Distance of Education/ Health Institution by Subregion and Zones (km)

Zone	Social Institutions	Subregion			Overall
		Ghotki	Sukkur	Kotri	
Zone A	Primary School	2	0.2	0.2	0.4
	Middle School	4	3.4	7.4	4.5
	High school	5	5	17.7	8.2
	College	9.6	11.9	33.5	17.1
	BHU	7.6	4.6	14	7.2
	Hospital	18.6	12.5	31.9	17.8
	Agriculture extension	20	12	25.5	16.1
	Veterinary Services	20.0	10.3	18.2	13.1
Zone B	Primary School	0.3	1	0.1	0.9
	Middle School	6.3	5.3	3.4	5.2
	High school	6.3	9.2	4.4	8.3
	College	10	13.3	14	13
	BHU	18.3	7	3.4	7.9
	Hospital	13	14	12.7	13.7
	Agriculture extension	18.3	16.5	20.4	17.2
	Veterinary Services	21.0	11.4	14.4	13.0

Table 4.6 7: Literacy Profile By Subregion And By Zones (Percent)

Zone	Level Of Education	Subregion						Overall	
		Ghotki		Sukkur		Kotri			
		Male	Female	Male	Female	Male	Female	Male	Female
Zone A	Graduation	1.4	0.0	6.8	1.1	2.5	0.0	6.0	0.9
	Intermediate	1.6	0.0	11.7	2.7	3.1	0.0	10.2	2.2
	High School	10.5	0.0	13.8	3.2	4.6	0.4	12.5	2.6
	Middle School	19.7	0.2	6.2	2.4	2.6	0.1	6.4	2.0
	Primary School	19.7	1.8	14.4	10.3	9.9	3.0	14.1	8.9
	Madressah	7.0	0.8	3.2	1.5	1.6	2.1	3.2	1.6
	No Education	40.1	97.2	44.0	78.8	75.7	94.4	47.7	81.8
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Zone B	Graduation	0.1	0.0	2.4	0.6	2.9	0.0	2.3	0.4
	Intermediate	1.4	0.0	5.1	1.6	5.3	0.9	4.9	1.3
	High School	6.1	0.0	7.2	1.4	4.3	0.6	6.6	1.1
	Middle School	2.0	0.0	8.2	6.7	5.1	0.8	7.2	4.9
	Primary School	7.2	0.3	25.1	27.9	15.8	3.0	22.2	20.6
	Madressah	2.0	1.8	5.5	3.3	0.0	0.0	4.2	2.5
	No Education	81.0	97.9	46.6	58.5	66.6	94.7	52.6	69.1
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 4.6 8: Incidence of Disease By Subregions and Zones

Zone	Diseases	**Subregion**			**Overall**
		Ghotki	**Sukkur**	**Kotri**	
Zone A	Diarrhea	Medium	Medium	Medium	Medium
	Flue	Medium	Low	Low	Low
	Malaria	High	High	Medium	Medium
	Typhoid	Low	Low	Low	Low
	TB	Low	Low	Low	Low
	Natal/prenatal	Low	Low	Low	Low
	Hepatitis	Medium	Medium	Medium	Medium
Zone B	Diarrhea	Medium	Low	Medium	Medium
	Flue	Low	Low	Low	Low
	Malaria	High	Medium	High	High
	Typhoid	Low	Low	Very Low	Low
	TB	Low	Low	Null	Low
	Natal/prenatal	Null	Very low	Null	Low
	Hepatitis	Very Low	Low	Low	Low

Table 4.6 9: Percentage of Villages With Access to Utilities By Subregion and Zones

Zone	Facility	Subregion			Overall
		Ghotki	Sukkur	Kotri	
Zone A	Electricity	100.0	82.9	92.4	85.3
	Pond/Tank	1.4	13.0	1.9	10.5
	Hand pump/Dugwell/tubewell	88.4	59.2	1.6	48.2
	Pipe water	0.0	4.4	0.0	3.4
	House Latrine	22.8	42.7	1.9	34.0
	Sewerage system	0.0	18.3	0.0	14.2
Zone B	Electricity	100	100.0	100	100.0
	Pond/Tank	2	41.1	70	43.3
	Hand pump/Dugwell/tubewell	21	16.7	92	24.7
	Pipe water	0.0	2.1	0.0	1.8
	House Latrine	23	62.5	72	62.7
	Sewerage system	0.0	4.1	83	12.4

Table 4.6 10: Employment Pattern and Average Monthly Income (PKR.)

Zone	Type of Employment	Subregion						Overall	
		Ghotki		Sukkur		Kotri			
		Number	Average Income	Number	Average Income	Number	Average Income	Number	Average Income
Zone A	Service / salaried persons	12	8,000	230	12,825	62	9,444	304	11,532
	Services / salaried in other town/cities	13	12,500	383	12,909	39	12,250	435	12,786
	Employed overseas	0	0	36	21,375	0	0	36	21,375
	Self employed	7	13,000	218	9,421	44	8,875	269	9,633
	Self employed elsewhere	3	10,000	44	8,571	0	0	47	8,750
	Daily wage workers	37	5,000	1839	5,271	1426	6,500	3302	5,529
	Property rent	0	0	89	1,750	1	1,000	90	1,643
	Pensioners	3	4,250	62	5,692	21	7,667	86	5,861
	Other income (unspecified)	0	0	0	0	100	20,000	100	10,000
	Total	75		2,901		1,693		4,669	
Zone B	Service / salaried persons	9	11,000	162	12,400	21	7,000	192	11,429
	Services / salaried in other town/cities	13	10,667	92	18,846	44	15,000	149	17,056
	Employed overseas	0	0	4	37,500	0	0	4	37,500
	Self employed	16	14,667	94	7,333	22	12,500	132	9,235
	Self employed elsewhere	0	0	20	20,250	2	40,000	22	24,200
	Daily wage workers	49	3,400	1166	3,878	380	3,750	1595	3,795
	Property rent	13	1,200	5	22,500	0	0	18	15,400
	Pensioners	2	3,500	39	5,200	0	0	41	4,917
	Other income (unspecified)	0	0	0	0	0	0	0	0
	Total	102		1,582		469		2,153	

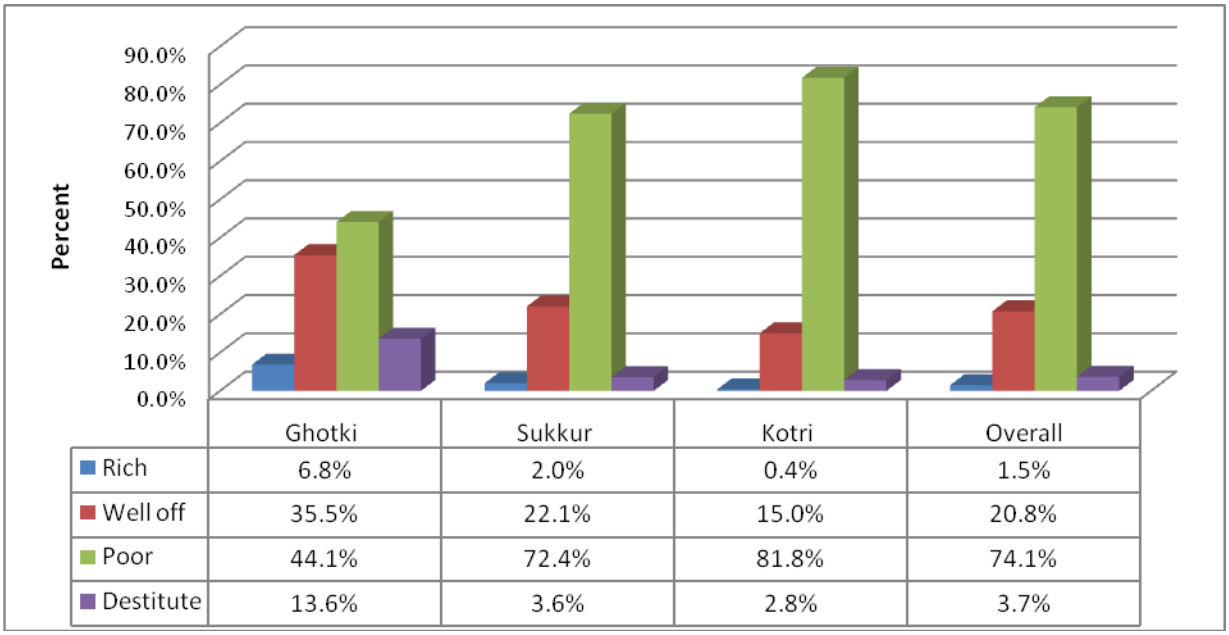
Table 4.6 11: Average Monthly Per HH Income By Subregions and Zones (PKR)

Zone	Source of Income	Subregion			Overall
		Ghotki	Sukkur	Kotri	
Zone A	Agriculture	10,445	21,541	6,927	16,963
	Livestock	8,840	3,163	3,264	3,661
	Nonfarm	3,647	5,768	11,747	7,086
	Total Income	22,932	30,472	21,938	27,710
Zone B	Agriculture	20,282	14,015	23,219	15,949
	Livestock	2,696	3,501	6,033	3,717
	Nonfarm	4,706	3,969	5,739	4,282
	Total Income	27,684	21,485	34,991	23,948

Table 4.6 12: Breakdown of Monthly Average HH Expenditure (PKR)

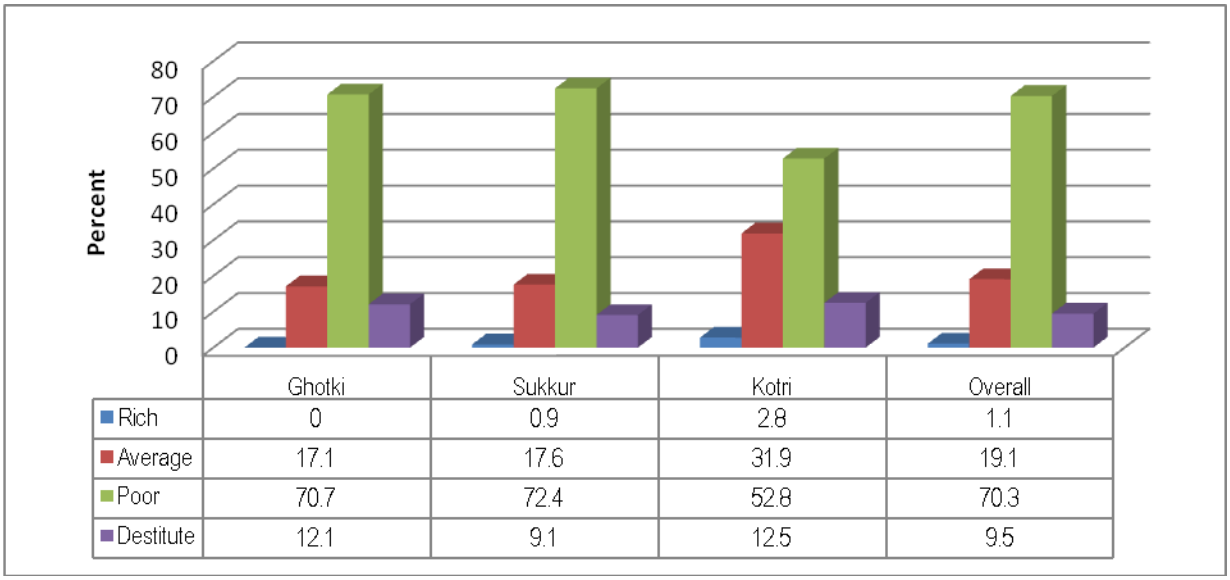
Zone	Expenditure Item	Subregion						Overall	
		Ghotki		Sukkur		Kotri			
		Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
Zone A	Food	14,000	43%	14,471	43%	10,389	45%	13,582	43%
	Health	5,000	15%	4,463	13%	3,093	14%	4,243	13%
	Education	3,167	10%	3,146	9%	2,083	9%	3,041	10%
	Clothes	1,352	4%	1,210	4%	667	3%	1,104	4%
	Utility bills	1,555	5%	1,827	5%	1,028	4%	1,707	5%
	Transportation	3,667	11%	4,462	13%	3,167	14%	3,953	13%
	Social obligations	1,185	4%	1,342	4%	702	3%	1,178	4%
	Communication	2,533	8%	2,954	9%	1,738	8%	2,722	9%
	Total	**32,459**	**100%**	**33,874**	**100%**	**22,867**	**100%**	**31,531**	**100%**
Zone B	Food	8,167	52%	13,741	50%	14,333	45%	12,778	49%
	Health	2,667	17%	4,411	16%	4,000	13%	4,030	16%
	Education	884	6%	3,430	13%	2,889	9%	3,042	12%
	Clothes	931	6%	1,168	4%	1,639	5%	1,159	4%
	Utility bills	683	4%	1,065	4%	2,056	6%	1,117	4%
	Transportation	1,800	11%	2,141	8%	4,966	16%	2,377	9%
	Social obligations	674	4%	1,379	5%	2,028	6%	1,344	5%
	Communication	1,217	7%	2,358	8%	2,922	8%	2,467	9%
	Total	**17,023**	**100%**	**29,693**	**100%**	**34,833**	**100%**	**28,314**	**100%**

Figure 4.6 1: Perceived Poverty Profile By Subregions in Zone A



	Ghotki	Sukkur	Kotri	Overall
Rich	6.8%	2.0%	0.4%	1.5%
Well off	35.5%	22.1%	15.0%	20.8%
Poor	44.1%	72.4%	81.8%	74.1%
Destitute	13.6%	3.6%	2.8%	3.7%

Figure 4.6 2: Perceived Poverty Profile By Subregions in Zone B



	Ghotki	Sukkur	Kotri	Overall
Rich	0	0.9	2.8	1.1
Average	17.1	17.6	31.9	19.1
Poor	70.7	72.4	52.8	70.3
Destitute	12.1	9.1	12.5	9.5

Table 4.6 13: Percent of Borrowers by Lending Institutions

Zone	Source of Credit	Subregion			Overall
		Ghotki	Sukkur	Kotri	
Zone A	Commercial banks	25.0	17.2	2.7	14.0
	ZTBL banks	30.0	33.6	12.2	27.7
	Commission agents	0.0	13.4	20.3	14.3
	Money lenders	35.0	27.0	62.2	36.8
	Friends and relatives	10.0	8.8	2.7	7.2
	Total	**100.0**	**100.0**	**100.0**	**100.0**
Zone B	Commercial banks	0.0	7.3	0.0	5.6
	ZTBL banks	18.5	28.9	50.0	30.4
	Commission agents	22.2	9.0	16.7	11.5
	Money lenders	48.1	44.0	33.3	43.1
	Friends and relatives	11.1	10.7	0.0	9.4
	Total	**100.0**	**100.0**	**100.0**	**100.0**

Table 4.6 14: Land Utilization in 2006/07 In The Study Area (000 ha)

Subregion And Districts	Geographical Area	Reported Area (4+12)	Total (5+6)	Current Fallows	Net Area Sown	Area Sown More Than Once	Total (6+7)	Forest	Culturable Waste	Not Available For Cultivation	Total (9+10+11)
1	2	3	4	5	6	7	8	9	10	11	12
Ghotki	629	630	178	15	163	74	237	19	55	378	452
Sukkur	480	480	153	66	87	39	126	35	26	266	327
Guddu Subregion	**1,109**	**1,110**	**331**	**81**	**250**	**113**	**363**	**54**	**81**	**644**	**779**
Khairpur	1574	1573	251	23	228	98	326	18	48	1256	1,322
Naushehro Feroze	302	302	189	20	169	33	202	10	52	51	113
S. Benazirabad	451	452	240	72	168	51	219	27	31	154	212
Sanghar	1018	1017	457	236	221	76	297	9	167	384	560
Mirpurkhas	352	353	321	187	134	32	166	1	19	12	32
Umer Kot	501	500	251	153	98	24	122	40	121	88	249
Tharparkar	2017	2017	1014	773	241	1	242	69	85	849	1,003
Hyderabad	101	100	47	21	26	12	38	7	7	39	53
Tando Allahyar	173	173	121	54	67	32	99	0	12	40	52
Matiari	142	141	97	43	54	34	88	23	5	16	44
Sukkur Subregion	**6,631**	**6,628**	**2,988**	**1,582**	**1,406**	**393**	**1,799**	**204**	**547**	**2,889**	**3,640**
Tando M. Khan	195	194	104	41	63	28	91	0	27	63	90
Badin	612	612	453	178	275	35	310	12	74	73	159
Thatta	1735	1736	403	243	160	41	201	348	171	814	1,333
Kotri Subregion	**2,542**	**2,542**	**960**	**462**	**498**	**104**	**602**	**360**	**272**	**950**	**1,582**
Total Left Bank	**10,282**	**10,280**	**4,279**	**2,125**	**2,154**	**610**	**2,764**	**618**	**900**	**4,483**	**6,001**
Share of Subregions in the Left Bank											
Guddu Subregion	10.8%	10.8%	7.7%	3.8%	11.6%	18.5%	13.1%	8.7%	9.0%	14.4%	13.0%
Sukkur Subregion	66.4%	66.4%	72.3%	76.4%	68.2%	69.0%	68.4%	33.0%	63.8%	65.8%	62.2%
Kotri Subregion	22.8%	22.8%	20.0%	19.8%	20.2%	12.5%	18.5%	58.3%	27.2%	19.8%	24.9%

Source: Development Statistics of Sindh 2008

Table 4.6 15: Land Base Pattern by Subregion and Zones (hectare)

Zone	Land Base	Subregion						Overall	
		Ghotki		Sukkur		Kotri			
		Sum	Mean	Sum	Mean	Sum	Mean	Sum	Mean
Zone A	Total cultivable area	941.7	314.0	7,530.1	313.6	3,137.2	348.4	11,609.1	322.5
	Area net available for cultivable	794.8	265.1	5,907.7	246.1	875.8	109.7	7,639.0	218.3
	Percentage	84.4%		78.5%		29.9%		65.3%	
Zone B	Total cultivable area	793.2	264.3	5,356.1	297.5	1,060.3	3,53.3	7,209.6	300.3
	Area net available for cultivable	586.8	195.5	3,827.2	212.5	793.2	2,64.3	5,207.2	216.9
	Percentage	74.0%		71.5%		74.8%		72.2%	

Table 4.6 16: Number and Farm Area By Ownership Structure In The Study Area

Subregion/ Districts	Number (000)						Area owned (000) ha						Average Farm Size (ha)
	Very Small Size Farms <1 ha	Small Size Farms 1 to <5 ha	Medium Size Farms 5 to 10 ha	Large Size farms 10 to 40 ha	Very Large Size Farms >40 ha	All Farms	Very Small Size Farms <1 ha	Small Size Farms 1 to <5 ha	Medium Size Farms 5 to 10 ha	large Size farms 10 to 40 ha	Very Large Size Farms >40 ha	All Farms	
Ghotki	21.76	38.78	9.21	0.74	0.13	70.62	13.17	88.93	60.87	11.24	8.73	182.93	**2.6**
Sukkur	10.31	13.86	1.20	1.28	0.19	26.84	6.39	33.41	8.11	20.38	18.46	86.76	**3.2**
Guddu Subregion	**32.07**	**52.64**	**10.41**	**2.02**	**0.32**	**97.46**	**19.56**	**122.34**	**68.98**	**31.62**	**27.19**	**269.69**	**2.8**
Share in All farms	32.9%	54.0%	10.7%	2.1%	0.3%	100.0%	7.3%	45.4%	25.6%	11.7%	10.1%	100.0%	
Khairpur	48.59	54.89	5.51	2.94	0.24	112.18	28.66	121.48	37.56	41.17	14.96	243.83	**2.2**
Naushehro Feroz	16.31	23.96	4.04	5.19	0.59	50.08	9.59	57.00	28.84	87.70	40.42	223.54	**4.5**
Shaheed Benazirabad	5.10	23.71	5.89	4.01	0.35	39.06	3.43	65.57	41.75	67.09	28.67	206.52	**5.3**
Sanghar	4.78	26.73	8.31	7.07	1.45	48.34	3.45	68.68	59.65	121.45	131.39	384.63	**8.0**
Mirpurkhas	1.59	11.25	6.06	6.82	0.87	26.59	1.19	30.13	41.62	117.42	113.72	304.09	**11.4**
Mithi	2.35	20.94	11.48	17.97	1.19	53.92	1.83	63.12	83.26	292.97	79.98	521.16	**9.7**
Tharparkar	2.99	9.61	3.61	3.31	0.96	20.48	2.32	24.25	25.36	57.36	81.53	190.82	**9.3**
Hyderabad	6.25	26.06	6.21	5.69	1.32	45.52	4.52	66.62	42.91	105.53	154.96	374.53	**8.2**
Sukkur Subregion	**87.95**	**197.13**	**51.11**	**53.01**	**6.97**	**396.16**	**55.00**	**496.84**	**360.95**	**890.70**	**645.63**	**2,449.12**	**6.2**
Share in All farms	22.2%	49.8%	12.9%	13.4%	1.8%	100.0%	2.2%	20.3%	14.7%	36.4%	26.4%	100.0%	
Badin	4.67	31.05	9.23	8.18	1.08	54.20	3.34	80.05	65.87	140.09	102.47	391.82	**7.2**
Thatta	6.70	31.30	6.61	5.96	0.77	51.33	4.64	81.25	45.27	95.63	72.03	298.82	**5.8**
Kotri Subregion	**11.36**	**62.35**	**15.84**	**14.14**	**1.85**	**105.53**	**7.98**	**161.30**	**111.13**	**235.72**	**174.50**	**690.64**	**6.5**
Share in All farms	10.8%	59.1%	15.0%	13.4%	1.8%	100.0%	1.2%	23.4%	16.1%	34.1%	25.3%	100.0%	
Total Left Bank	**131.38**	**312.12**	**77.36**	**69.17**	**9.13**	**599.16**	**82.54**	**780.48**	**541.06**	**1,158.04**	**847.33**	**3,409.45**	**5.7**
Share in All farms	21.9%	52.1%	12.9%	11.5%	1.5%	100.0%	2.4%	22.9%	15.9%	34.0%	24.9%	100.0%	
Average Farm Size							**0.6**	**2.5**	**7.0**	**16.7**	**92.8**	**5.7**	

Source: Computed from Agriculture Census 2000. Sindh Province.

Table 4.6 17: Land Ownership Pattern/Distribution By Subregion and Zones (Area in ha)

Farm Size Groups	Subregions									Overall		
	Ghotki			Sukkur			Kotri					
	Number	Area	Average Size	Number	Area	Average Size	Number	Area	Average Size	Number	Area	Average Size
Very small	135 54.0%	231 24.5%	1.7	828 55.5%	1,013 13.5%	1.2	54 34.6%	49 1.6%	0.9	1017 53.6%	1,294 11.1%	1.3
Small	85 34.0%	331 35.1%	3.9	341 22.9%	1,159 15.4%	3.4	33 21.2%	123 3.9%	3.7	459 24.2%	1,613 13.9%	3.5
Medium	23 9.2%	123 13.1%	5.3	242 16.2%	1,556 20.7%	6.4	36 23.1%	192 6.1%	5.3	301 15.9%	1,871 16.1%	6.2
Large	7 2.8%	257 27.3%	36.7	81 5.4%	3,802 50.5%	46.9	33 21.2%	2,773 88.4%	84.0	121 6.4%	6,831 58.8%	56.5
Total	**250** **100.0%**	**942** **100.0%**	**3.8**	**1,492** **100.0%**	**7,530** **100.0%**	**5.0**	**156** **100.0%**	**3,137** **100.0%**	**20.1**	**1898** **100.0%**	**11,609** **100.0%**	**6.1**
Very small	75 67.6%	87 11.0%	1.2	133 25.5%	185 3.5%	1.4	144 55.6%	148 14.0%	1.0	352 39.2%	419 5.8%	1.2
Small	20 18.0%	83 10.5%	4.2	158 30.3%	522 9.7%	3.3	70 27.0%	162 15.3%	2.3	248 27.6%	767 10.6%	3.1
Medium	10 9.0%	81 10.2%	8.1	155 29.7%	1,080 20.2%	7.0	24 9.3%	142 13.4%	5.9	194 21.6%	1,303 18.1%	6.7
Large	6 5.4%	542 68.3%	90.3	76 14.6%	3,569 66.6%	47.0	21 8.1%	609 57.5%	29.0	103 11.5%	4,720 65.5%	45.8
Total	**111** **100.0%**	**793** **100.0%**	**7.1**	**522** **100.0%**	**5,356** **100.0%**	**10.3**	**259** **100.0%**	**1,060** **100.0%**	**4.1**	**897** **100.0%**	**7,209** **100.0%**	**8.0**

Very Small: Less than 2 ha. Small >2 ha to <5 ha. Medium: 5 ha to 10 ha. Large: >10 Ha.

Table 4.6 18: Tenurial Pattern and Farm Area In The Study Area

Subregion and Districts	Number of farms by tenure (000)				Farm area by tenure (000 ha)				Average farm size (ha)			
	Owner Cultivators	Owner-cum-Tenants	Tenants	Total	Owner Cultivators	Owner-cum-Tenants	Tenants	Total	Owner Cultivators	Owner-cum-Tenants	Tenants	All Categories
Ghotki	62.2	4.8	7.4	74.5	158.7	14.8	18.2	200.0	2.5	3.1	2.4	2.7
Sukkur	18.2	8.1	3.2	29.6	55.0	27.3	9.5	88.2	3.0	3.4	2.9	3.0
Guddu Subregion	**80.5**	**12.9**	**10.7**	**104.1**	**213.7**	**42.1**	**27.7**	**288.2**	**2.7**	**3.2**	**2.6**	**2.8**
Percent	77.3%	12.4%	10.2%	100%	74.1%	14.6%	9.6%	100%				
Khairpur	42.7	1.4	1.9	46.1	217.6	20.0	11.2	247.8	5.1	13.9	5.8	**5.4**
Naushehro Feroz	45.5	1.4	2.4	49.3	200.5	9.9	5.7	189.7	4.4	7.2	2.3	**3.8**
Shaheed Benazirabad	23.4	2.5	24.4	50.2	106.7	15.1	59.0	182.4	4.6	6.1	2.4	**3.6**
Sanghar	31.7	0.9	63.5	96.2	165.1	7.4	138.7	293.3	5.2	8.0	2.2	**3.0**
Mirpurkhas	22.7	0.8	15.2	38.7	223.2	47.1	31.5	211.9	9.8	56.5	2.1	**5.5**
Tharparkar	49.3	2.4	3.2	54.8	474.8	21.3	13.7	450.2	9.6	9.0	4.3	**8.2**
Umerkot	15.2	0.8	49.0	64.9	133.4	12.2	77.5	177.4	8.8	15.1	1.6	**2.7**
Hyderabad	39.2	1.9	34.4	75.5	226.2	19.1	76.2	284.4	5.8	10.1	2.2	**3.8**
Sukkur Subregion	**269.7**	**12.1**	**194.0**	**475.8**	**1747.7**	**152.0**	**413.6**	**2037.0**	**6.5**	**12.6**	**2.1**	**4.3**
Percent	57%	2.5%	40.8%	100%	85.8%	7.5%	20.3%	100%				
Badin	43.6	3.8	49.2	96.6	289.1	39.0	138.7	402.4	6.6	10.2	2.8	**4.2**
Thatta	47.7	1.3	2.0	51.1	50.9	26.3	18.1	89.7	1.1	19.8	9.1	
Kotri Subregion	**91.3**	**5.1**	**51.2**	**147.6**	**340.0**	**65.3**	**156.8**	**492.1**	**3.7**	**12.7**	**3.1**	**3.3**
Percent	61.8%	3.5%	34.7%	100%	69.1%	13.3%	31.9%	100%				
Total Left Bank	**441.4**	**30.2**	**255.9**	**727.5**	**2301.3**	**259.3**	**598.1**	**2817.4**	**5.2**	**8.6**	**2.3**	**3.9**
Percent	60.7%	4.1%	35.2%	100%	81.7%	9.2%	21.2%	100%				

Source: Computed from Agriculture Census 2000. Sindh Province

Table 4.6 19: Tenurial Status of Operated Farms By Subregion and Zones

Zone	Type of Operators	Subregion			Overall
		Ghotki	Sukkur	Kotri	
Zone A	Owner Cultivators	50	854	72	976
	Percentage	19.9%	39.7%	28.7%	36.8%
	Owner-cum-Tenants	84	343	49	476
	Percentage	33.5%	16.0%	19.5%	17.9%
	Tenants	117	953	130	1,200
	Percentage	46.6%	44.3%	51.8%	45.2%
	Total	251	2,150	251	2,652
	Percentage	100%	100%	100%	100%
	Landlords	115	360	57	532
Zone B	Owner Cultivators	70	217	100	387
	Percentage	33.3%	14.0%	21.8%	17.5%
	Owner-cum-Tenants	35	96	100	231
	Percentage	16.7%	6.2%	21.8%	10.4%
	Tenants	105	1,232	258	1,595
	Percentage	50.0%	79.7%	56.3%	72.1%
	Total	210	1,545	458	2,213
	Percentage	100%	100%	100%	100%
	Landlords	36	233	59	328

Table 4.6 20: GCA, CCA, And Canal Withdrawals In The Study Area

Subregions/Canals	000 ha		Billion Cubic Meter					
	GCA	CCA	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
Ghotki Canal	411.7	347.0	2.11	2.51	2.67	2.69	2.37	2.17
Guddu Subregion	**411.7**	**347.0**	**2.11**	**2.51**	**2.67**	**2.69**	**2.37**	**2.17**
Khairpur Feeder (West)	171.7	169.0	0.70	0.65	0.65	0.65	0.67	0.68
Khairpur Feeder (East)	231.6	151.0	0.81	0.89	0.89	0.96	0.98	1.00
Nara Canal	1,010.3	880.0	5.67	6.48	5.83	5.88	6.95	6.02
Rohri Canal	1,078.5	1,036.0	4.94	5.83	4.78	5.27	5.07	5.18
Sukkur Subregion	**2,492.1**	**2,236.0**	**12.12**	**13.86**	**12.16**	**12.75**	**13.68**	**12.89**
Fuleli Canal	406.9	374.0	3.81	3.73	2.67	2.50	2.97	2.78
Pinyari Canal	325.5	307.0	2.67	2.19	1.78	1.67	1.86	1.52
Lined Channel/Akram Wah	209.7	203.0	0.89	1.22	0.81	0.79	1.05	0.84
Kotri Subregion	**942.1**	**884.0**	**7.37**	**7.13**	**5.27**	**4.96**	**5.88**	**5.14**
Total Left Bank	**3,845.9**	**3,467.0**	**21.60**	**23.50**	20.10	20.39	21.93	20.20

Source: Computed from Development Statistics of Sindh 2008 for GCA, CCA, .Canal withdrawals for 2004/05-2006/07 and later years from IPD Sindh

Table 4.6 21: Number of Tubewell Installed During 2004/05 to 2006/07 in The Study Area

Subregion/Districts	Public			Private			Total		
	Electric	Diesel	Total	Electric	Diesel	Total	Electric	Diesel	Total
Ghotki	0	0	0	0	25	25	0	25	25
Sukkur	0	0	0	3	71	74	3	71	74
Guddu Subregion	**0**	**0**	**0**	**3**	**96**	**99**	**3**	**96**	**99**
Khairpur	0	0	0	0	4,622	4,622	0	4,622	4,622
Naushehro Feroz	0	0	0	0	32	32	0	32	32
Shaheed Benazirabad	1	5	0	0	0	1	5	6	6
Sanghar	0	17	17	0	0	0	0	17	17
Tharparkar	183	0	183	0	0	0	183	0	183
Mirpurkhas	0	173	173	0	178	178	0	347	347
Umerkot	0	0	0	39	7,476	7,515	24	7,476	7,500
Hyderabad	0	0	0	3	8	11	9	8	17
Matiari	0	0	0	0	10	10	0	10	10
Tando Allahyar	0	0	0	0	10	10	0	10	10
Sukkur Subregion	**184**	**195**	**379**	**42**	**12,326**	**12,368**	**217**	**12,517**	**12,734**
T.M Khan	3	0	3	3	0	3	15	0	15
Badin	0	0	0	3	9	12	0	233	233
Thatta	0	0	0	56	321	377	59	97	156
Kotri Subregion	**3**	**0**	**3**	**62**	**330**	**392**	**74**	**330**	**404**
Total Left Bank	**187**	**195**	**382**	**107**	**12,752**	**12,859**	**294**	**12,943**	**13,237**

Source: Computed from Development Statistics of Sindh 2008

Table 4.6 22: Total Area Sown by Mode of Irrigation in the Study Area (000 ha)

Subregion/district	Total area sown	Rain fed	Irrigated		
			Canal	Tubewells	Total irrigated
Ghotki	163.1	5.3	15.3	142.6	157.8
Sukkur	86.9	8.0	63.7	15.2	78.8
Guddu Subregion	**250.0**	**13.3**	**79.0**	**157.7**	**236.7**
Khairpur	227.7	5.5	196.5	25.7	222.2
Naushehro Feroze	169.2	6.3	151.7	11.2	162.9
Shaheed Benazirabad	168.2	4.9	148.2	15.2	163.3
Sanghar	221.6	5.0	214.1	2.6	216.6
Mirpurkhas	134.0	8.5	119.6	5.9	125.5
Umer Kot	97.6	13.6	77.7	6.2	83.9
Tharparkar	241.0	225.2	9.7	6.0	15.7
Hyderabad	26.0	0.1	18.7	7.2	25.9
Tando Allahyar	67.1	1.0	44.9	21.2	66.1
Matiari	53.6	4.2	11.5	37.9	49.4
Sukkur Subregion	**1,406.0**	**274.3**	**992.5**	**139.1**	**1,131.7**
Tando Mohammad Khan	63.5	1.5	50.8	11.2	62.0
Badin	275.3	40.0	234.0	1.3	235.3
Thatta	159.9	34.8	118.9	6.2	125.1
Kotri Subregion	**498.7**	**76.3**	**403.7**	**18.7**	**422.4**
Total Left Bank	**2,154.6**	**363.9**	**1,475.2**	**315.6**	**1,790.7**
		17%	68.5%	14.6%	83.1%

Source: Computed from Development Statistics of Sindh 2008

Table 4.6 23: Access to SCARP And Private Tubewells And Drainage network

Zone	Description	Subregion			Overall
		Ghotki	Sukkur	Kotri	
Zone A	SCARP tubewells	2	14	0	16
	Private tubewells	1	15	0	16
	Access to tertiary drains	0	15	7	22
Zone B	SCARP tubewells	0	0	0	0
	Private tubewells	0	5	2	7
	Access to main drain	0	0	0	0

Table 4.6 24: Area under Crops in 2007/08 in the Study Area (000 ha)

Subregion/ Districts	Wheat	Canola	Rice	Cotton	Sugarcane	Millets	Fodder	Guarseed	Total Pulses	Kharif Oilseeds	Vegetables	Condiments	Non traditional oilseeds	Other Crops	All Fruits	Total
Ghotki	90.1	2.3	8.6	97.6	8.4	0.1	11.3	0.7	0.7	0.0	3.6	0.7	0.4	5.2	3.2	233.0
Sukkur	44.8	0.5	5.9	33.8	3.0	0.1	14.1	0.4	4.7	-	2.1	0.5	0.3	4.0	9.5	123.8
Guddu Subregion	**134.9**	**2.8**	**14.5**	**131.4**	**11.4**	**0.2**	**25.4**	**1.2**	**5.4**	**0.0**	**5.8**	**1.2**	**0.7**	**9.2**	**12.7**	**356.7**
Share in Cropped Area	**38.5%**	**0.8%**	**4.1%**	**37.5%**	**3.3%**	**0.1%**	**7.2%**	**0.3%**	**1.5%**	**0.0%**	**1.6%**	**0.3%**	**0.2%**	**2.6%**	**1.9%**	**100.0%**
Khairpur	103.2	2.2	5.9	76.1	24.6	-	43.6	3.9	1.3	-	2.7	0.5	0.7	25.7	42.6	333.1
N. Feroze	98.7	2.2	5.3	38.6	23.7	0.1	13.5	0.7	1.2	-	2.7	0.0	0.7	2.8	11.2	201.5
Shaheed Benazirabad	71.8	5.1	0.5	57.2	26.7	3.4	15.8	1.0	1.6	-	8.0	0.1	1.4	8.6	8.9	210.1
Sanghar	120.2	9.2	2.8	132.4	13.9	0.2	29.6	1.2	1.9	-	8.3	3.7	5.2	-	11.2	339.9
Tharparkar	1.4	0.5	-	1.0	1.7	147.3	48.8	47.0	18.2	2.2	0.4	0.9	0.1	-	4.0	273.5
Mirpurkhas	61.5	1.6	0.4	37.2	16.4	0.1	13.9	1.1	0.7	-	7.0	10.2	18.6	0.1	10.4	179.3
Umarkot	39.7	1.6	-	26.8	7.7	0.7	12.3	2.7	0.4	0.2	3.1	11.5	21.2	0.1	3.8	132.0
Hyderabad	13.1	0.1	1.5	6.8	5.8	0.1	4.0	0.1	0.1	-	0.3	0.4	1.3	-	4.9	38.5
Matiari	37.2	0.5	0.1	32.9	15.2	0.2	12.0	0.1	1.4	-	2.7	0.6	0.7	0.1	10.3	114.2
Tando Allahyar	30.2	0.2	-	18.2	21.7	0.4	13.7	0.1	0.3	-	2.2	1.4	1.0	0.2	9.1	98.7
Sukkur Subregion	**577.0**	**23.2**	**16.5**	**427.2**	**157.4**	**152.5**	**207.2**	**57.9**	**27.1**	**2.4**	**37.6**	**29.4**	**51.1**	**37.6**	116.6	**1,920.6**
Share in Cropped Area	30.0%	1.2%	0.9%	22.2%	8.2%	7.9%	10.8%	3.0%	1.4%	0.1%	2.0%	1.5%	2.7%	2.0%	6.1%	100.0%
T.M.Khan	9.3	0.1	15.7	4.5	34.7	-	6.3	0.0	0.4	-	1.8	0.1	10.7	0.1	1.7	85.4
Badin	29.7	0.8	59.1	14.9	59.9	1.9	12.1	0.1	0.2	-	3.8	15.9	127.1	2.1	4.8	332.4
Thatta	13.1	1.8	75.6	0.8	41.0	-	12.2	0.1	0.5	-	5.6	8.8	52.6	1.8	12.6	226.4
Kotri Subregion	**52.1**	**2.7**	**150.4**	**20.2**	**135.6**	**1.9**	**30.6**	**0.2**	**1.1**	**-**	**11.2**	**24.7**	**190.4**	**4.0**	**19.0**	**644.2**
Share in Cropped Area	8.1%	0.4%	23.3%	3.1%	21.0%	0.3%	4.7%	0.0%	0.2%	0.0%	1.7%	3.8%	29.6%	0.6%	3.0%	100.0%
Total Left Bank	**764.0**	**28.7**	**181.4**	**578.8**	**304.4**	**154.6**	**263.2**	**59.3**	**33.6**	**2.4**	**54.6**	**55.3**	**242.2**	**50.8**	**142.1**	**2,915.4**
Share in Cropped Area	26.2%	1.0%	6.2%	19.9%	10.4%	5.3%	9.0%	2.0%	1.2%	0.1%	1.9%	1.9%	8.3%	1.7%	4.9%	100.0%

Source: Computed from District Wise Crop Statistics 2008-2009. Ministry of Food & Agriculture. Islamabad

Table 4.6 25: Area under Crops in 2008/09 in the Study Area (000 ha)

Subregion/ Districts	Wheat	Canola	Paddy	Cotton	Sugarcane	Millets	Fodder	Guarseed	Total Pulses	Kharif Oilseeds	Vegetables	Condiments	Non Traditional Oilseeds	Other Crops	All Fruits	Total
Ghotki	97.5	0.6	33.1	76.9	5.9	5.7	10.6	0.6	1.1	0.7	3.3	0.7	0.4	0.1	1.3	239
Sukkur	43.6	0.5	14.4	30.2	2.2	7.0	12.5	0.3	3.2	0.2	2.5	0.4	0.3	0.3	4.2	122
Guddu Subregion	**141.1**	**1.1**	**47.5**	**107.1**	**8.1**	**12.7**	**23.1**	**0.9**	**4.3**	**0.9**	**5.9**	**1.1**	**0.7**	**0.4**	**5.4**	**360**
Share in Cropped Area	39.2%	0.3%	13.2%	29.7%	2.2%	3.5%	6.4%	0.3%	1.2%	0.3%	1.6%	0.3%	0.2%	0.1%	1.5%	100.0%
Khairpur	102.8	2.1	8.8	78.9	21.7	8.8	41.1	3.0	0.6	0.2	2.4	0.4	0.7	0.6	43.5	316
N. Feroze	100.2	1.1	6.8	36.9	20.9	2.3	12.1	0.7	0.8	0.2	3.1	0.1	0.7	0.1	10.7	197
Shaheed Benazirabad	77.5	5.9	3.8	46.3	23.7	11.3	16.2	1.0	0.8	0.2	7.8	0.1	1.4	0.4	8.6	205
Sanghar	122.6	8.3	13.3	122.9	11.6	0.9	31.4	1.1	0.6	3.7	8.5	4.7	5.5	0.0	11.5	347
Mirpurkhas	63.0	3.8	1.4	35.3	13.1	0.4	14.2	1.0	0.4	0.7	8.5	13.4	19.4	1.1	14.1	190
Umerkot	41.3	0.9	0.0	23.3	5.1	0.2	11.8	2.0	0.8	0.2	3.2	15.2	22.1	0.2	3.8	130
Tharparkar	1.4	0.6	0.0	0.7	1.4	67.7	39.4	40.4	10.3	5.9	0.4	1.2	0.1	0.0	5.6	175
Hyderabad	14.3	0.1	1.5	7.0	5.8	0.4	4.4	0.1	0.1	0.0	1.5	0.4	1.4	0.0	7.0	44
Tando Allahyar	32.2	0.2	0.0	20.8	20.7	0.7	11.9	0.1	1.5	0.2	5.7	1.6	1.1	0.1	9.6	106
Matiari	39.6	0.5	1.0	33.1	12.6	0.7	11.8	0.1	1.0	0.0	4.9	1.1	0.8	0.0	10.0	117
Sukkur Subregion	**594.9**	**23.5**	**36.6**	**405.2**	**136.6**	**93.4**	**194.3**	**49.4**	**16.8**	**11.2**	**46.0**	**38.1**	**53.1**	**2.5**	**124.4**	**1,826**
Share in Cropped Area	32.6%	1.3%	2.0%	22.2%	7.5%	5.1%	10.6%	2.7%	0.9%	0.6%	2.5%	2.1%	2.9%	0.1%	6.8%	100.0%
T.M.Khan	11.4	0.1	18.1	4.4	28.8	0.0	6.0	0.0	0.3	0.0	2.7	0.3	11.1	0.1	1.8	85
Badin	33.3	1.3	80.5	13.6	53.6	2.0	12.4	0.1	0.1	0.0	10.3	17.0	132.2	1.3	5.2	363
Thatta	13.6	3.2	78.5	0.8	33.2	0.2	9.5	0.1	0.5	0.0	12.7	7.7	54.7	1.2	10.6	227
Kotri Subregion	**58.3**	**4.6**	**177.1**	**18.8**	**115.6**	**2.2**	**27.9**	**0.2**	**1.0**	**0.0**	**25.7**	**25.0**	**198.0**	**2.6**	**17.6**	**675**
Share in Cropped Area	8.6%	0.7%	26.3%	2.8%	17.1%	0.3%	4.1%	0.0	0.1%	0.0	3.8%	3.7%	29.4	0.4%	2.6%	100%
Total Left Bank	**794.3**	**29.2**	**261.2**	**531.1**	**260.3**	**108.3**	**245.3**	**50.5**	**22.1**	**12.1**	**77.6**	**64.2**	**251.9**	**5.5**	**147.5**	**2,861**
Share in Cropped Area	27.8%	1.0%	9.1%	18.6%	9.1%	3.8%	8.6%	1.8%	0.8%	0.4%	2.7%	2.2%	8.8%	0.2%	5.2%	100

Source: Computed from District Wise Crop Statistics 2008-2009. Ministry of Food & Agriculture. Islamabad

Table 4.6 26: Area under Crops in 2009/10 in the Study Area (000 ha)

DISTRICTS	Wheat	Canola	Rice	Cotton	Sugarcane	Millets	Fodder	Guarseed	Total Pulses	Kharif Oilseeds	Vegetables	Condiments	Non Traditional Oilseeds	Other Crops	All Fruits	Total
Ghotki	98.31	0.01	20.31	90.69	4.76	0.03	10.45	0.41	0.78	0.00	0.43	0.23	0.21	6.69	1.13	234.45
Sukkur	45.46	0.04	8.59	35.75	2.01	0.07	9.52	0.13	1.86	0.00	0.87	0.20	0.14	6.09	4.31	115.05
Guddu Subregion	**143.77**	**0.06**	**28.90**	**126.44**	**6.77**	**0.10**	**19.97**	**0.54**	**2.65**	**0.00**	**1.31**	**0.43**	**0.35**	**12.78**	**5.44**	**349.50**
Share in Cropped Area	41.1%	0.0%	8.3%	36.2%	1.9%	0.0%	5.7%	0.2%	0.8%	0.0%	0.4%	0.1%	0.1%	3.7%	1.6%	100.0%
Khairpur	103.72	0.58	8.59	80.20	17.09	0.22	33.84	2.96	0.58	0.00	0.52	0.29	0.43	4.19	40.04	293.23
N. Feroze	102.19	0.02	4.81	40.97	17.84	0.05	10.33	1.01	0.99	0.00	0.98	0.08	0.35	1.07	7.54	188.21
Shaheed Benazirabad	80.39	0.00	3.20	55.97	23.06	0.60	14.85	1.85	0.85	0.00	0.51	0.19	0.54	1.43	7.25	190.68
Sanghar	124.81	0.03	14.18	135.62	11.67	0.47	28.41	0.77	0.45	0.00	1.26	3.56	3.79	0.63	11.70	337.34
Tharparkar	1.56	0.00	0.00	1.10	1.00	67.88	28.77	86.16	14.00	0.45	0.18	1.80	0.01	0.00	8.85	211.76
Mirpurkhas	64.31	0.35	1.24	40.32	10.71	1.10	13.06	0.70	0.74	0.00	2.85	14.15	11.29	0.34	14.97	176.12
Umarkot	43.71	0.00	0.00	24.79	2.64	0.42	9.93	1.37	0.20	0.02	0.65	14.77	15.03	0.37	4.56	118.45
Hyderabad	15.01	0.00	1.67	7.90	5.98	0.04	2.28	0.05	0.21	0.00	1.63	0.45	0.95	0.43	10.44	47.04
Matiari	42.19	0.00	0.72	38.21	12.24	0.33	11.16	0.06	1.03	0.00	2.46	0.86	0.42	0.06	8.64	118.38
Tando Allahyar	34.57	0.01	0.00	23.31	17.84	0.53	11.43	0.09	1.58	0.00	2.74	1.55	0.37	0.15	12.13	106.29
Sukkur Subregion	**612.46**	**0.99**	**34.40**	**448.37**	**120.06**	**71.62**	**164.05**	**95.02**	**20.61**	**0.47**	**13.78**	**37.70**	**33.18**	**8.68**	**126.12**	**1787.49**
Share in Cropped Area	34.3%	0.1%	1.9%	25.1%	6.7%	4.0%	9.2%	5.3%	1.2%	0.0%	0.8%	2.1%	1.9%	0.5%	7.1%	100.0%
T.M.Khan	13.76	0.01	17.92	4.98	25.34	0.00	5.68	0.00	0.26	0.00	0.88	0.32	12.03	0.05	2.00	83.22
Badin	36.14	0.00	82.69	18.89	46.12	1.21	13.21	0.07	0.11	0.00	7.19	15.78	121.05	1.97	5.64	350.07
Thatta	15.27	0.43	72.10	2.06	31.23	0.20	9.09	0.07	0.43	0.00	5.06	10.49	53.46	1.28	6.33	207.49
Kotri Subregion	**65.18**	**0.44**	**172.71**	**25.93**	**102.68**	**1.41**	**27.98**	**0.14**	**0.80**	**0.00**	**13.13**	**26.58**	**186.53**	**3.30**	**13.96**	**640.78**
Share in Cropped Area	10.2%	0.1%	27.0%	4.0%	16.0%	0.2%	4.4%	0.0%	0.1%	0.0%	2.0%	4.1%	29.1%	0.5%	2.2%	100.0%
Total Left Bank	**821.40**	**1.49**	**236.01**	**600.73**	**229.51**	**73.13**	**212.00**	**95.71**	**24.06**	**0.47**	**28.21**	**64.71**	**220.06**	**24.76**	**145.52**	**2777.76**
Share in Cropped Area	29.6%	0.1%	8.5%	21.6%	8.3%	2.6%	7.6%	3.4%	0.9%	0.0%	1.0%	2.3%	7.9%	0.9%	5.2%	100.0%

Source: Unpublished Data from Department of Agriculture Extension 2011

Table 4.6 27: Cropping Pattern of Ghotki Feeder (Guddu subregion) for the Year 2009/10

Name of Crop	Crop Area		%
	Acres	Hectares	
CCA	855,000	344,758	
Cotton	83,558	33,693	9.8
Rice	93,803	37,824	11.0
Garden/Banana	5,449	2,197	0.6
Sugarcane	7,067	2,850	0.8
Wheat	31,935	12,877	3.7
Fodder	1,664	671	0.2
Other Crops	76,581	30,879	9.0
Total Annual	300,057	120,991	35.1

Table 4.6 28: Cropping Pattern of Khairpur West (Sukkur Sub region) for the Year 2009-2010

Season	Name of Crop	Crop Area		%
		Acres	Hectares	
	CCA	322,000	129,839	
Kharif	Cotton	42,958	17,322	13.3
	Rice	9,152	3,690	2.8
	Garden/Banana	47,268	19,060	14.7
	Sugarcane	12,465	5,026	3.9
	Fodder	53,314	21,498	16.6
	Vegetable	570	230	0.2
	Other Crops	-	-	1.3
	Total	**165,727**	**66,825**	**51.5**
Rabi	Wheat	109,989	44,350	34.2
	Vegetable	576	232	0.2
	Oil Seeds	-	-	0.0
	Fodder	9,237	3,725	2.9
	Other Crops	3,135	1,264	1.0
	Total	122,937	49,571	38.2
	Annual	288,664	116,397	89.7

Table 4.6 29: Cropping Pattern of Khairpur East (Sukkur Sub region) for the Year 2009-2010

Season	Name of Crop	Crop Area		%
		Acers	Hectares	
	CCA	369,000	148,790	
Kharif	Cotton	101,557	40,950	27.5
	Rice	1,781	718	0.5
	Garden/Banana	20,205	8,147	5.5
	Sugarcane	8,225	3,317	2.2
	Fodder	43,099	17,379	11.7
	Vegetable	416	168	0.1
	Other Crops	11,737	4,733	3.2
	Total	187,020	75,411	50.7
Rabi	Wheat	103,112	41,577	27.9
	Vegetable	402	162	0.1
	Oil Seeds	3,539	1,427	1.0
	Fodder	11,023	4,445	3.0
	Other Crops	119	48	0.0
	Total	118,195	47,659	32.0
	Annual	**305,215**	**123,071**	**82.7**

Table 4.6 30: Cropping Pattern of Nara Canal (Sukkur Sub region) for the Year 2009-2010

Season	**Name of Crop**	**Crop Area**		**%**
		Acres	**Hectares**	
	CCA	2,518,834	1,015,659	
Kharif	Cotton	287,675	115,998	11.4
	Rice	24,779	9,992	1.0
	Garden/Banana	40,928	16,503	1.6
	Sugarcane	33,142	13,364	1.3
	Fodder	70,613	28,473	2.8
	Jowar/Bajra	62,874	25,352	2.5
	Oil Seeds	2,580	1,040	0.1
	Pulses	5,167	2,083	0.2
	Forests/Hurries	170	69	0.0
	Vegetable	13,285	5,357	0.5
	Other Crops	65,123	26,259	2.6
	Total	606,336	244,490	24.1
Rabi	Wheat	301,053	121,392	12.0
	Vegetable	6,726	2,712	0.3
	Oil Seeds	45,591	18,383	1.8
	Maize	175	71	0.0
	Pulses	29	12	0.0
	Fodder	31,161	12,565	1.2
	Other Crops	25,509	10,286	1.0
	Total	410,244	165,421	16.3
	Annual	1,016,580	409,911	40.4

Table 4.6 31: Cropping Pattern of Rohri Canal (Sukkur Sub region) for the Year 2009-2010

Season	Name of Crop	Crop Area		%
		Acres	Hectares	
	CCA	2,474,469	997,770	
Kharif	Cotton	361,711	145,851	14.6
	Rice	-	-	0.0
	Garden/Banana	-	-	0.0
	Sugarcane	91,424	36,865	3.7
	Fodder	122,321	49,323	4.9
	Vegetable	-	-	0.0
	Other Crops	351,545	141,752	14.2
	Total	927,001	373,791	37.5
Rabi	Wheat	470,121	189,565	19.0
	Vegetable	-	-	0.0
	Oil Seeds	39,521	15,936	1.6
	Fodder	-	-	0.0
	Other Crops	139,011	56,053	5.6
	Total	648,653	261,554	26.2
	Annual	1,575,654	635,344	63.7

Table 4.6 32: Cropping Pattern of Akram Wah (Kotri Sub region) for the Year 2009-2010

Season	Name of Crop	Crop Area		%
		Acres	Hectares	
	CCA	**487,000**	**196,371**	
Kharif	Cotton	10,323	4,163	2.1
	Rice	56,504	22,784	11.6
	Garden/Banana	1,176	474	0.2
	Sugarcane	26,418	10,652	5.4
	Fodder	4	2	0.0
	Jowar/Bajra	2,262	912	0.5
	Oil Seeds	-	-	0.0
	Forests/Hurries	-	-	0.0
	Vegetable	3,448	1,390	0.7
	Other Crops	27,658	11,152	5.7
	Total	127,793	51,529	26.2
Rabi	Wheat	6,374	2,570	1.3
	Vegetable	1,319	532	0.3
	Oil Seeds	2,575	1,038	0.5
	Maize	840	339	0.2
	Fodder	2,400	968	0.5
	Other Crops	5,311	2,142	1.1
	Total	18,819	7,588	3.9
	Annual	146,612	59,118	30.1

Table 4.6 33: Cropping Pattern of Pinyari Wah (Kotri Sub region) for the Year 2009-2010

Season	Name of Crop	Crop Area		%
		Acres	Hectares	
	CCA	**786,000**	**316,935**	
Kharif	Cotton	637	257	0.1
	Rice	68,212	27,505	8.7
	Garden/Banana	514	207	0.1
	Sugarcane	18,408	7,423	2.3
	Other Crops	28,994	11,691	3.7
	Total	116,765	47,083	14.9
Rabi	Wheat	7,051	2,843	0.9
	Vegetable	-	-	0.0
	Oil Seeds	11,426	4,607	1.5
	Other Crops	16,141	6,508	2.1
	Total	34,618	13,959	4.4
	Annual	151383	61,042	19.3

Table 4.6 34: Cropping Pattern of Fuleli Canal (Kotri Sub region) for the Year 2009-2010

Season	Name of Crop	Crop Area		%
		Acres	Hectares	
	CCA	**929,000**	**374,597**	
Kharif	Cotton	11,094	4,473	1.2
	Rice	97,911	39,480	10.5
	Garden/Banana	1,377	555	0.2
	Sugarcane	22,127	8,922	2.4
	Vegetable	3,982	1,606	0.4
	Other Crops	34,875	14,063	3.8
	Total	**171,365**	**69,099**	**18.5**
Rabi	Wheat	-	-	0.0
	Vegetable	-	-	0.0
	Oil Seeds	-	-	0.0
	Other Crops	-	-	0.0
	Total	-	-	0.0

Table 4.6 35: Cropping Pattern and Intensity By Subregion and Zones

Zone	Crops	Subregion						Overall	
		Ghotki		Sukkur		Kotri			
		Area	Percent	Area	Percent	Area	Percent	Area	Percent
Zone A	Wheat	130	33.7	2,295	39.7	210	22.7	2,635	37.1
	Barley	0	0.0	24	0.4	8	0.9	32	0.5
	Rapeseed & Mustard	0	0.0	242	4.2	81	8.7	323	4.6
	Rabi Fodder	22	5.8	151	2.6	32	3.5	206	2.9
	Rabi Vegetables	4	1.1	38	0.7	24	2.6	67	0.9
	Cotton	32	8.4	1,369	23.7	101	10.9	1,503	21.2
	Paddy	182	47.4	409	7.1	417	45.0	1,008	14.2
	Sugarcane	12	3.2	749	13.0	40	4.4	801	11.3
	Millet	0	0.0	4	0.1	0	0.0	4	0.1
	Kharif Fodder	2	0.5	96	1.7	0	0.0	98	1.4
	Kharif Vegetable	0	0.0	55	0.9	12	1.3	67	0.9
	Fruits	0	0.0	349	6.0	0	0.0	349	4.9
	Total	384	100.0	5781	100.0	927	100.0	7,092	100.0
	Cropping Intensity	**43.8%**		**97.8%**		**99.0%**		**92.8%**	
Zone B	Wheat	190	50.2	1,964	44.6	304	35.5	2,458	43.6
	Barley	0	0.0	15	0.3	18	2.1	34	0.6
	Rapeseed & Mustard	2	0.5	287	6.5	0	0.0	289	5.1
	Rabi Fodder	13	3.4	122	2.8	6	0.7	141	2.5
	Rabi Vegetables	6	1.6	20	0.5	0	0.0	26	0.5
	Cotton	125	33.1	1,322	30.0	263	30.7	1,710	30.3
	Paddy	36	9.6	121	2.8	0	0.0	158	2.8
	Sugarcane	2	0.4	321	7.3	251	29.3	573	10.2
	Millet	0	0.0	1	0.0	0	0.0	1	0.0
	Kharif Fodder	4	1.1	93	2.1	0	0.0	97	1.7
	Kharif Vegetable	0	0.0	33	0.8	8	0.9	41	0.7
	Kharif Oilseed	0	0.0	20	0.5	0	0.0	20	0.4
	Fruits	0	0.1	87	2.0	6	0.7	93	1.6
	Total	379	100.0	4,407	100.0	856	100.0	5,642	100.0
	Cropping Intensity	**64.6%**		**115.2%**		**107.9%**		**108.3%**	

Table 4.6 36: Crop Wise Details of Area Sown In Badin & Thatta Districts during Last 20 Years from The Year 1991 To 2010

Name of crop	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
BADIN																			
Rice	96,535	54,142	78,359	60,396	71,640	79,439	75,449	74,197	64,190	70,459	60,958	64,783	58,751	58,934	61,199	62,324	59,132	80,544	82,687
Cotton	4,141	2,369	3,470	942	2,321	2,824	2,732	3,015	2,956	1,788	3,237	6,210	2,438	4,706	5,671	9,376	14,857	13,628	18,890
Kharif Fruits	2,646	2,649	2,648	2,593	2,788	2,982	3,066	3,149	3,210	3,441	3,325	3,208	3,626	3,192	3,178	4,688	4,327	4,803	5,278
Rabi Fruits	90	92	90	89	91	92	93	94	103	117	117	117	123	125	393	433	462	476	458
Sugarcane	56,942	52,491	61,157	54,256	58,474	57,037	59,989	62,613	30,898	43,792	47,872	52,139	43,260	36,248	38,453	39,667	59,847	53,640	46,117
Kharif Veg.	1,052	1,150	1,220	1,257	931	932	937	960	973	960	1,992	1,498	1,326	1,176	1,210	1,850	1,210	1,852	2,302
Rabi Veg.	1,377	1,625	1,619	1,628	1,969	1,994	2,005	2,014	1,942	2,017	4,152	4,396	4,094	3,865	6,470	4,639	4,918	4,976	4,888
Wheat	41,638	42,651	42,893	32,189	33,385	33,762	32,431	34,892	35,079	21,326	21,763	18,047	22,178	28,146	30,947	28,346	29,730	33,350	36,142
Kharif Fodder	16,780	14,391	14,489	14,523	14,155	12,858	13,125	13,484	10,859	8,455	8,697	5,236	7,518	4,992	5,802	6,479	4,152	4,071	2,302
Rabi Fodder	8,819	8,895	8,944	1,978	9,551	9,365	9,486	9,529	8,787	8,127	7,536	8,028	8,359	7,735	7,804	7,952	7,952	8,333	8,022
Subtotal	**230,020**	**180,455**	**214,889**	**169,851**	**195,304**	**201,285**	**199,313**	**203,947**	**158,997**	**160,482**	**159,649**	**163,662**	**151,673**	**149,119**	**161,127**	**165,754**	**186,587**	**205,673**	**207,086**
Sunflower	2,146	1,734	2,375	4,047	7,919	7,875	7,924	16,187	19,424	13,597	14,019	34,510	91,369	118,936	138,000	123,773	127,136	132,221	121,049
Total Area	**232,166**	**182,189**	**217,264**	**173,898**	**203,223**	**209,160**	**207,237**	**220,134**	**178,421**	**174,079**	**173,668**	**198,172**	**243,042**	**268,055**	**299,127**	**289,527**	**313,723**	**337,894**	**328,135**
THATTA																			
Rice	58,291	42,961	60,118	51,448	61,418	68,394	65,321	66,249	58,140	61,496	45,792	56,422	54,778	54,169	54,178	68,192	77,646	78,486	72,100
Cotton	229	45	108	17	59	56	41	48	50	48	864	528	515	522	692	506	812	836	2,056
Kharif Fruits	1,810	1,817	1,810	3,013	3,216	3,419	3,479	3,538	4,573	4,963	5,381	5,798	7,925	8,765	16,219	15,866	12,488	11,047	9,606
Rabi Fruits	120	121	117	118	122	126	127	128	130	156	145	133	136	138	75	65	64	35	46
Sugarcane	22,438	21,727	25,308	23,470	24,361	23,676	25,851	28,319	25,009	23,697	26,742	28,226	30,695	22,648	20,851	27,356	40,969	33,179	31,229
Kharif Veg.	706	1,111	1,132	1,166	1,053	1,068	1,075	1,097	1,096	1,035	1,786	1,495	1,574	1,503	1,496	1,624	1,066	725	296
Rabi Veg.	2,724	2,405	2,396	2,383	2,711	2,717	2,810	2,820	2,734	2,846	1,892	1,980	2,122	2,092	2,555	2,824	4,097	5,060	4,764
Wheat	5,827	8,972	9,536	9,716	10,353	11,879	11,024	12,673	13,126	8,709	10,116	8,196	9,974	9,562	12,846	11,889	13,104	13,636	15,271
Kharif Fodder	1,330	2,268	2,363	2,382	2,372	2,000	2,051	2,111	1,838	1,532	1,561	1,806	3,921	2,510	2,156	4,101	3,607	3,516	3,145
Rabi Fodder	7,433	7,477	7,445	7,617	8,003	7,778	7,928	7,974	7,284	6,501	8,479	8,892	9,387	8,749	8,501	8,571	8,519	5,976	5,946
Subtotal	**100,908**	**88,904**	**110,333**	**101,330**	**113,668**	**121,113**	**119,707**	**124,957**	**113,980**	**110,983**	**102,757**	**113,476**	**121,027**	**110,658**	**119,569**	**140,994**	**162,372**	**152,496**	**144,459**
Sunflower	1,216	503	971	1,821	1,528	3,732	3,772	4,452	5,666	3,966	4,089	4,801	37,196	45,610	52,579	43,974	52,612	54,716	53,454
Total Area	**102,124**	**89,407**	**111,304**	**103,151**	**115,196**	**124,845**	**123,479**	**129,409**	**119,646**	**114,949**	**106,846**	**118,277**	**158,223**	**156,268**	**172,148**	**184,968**	**214,984**	**207,212**	**197,913**

Source: Unpublished Data from Department of Agriculture Extension 2011

Table 4.6 37: Crop Wise Index of Area in Badin & Thatta Districts during Last 20 Years

District	Name of crop	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
Badin	Rice	100	56	81	63	74	82	78	77	66	73	63	67	61	61	63	65	61	83	86
	Cotton	100	57	84	23	56	68	66	73	71	43	78	150	59	114	137	226	359	329	456
	Kharif Fruits	100	100	100	98	105	113	116	119	121	130	126	121	137	121	120	177	164	182	199
	Rabi Fruits	100	102	100	99	101	102	103	104	114	130	130	130	137	139	437	481	513	529	509
	Sugarcane	100	92	107	95	103	100	105	110	54	77	84	92	76	64	68	70	105	94	81
	Kharif Vegetable	100	109	116	119	88	89	89	91	92	91	189	142	126	112	115	176	115	176	219
	Rabi Vegetables	100	118	118	118	143	145	146	146	141	146	302	319	297	281	470	337	357	361	355
	Wheat	100	102	103	77	80	81	78	84	84	51	52	43	53	68	74	68	71	80	87
	Kharif Fodder	100	86	86	87	84	77	78	80	65	50	52	31	45	30	35	39	25	24	14
	Rabi Fodder	100	101	101	22	108	106	108	108	100	92	85	91	95	88	88	90	90	94	91
	Subtotal	**100**	**78**	**93**	**74**	**85**	**88**	**87**	**89**	**69**	**70**	**69**	**71**	**66**	**65**	**70**	**72**	**81**	**89**	**90**
	Sunflower	100	81	111	189	369	367	369	754	905	634	653	1,608	4,258	5,542	6,431	5,768	5,924	6,161	5,641
	Total Area	**100**	**78**	**94**	**75**	**88**	**90**	**89**	**95**	**77**	**75**	**75**	**85**	**105**	**115**	**129**	**125**	**135**	**146**	**141**
Thatta	Rice	100	74	103	88	105	117	112	114	100	105	79	97	94	93	93	117	133	135	124
	Cotton	100	20	47	7	26	24	18	21	22	21	377	231	225	228	302	221	355	365	898
	Kharif Fruits	100	100	100	166	178	189	192	195	253	274	297	320	438	484	896	877	690	610	531
	Rabi Fruits	100	101	98	98	102	105	106	107	108	130	120	111	113	115	63	54	53	29	38
	Sugarcane	100	97	113	105	109	106	115	126	111	106	119	126	137	101	93	122	183	148	139
	Kharif Vegetable	100	157	160	165	149	151	152	155	155	147	253	212	223	213	212	230	151	103	42
	Rabi Vegetables	100	88	88	87	100	100	103	104	100	104	69	73	78	77	94	104	150	186	175
	Wheat	100	154	164	167	178	204	189	217	225	149	174	141	171	164	220	204	225	234	262
	Kharif Fodder	100	171	178	179	178	150	154	159	138	115	117	136	295	189	162	308	271	264	236
	Rabi Fodder	100	101	100	102	108	105	107	107	98	87	114	120	126	118	114	115	115	80	80
	Subtotal	100	88	109	100	113	120	119	124	113	110	102	112	120	110	118	140	161	151	143
	Sunflower	100	41	80	150	126	307	310	366	466	326	336	395	3,059	3,751	4,324	3,616	4,327	4,500	4,396
	Total Area	**100**	**88**	**109**	**101**	**113**	**122**	**121**	**127**	**117**	**113**	**105**	**116**	**155**	**153**	**169**	**181**	**211**	**203**	**194**

Source: Unpublished Data from Department of Agriculture Extension 2011

Figure 4.6 3: Trend of Crop Cultivation Badin Area

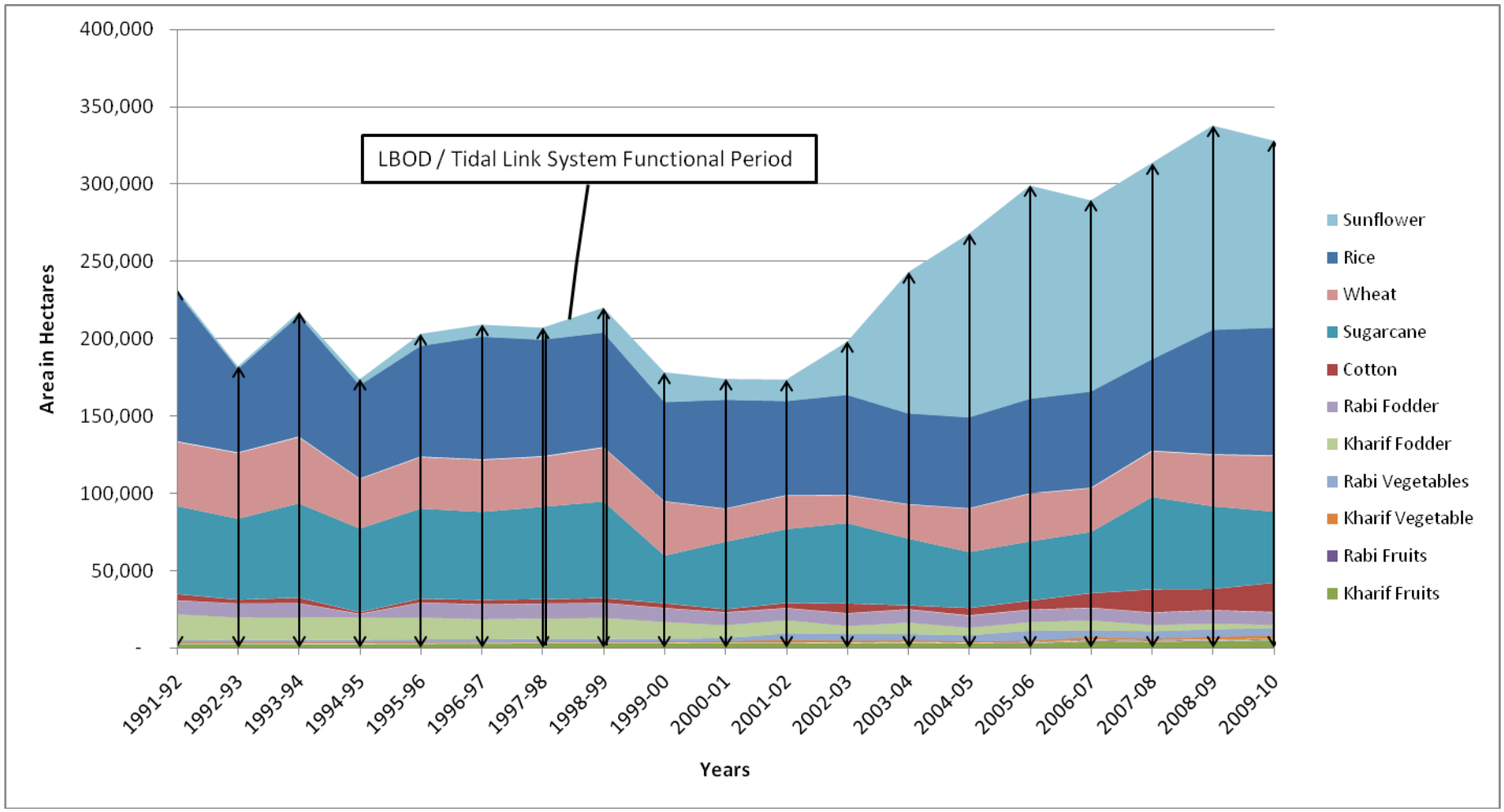


Figure 4.6 4: Trend of Crop Cultivation Thatta Area

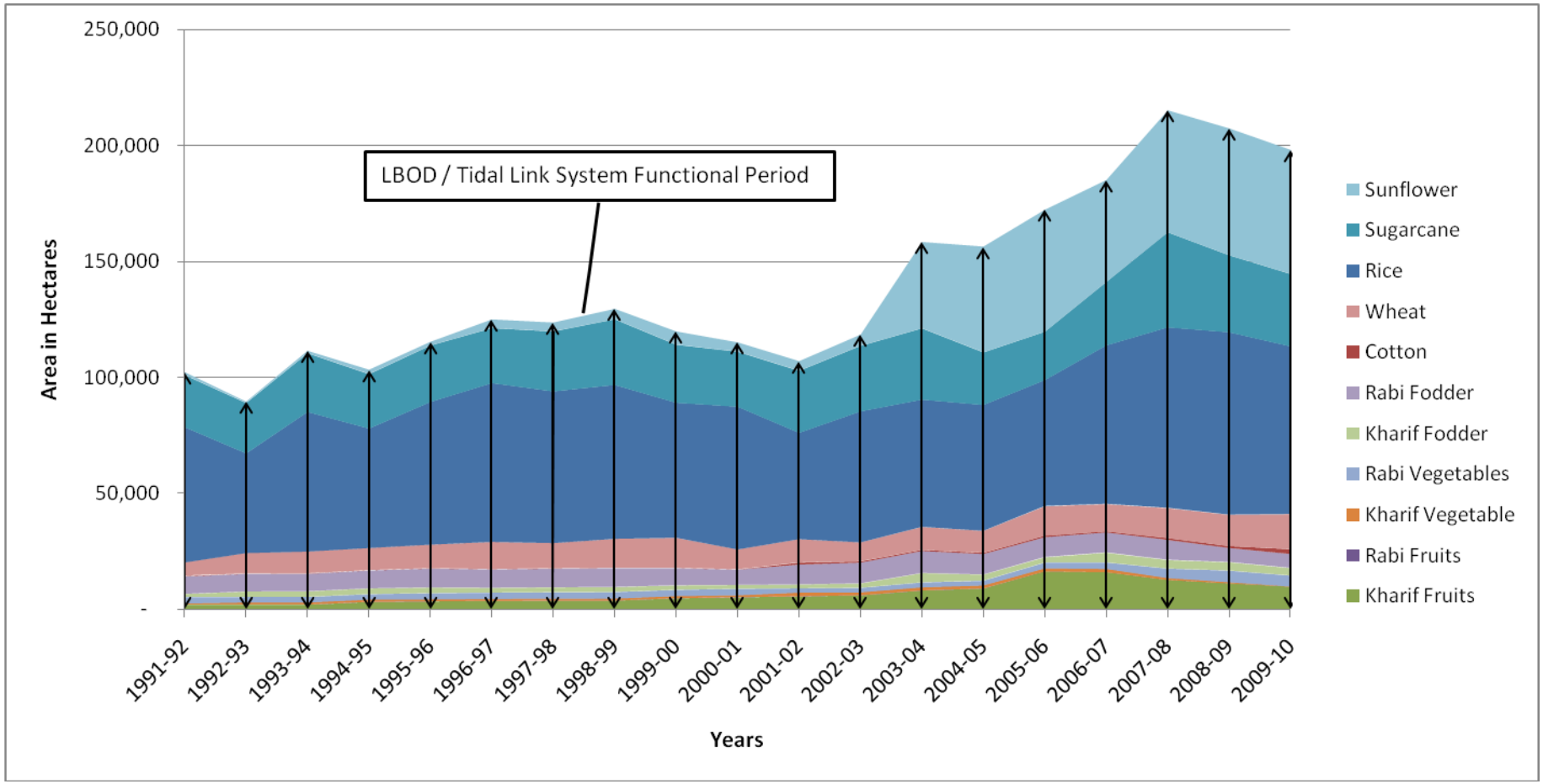


Table 4.6 38: Share of Different crops in total cropped Area (Excluding Sunflower) In Badin & Thatta Districts during Last 20 Years

District	Name of crop	1991/92	1992/93	1993/94	1194/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
Badin	Rice	42%	30%	36%	36%	37%	39%	38%	36%	40%	44%	38%	40%	39%	40%	38%	38%	32%	39%	40%
	Cotton	2%	1%	2%	1%	1%	1%	1%	1%	2%	1%	2%	4%	2%	3%	4%	6%	8%	7%	9%
	Kharif Fruits	1%	1%	1%	2%	1%	1%	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	2%	2%	3%
	Rabi Fruits	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Sugarcane	25%	29%	28%	32%	30%	28%	30%	31%	19%	27%	30%	32%	29%	24%	24%	24%	32%	26%	22%
	Kharif Vegetables	0%	1%	1%	1%	0%	0%	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
	Rabi Vegetables	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	3%	3%	3%	3%	4%	3%	3%	2%	2%
	Wheat	18%	24%	20%	19%	17%	17%	16%	17%	22%	13%	14%	11%	15%	19%	19%	17%	16%	16%	17%
	Kharif Fodder	7%	8%	7%	9%	7%	6%	7%	7%	7%	5%	5%	3%	5%	3%	4%	4%	2%	2%	1%
	Rabi Fodder	4%	5%	4%	1%	5%	5%	5%	5%	6%	5%	5%	5%	6%	5%	5%	5%	4%	4%	4%
	Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	Sunflower	1%	1%	1%	2%	4%	4%	4%	7%	11%	8%	8%	17%	38%	44%	46%	43%	41%	39%	37%
	Total Area	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Thatta	Rice	58%	48%	54%	51%	54%	56%	55%	53%	51%	55%	45%	50%	45%	49%	45%	48%	48%	51%	50%
	Cotton	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%	1%	1%	1%
	Kharif Fruits	2%	2%	2%	3%	3%	3%	3%	3%	4%	4%	5%	5%	7%	8%	14%	11%	8%	7%	7%
	Rabi Fruits	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Sugarcane	22%	24%	23%	23%	21%	20%	22%	23%	22%	21%	26%	25%	25%	20%	17%	19%	25%	22%	22%
	Kharif Vegetable	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	2%	1%	1%	1%	1%	1%	1%	0%	0%
	Rabi Vegetables	3%	3%	2%	2%	2%	2%	2%	2%	2%	3%	2%	2%	2%	2%	2%	2%	3%	3%	3%
	Wheat	6%	10%	9%	10%	9%	10%	9%	10%	12%	8%	10%	7%	8%	9%	11%	8%	8%	9%	11%
	Kharif Fodder	1%	3%	2%	2%	2%	2%	2%	2%	2%	1%	2%	2%	3%	2%	2%	3%	2%	2%	2%
	Rabi Fodder	7%	8%	7%	8%	7%	6%	7%	6%	6%	6%	8%	8%	8%	8%	7%	6%	5%	4%	4%
	Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	Sunflower	1%	1%	1%	2%	1%	3%	3%	3%	5%	3%	4%	4%	24%	29%	31%	24%	24%	26%	27%
	Total Area	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Unpublished Data from Department of Agriculture Extension 2011

Table 4.6 39: Production of Major Crops 2007/08 In The Study Area (mt)

DISTRICTS	Wheat	Canola	Rice	Cotton	Sugarcane	Millets	Fodder	Guarseed	Total Pulses	Kharif Oilseeds	Vegetables	Condiments Non traditional oilseeds	Other Crops	All Fruits
Ghotki	329.6	2.4	22.3	434.9	538.4	0.1	346.0	0.7	0.5	0.0	50.7	2.6	0.5	3.3	11.8
Sukkur	161.5	0.4	16.2	140.7	189.0	-	432.9	0.4	3.7	-	28.4	1.8	0.4	2.8	38.3
Guddu Subregion	**491.1**	**2.8**	**38.5**	**575.6**	**727.4**	**0.1**	**778.9**	**1.0**	**4.2**	**0.0**	**79.1**	**4.3**	**0.9**	**6.1**	**50.1**
Share in Production	17.8%	9.4%	8.4%	23.8%	3.9%	0.1%	11.8%	2.6%	22.3%	0.6%	11.5%	4.0%	0.3%	17.2%	5.4%
Khairpur	375.3	2.3	15.9	337.7	1,612.4	-	979.0	3.3	1.0	-	37.7	0.5	0.9	18.2	294.6
N. Feroze	370.9	2.7	14.5	168.9	1,436.0	0.1	543.7	0.6	0.9	-	36.6	0.1	0.9	1.9	81.9
Shaheed Benazirabad	258.5	5.3	1.2	243.6	1,554.0	2.2	684.8	0.8	1.1	-	117.0	0.4	1.8	6.7	61.4
Sanghar	446.9	10.6	6.7	518.1	849.9	0.1	849.5	0.9	0.9	-	112.4	6.8	6.7	-	77.4
Tharparkar	3.8	0.5	-	3.9	84.7	72.5	539.7	29.7	8.5	1.6	3.8	1.9	0.1	-	34.7
Mirpurkhas	213.8	1.3	0.9	148.5	912.7	0.1	288.1	0.8	0.3	-	80.8	23.8	22.7	0.1	55.1
Umarkot	125.7	1.3	-	106.1	415.0	0.5	277.2	1.7	0.2	0.1	35.0	27.3	24.8	0.1	20.6
Hyderabad	61.9	-	2.9	25.7	349.2	0.1	72.6	0.0	0.0	-	4.1	0.7	1.5	-	33.8
Matiari	152.6	0.4	0.3	129.8	954.0	0.1	258.5	0.1	1.0	-	39.7	1.2	0.8	-	56.6
Tando Allahyar	115.1	0.1	-	78.3	1,374.4	0.2	383.8	0.1	0.1	-	31.1	2.8	1.1	0.1	54.3
Sukkur Subregion	**2,124.5**	**24.5**	**42.4**	**1,760.6**	**9,542.3**	**75.9**	**4,876.9**	**38.0**	**14.1**	**1.7**	**498.3**	**65.5**	**61.2**	**27.1**	**770.5**
Share in Production	77.1%	82.5%	9.3%	72.7%	51.4%	98.8%	73.6%	97.1%	74.9%	99.4%	72.6%	60.0%	22.2%	76.3%	83.0%
T.M.Khan	25.8	0.1	33.6	17.3	2,141.8	-	230.4	0.0	0.2	-	18.6	0.3	11.5	-	9.5
Badin	78.5	0.8	149.0	65.0	3,709.0	0.8	370.5	0.1	0.1	-	36.3	25.5	143.3	1.3	28.3
Thatta	35.8	1.5	192.9	3.3	2,445.9	-	372.0	0.1	0.2	-	53.9	13.5	58.2	1.0	70.2
Kotri Subregion	**140.1**	**2.4**	**375.5**	**85.6**	**8,296.7**	**0.8**	**972.9**	**0.1**	**0.5**	**-**	**108.8**	**39.3**	**213.0**	**2.3**	108.0
Share in Production	5.1%	8.1%	82.3%	3.5%	44.7%	1.0%	14.7%	0.4%	2.8%	0.0%	15.9%	36.0%	77.4%	6.5%	11.6%
Total	**2,755.7**	**29.7**	**456.4**	**2,421.8**	**18,566.4**	**76.8**	**6,628.7**	**39.2**	**18.8**	**1.7**	**686.2**	**109.2**	**275.1**	**35.5**	**928.5**
Share in Production	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Computed from District Wise Crop Statistics 2008-2009. Ministry of Food & Agriculture. Islamabad

Table 4.6 40: Production of Major Crops 2008/09 In The Study Area (mt)

Subregion/ Districts	Wheat	Canola	Rice	Cotton	Sugarcane	Millets	Fodder	Guarseed	Total Pulses	Kharif Oilseeds	Vegetables	Condiments	Non Traditional Oilseeds	Other Crops	All Fruits
Ghotki	363.2	0.6	65.5	379.4	298.8	3.9	307.6	0.5	0.5	0.7	43.6	2.4	0.5	0.1	9.1
Sukkur	158.3	0.4	32.4	142.8	108.6	5.4	369.3	0.3	1.0	0.2	28.4	1.4	0.4	0.2	34.2
Guddu Subregion	**521.5**	**1.0**	**97.9**	**522.2**	**407.4**	**9.3**	**676.9**	**0.8**	**1.4**	**0.9**	**72.0**	**3.9**	**1.0**	**0.3**	**43.4**
Share in Production	18.3%	3.2%	13.1%	21.3%	3.1%	13.4%	11.5%	2.3%	16.2%	10.6%	9.0%	2.2%	0.3%	10.1%	4.5%
Khairpur	376.0	2.4	27.7	377.7	1,164.1	7.3	836.4	2.6	0.2	0.2	27.8	0.4	0.9	0.4	306.1
N. Feroze	376.2	1.4	20.7	186.6	1,137.8	1.6	467.7	0.5	0.2	0.1	34.6	0.1	1.0	0.1	76.0
Shaheed Benazirabad	277.9	6.5	12.7	236.9	996.1	8.1	705.3	0.8	0.3	0.1	107.8	0.4	1.9	0.2	58.3
Sanghar	451.9	9.8	41.5	256.9	487.9	0.5	840.0	0.8	0.3	3.6	103.8	11.8	6.9	0.0	79.0
Mirpurkhas	218.6	3.8	3.6	185.7	653.5	0.3	281.1	0.7	0.1	0.3	80.1	44.0	23.6	0.6	73.9
Umarkot	130.2	0.7	0.0	114.4	243.8	0.2	268.5	1.4	0.3	0.1	33.3	49.9	25.7	0.1	20.4
Tharparkar	3.7	0.6	0.0	3.5	59.1	40.0	381.7	26.0	4.8	3.2	3.3	3.5	0.1	0.0	47.4
Hyderabad	55.4		4.3	51.8	313.7	0.2	86.7	0.0	0.1	0.0	13.1	1.1	1.5	0.0	49.7
Tando Allahyar	121.7	0.2	0.0	137.6	1,141.4	0.3	284.0	0.0	0.5	0.1	60.1	3.8	1.1	0.0	58.3
Matiari	154.9	0.4	3.1	251.6	642.3	0.4	219.0	0.1	0.2	0.0	51.4	2.4	0.8	0.0	54.8
Sukkur Subregion	**2,166.5**	**25.8**	**113.6**	**1,802.7**	**6,839.7**	**58.9**	**4,370.4**	**32.9**	**7.0**	**7.8**	**515.3**	**117.4**	**63.6**	**1.5**	**823.9**
Share in Production	75.9%	83.5%	15.2%	73.6%	52.0%	84.6%	73.9%	97.3%	80.1%	89.3%	64.2%	67.8%	22.2%	45.7%	85.4%
T.M.Khan	32.5	0.1	61.8	28.5	1,536.6	0.0	216.6	0.0	0.1	0.0	23.5	0.6	12.0	0.0	9.9
Badin	93.0	1.2	270.7	90.3	2,730.5	1.2	372.5	0.1	0.0	0.0	85.7	36.6	149.0	0.7	31.7
Thatta	42.2	2.8	203.1	4.7	1,629.9	0.2	274.4	0.0	0.2	0.0	106.6	14.7	60.6	0.7	55.8
Kotri Subregion	**167.7**	**4.1**	**535.6**	**123.5**	**5,897.0**	**1.4**	**863.5**	**0.1**	**0.3**	**0.0**	**215.9**	**51.9**	**221.5**	**1.4**	**97.4**
Share in Production	5.9%	13.3%	71.7%	5.0%	44.9%	2.0%	14.6%	0.3%	3.7%	0.1%	26.9%	30.0%	77.4%	44.1%	10.1%
Total Left Bank	**2,855.7**	**30.9**	**747.1**	**2,448.4**	**13,144.1**	**69.6**	**5,910.8**	**33.8**	**8.8**	**8.7**	**803.2**	**173.2**	**286.1**	**3.2**	**964.7**
Share in Production	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: Computed from District Wise Crop Statistics 2008-2009. Ministry of Food & Agriculture. Islamabad

Table 4.6 41: Production of Major Crops 2009/10 In The Study Area (mt)

Subregion/ Districts	Wheat	Canola	Rice	Cotton	Sugarcane	Millets	Fodder	Guarseed	Total Pulses	Kharif Oilseeds	Vegetables	Condiments	Non Traditional Oilseeds	Other Crops	All Fruits
Ghotki	364.39	0.01	40.04	544.57	300.30	0.02	300.51	0.36	0.55	0.00	2.60	0.78	0.29	5.39	8.64
Sukkur	162.67	0.05	18.83	200.82	115.46	0.04	318.19	0.12	1.35	0.00	5.90	0.56	0.18	5.00	33.35
Guddu Subregion	**527.06**	**0.06**	**58.87**	**745.40**	**415.76**	**0.06**	**618.70**	**0.48**	**1.90**	**0.00**	**8.50**	**1.34**	**0.48**	**10.38**	**41.98**
Share in Production	17.8%	3.4%	8.5%	18.2%	3.1%	0.1%	11.4%	0.9%	9.8%	0.0%	4.3%	0.8%	0.2%	52.9%	4.4%
Khairpur	385.49	0.74	26.16	455.17	1038.58	0.13	713.54	2.66	0.61	0.00	3.88	0.46	0.57	3.78	297.26
N. Feroze	379.77	0.02	13.88	263.46	1068.79	0.03	393.40	0.72	2.20	0.00	6.30	0.15	0.51	0.84	51.45
Shaheed Benazirabad	321.02	0.00	10.20	349.13	1169.05	0.41	641.40	1.32	0.78	0.00	7.11	0.40	0.78	1.25	46.63
Sanghar	457.70	0.04	42.68	1052.46	643.71	0.28	820.81	0.56	0.53	0.00	6.98	9.40	4.98	0.44	77.82
Tharparkar	4.14	0.00	0.00	6.76	48.63	40.26	287.25	47.69	5.81	0.39	1.09	5.11	0.01	0.00	78.46
Mirpurkhas	228.19	0.44	3.22	273.34	661.58	0.65	265.51	0.48	1.98	0.00	16.13	44.50	14.73	0.25	76.52
Umarkot	128.74	0.00	0.00	147.88	154.08	0.25	234.53	1.06	0.09	0.01	3.78	48.88	18.42	0.22	23.36
Hyderabad	57.57	0.00	4.93	65.46	348.92	0.03	62.62	0.03	0.51	0.00	10.04	0.97	1.18	0.26	75.19
Matiari	163.06	0.00	1.86	313.12	725.85	0.20	198.71	0.05	1.45	0.00	14.44	1.93	0.47	0.04	49.15
Tando Allahyar	130.54	0.01	0.00	188.72	1128.25	0.29	305.25	0.06	2.15	0.00	17.44	3.20	0.44	0.12	63.45
Sukkur Subregion	**2256.23**	**1.24**	**102.92**	**3115.50**	**6987.42**	**42.52**	**3923.01**	**54.63**	**16.12**	**0.40**	**87.20**	**114.98**	**42.09**	**7.19**	**839.28**
Share in Production	76.2%	66.5%	14.9%	76.2%	52.6%	98.0%	72.3%	99.0%	82.9%	100.0%	44.2%	67.7%	16.3%	36.6%	87.6%
T.M.Khan	37.00	0.01	59.95	41.89	1585.23	0.00	216.53	0.00	0.32	0.00	6.37	0.68	12.60	0.03	9.95
Badin	96.46	0.00	254.81	167.59	2621.07	0.72	389.93	0.05	0.11	0.00	53.98	34.40	143.58	1.24	35.85
Thatta	42.42	0.55	215.53	15.53	1673.05	0.10	278.82	0.05	0.99	0.00	41.06	18.44	59.18	0.80	31.15
Kotri Subregion	**175.87**	**0.56**	**530.29**	**225.02**	**5879.35**	**0.82**	**885.28**	**0.09**	**1.43**	**0.00**	**101.41**	**53.51**	**215.36**	**2.07**	**76.95**
Share in Production	5.9%	30.1%	76.6%	5.5%	44.3%	1.9%	16.3%	0.2%	7.3%	0.0%	51.4%	31.5%	83.5%	10.5%	8.0%
Total	**2959.16**	**1.87**	**692.08**	**4085.91**	**13282.53**	**43.40**	**5426.99**	**55.20**	**19.44**	**0.40**	**197.10**	**169.83**	**257.92**	**19.64**	**958.21**
Share in Production	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Unpublished Data from Department of Agriculture Extension 2011

Table 4.6 42: Per Ha Yield of Major Crops 2007/08 In The Study Area (MT)

DISTRICTS	Wheat	Canola	Rice	Cotton	Sugarcane	Millets	Fodder	Guarseed	Total Pulses	Kharif Oilseeds	Vegetables	Condiments	Non traditional oilseeds	Other Crops	All Fruits
Ghotki	3.66	1.04	2.59	4.46	64.10	1.00	30.62	0.88	4.34	0.83	31.41	3.42	1.34	2.13	7.04
Sukkur	3.60	0.80	2.75	4.16	63.00	-	30.70	0.87	4.27	-	30.67	3.74	1.27	2.10	7.95
Guddu Subregion	**3.64**	**1.00**	**2.66**	**4.38**	**63.81**	**0.50**	**30.67**	**0.88**	**4.20**	**0.83**	**31.21**	**3.54**	**1.31**	**2.11**	**7.72**
Khairpur	3.64	1.05	2.69	4.44	65.54	-	22.45	0.84	4.37	-	30.74	0.87	1.28	2.46	6.91
N. Feroze	3.76	1.23	2.74	4.38	60.59	1.00	40.27	0.85	2.58	-	30.34	1.88	1.33	2.11	7.30
Shaheed Benazirabad	3.60	1.04	2.40	4.26	58.20	0.65	43.34	0.82	2.50	-	30.70	2.70	1.34	0.79	6.92
Sanghar	3.72	1.15	2.39	3.91	61.14	0.50	28.70	0.72	2.36	-	20.15	1.85	1.27	-	6.91
Tharparkar	2.71	1.00	-	3.90	49.82	0.49	11.06	0.63	1.28	0.72	16.64	2.13	1.14	-	8.56
Mirpurkhas	3.48	0.81	2.25	3.99	55.65	1.00	20.73	0.68	2.54	-	19.00	2.34	1.22	1.00	5.28
Umarkot	3.17	0.81	-	3.96	53.90	0.71	22.54	0.64	2.65	0.63	18.78	2.37	1.17	1.00	5.38
Hyderabad	4.73	-	1.93	3.78	60.21	1.00	18.15	0.62	2.30	-	23.12	1.83	1.11	-	6.91
Matiari	4.10	0.80	3.00	3.95	62.76	0.50	21.54	0.72	3.50	-	23.48	1.90	1.08	-	5.47
Tando Allahyar	3.81	0.50	-	4.30	63.34	0.50	28.01	0.67	2.75	-	22.44	2.07	1.07	0.50	5.99
Sukkur Subregion	**3.68**	**1.06**	**2.57**	**4.12**	**60.62**	**0.50**	**23.54**	**0.66**	**3.72**	**1.35**	**29.81**	**2.23**	**1.20**	**2.38**	**6.61**
T.M.Khan	2.77	1.00	2.14	3.84	61.72	-	36.57	0.68	3.24	-	19.17	2.23	1.08	-	5.55
Badin	2.64	1.00	2.52	4.36	61.92	0.42	30.62	0.64	2.28	-	20.98	1.61	1.13	1.25	5.91
Thatta	2.73	0.83	2.55	4.13	59.66	-	30.49	0.64	2.48	-	19.87	1.54	1.11	1.20	5.60
Kotri Subregion	**2.69**	**0.89**	**2.50**	**4.24**	**61.19**	**0.42**	**31.79**	**0.64**	**3.51**	**-**	**19.88**	**1.59**	**1.12**	**1.20**	**5.67**
Total	**3.61**	**1.03**	**2.52**	**4.18**	**60.99**	**0.50**	**25.19**	**0.66**	**3.75**	**1.35**	**30.77**	**1.97**	**1.14**	**2.49**	**6.53**

Source: Computed from District Wise Crop Statistics 2008-2009. Ministry of Food & Agriculture. Islamabad

Table 4.6 43: Per Ha Yield of Major Crops 2008/09 In The Study Area (MT)

Subregion/ Districts	Wheat	Canola	Rice	Cotton	Sugarcane	Total Millets	Fodder	Guarseed	Total Pulses	Kharif Oilseeds	Total Vegetables	Condiments	Non Traditional Oilseeds	Other Crops	All Fruits
Ghotki	3.73	1.00	1.98	4.93	50.64	0.68	29.02	0.88	0.42	0.99	13.01	3.58	1.31	1.05	7.23
Sukkur	3.63	0.80	2.25	4.73	49.36	0.77	29.54	0.87	0.30	1.00	11.16	3.69	1.27	0.68	8.20
Guddu Subregion	**3.70**	**0.91**	**2.06**	**4.88**	**50.30**	**0.73**	**29.30**	**0.88**	**0.33**	**0.99**	**12.21**	**3.62**	**1.29**	**0.78**	**7.97**
Khairpur	3.66	1.14	3.15	4.79	53.65	0.83	20.35	0.87	0.27	0.97	11.59	0.96	1.28	0.73	7.03
N. Feroze	3.75	1.27	3.04	5.06	54.44	0.70	38.65	0.73	0.28	0.45	11.19	2.13	1.33	1.03	7.12
Shaheed Benazirabad	3.59	1.10	3.34	5.12	42.03	0.72	43.54	0.82	0.42	0.40	13.79	3.19	1.34	0.50	6.80
Sanghar	3.69	1.18	3.12	2.09	42.06	0.56	26.75	0.72	0.48	0.98	12.18	2.52	1.27		6.85
Mirpurkhas	3.47	1.00	2.57	5.26	49.89	0.75	19.80	0.69	0.39	0.44	9.47	3.28	1.22	0.55	5.25
Umarkot	3.15	0.78		4.91	47.80	1.00	22.75	0.70	0.42	0.68	10.31	3.29	1.17	0.50	5.40
Tharparkar	2.64	1.00		5.00	42.21	0.59	9.69	0.64	0.46	0.55	8.83	3.02	1.15		8.46
Hyderabad	3.87	0.00	2.87	7.40	54.09	0.50	19.70	0.62	0.45		9.00	2.40	1.11		7.08
Tando Allahyar	3.78	1.00		6.62	55.14	0.43	23.87	0.68	0.37	0.59	10.55	2.41	1.06	0.00	6.05
Matiari	3.91	0.80	3.10	7.60	50.98	0.57	18.56	0.73	0.21		10.39	2.17	1.08		5.46
Sukkur Subregion	**3.64**	**1.10**	**3.10**	**4.45**	**50.07**	**0.63**	**22.49**	**0.67**	**0.42**	**0.69**	**11.20**	**3.08**	**1.20**	**0.58**	**6.62**
T.M.Khan	2.85	1.00	3.41	6.48	53.35		36.10	0.69	0.35		8.58	2.10	1.08	0.00	5.38
Badin	2.79	0.92	3.36	6.64	50.94	0.60	30.04	0.64	0.48	0.60	8.34	2.15	1.13	0.54	6.15
Thatta	3.10	0.88	2.59	5.88	49.09	1.00	28.88	0.64	0.30	0.50	8.39	1.91	1.11	0.58	5.26
Kotri Subregion	**2.88**	**0.89**	**3.02**	**6.57**	**51.01**	**0.64**	**30.95**	**0.65**	**0.33**	**0.54**	**8.39**	**2.08**	**1.12**	**0.54**	**5.53**
Left Bank	**3.60**	**1.06**	**2.86**	**4.61**	**50.50**	**0.64**	**24.10**	**0.67**	**0.40**	**0.72**	**10.35**	**2.70**	**1.14**	**0.57**	**6.54**

Source: Computed from District Wise Crop Statistics 2008-2009. Ministry of Food & Agriculture. Islamabad

Table 4.6 44: Per Ha Yield of Major Crops 2009/10 In The Study Area (MT)

DISTRICTS	Wheat	Canola	Rice	Cotton	Sugarcane	Millets	Fodder	Guarseed	Total Pulses	Kharif Oilseeds	Vegetables	Condiments	Non Traditional Oilseeds	Other Crops	All Fruits
Ghotki	3.71	1.08	1.97	6.00	63.06	0.70	52.41	0.89	3.78	0.00	12.98	6.56	1.43	13.01	12.16
Sukkur	3.58	1.19	2.19	5.62	57.53	0.59	58.35	0.89	3.79	0.00	14.16	5.76	1.27	4.68	13.81
Guddu Subregion	**3.67**	**1.16**	**2.04**	**5.90**	**61.42**	**0.63**	**55.31**	**0.89**	**3.80**	**0.00**	**13.81**	**6.22**	**1.36**	**10.47**	**13.64**
Khairpur	3.72	1.26	3.05	5.68	60.79	0.59	47.84	0.90	4.55	0.00	15.21	3.89	1.33	5.14	14.29
N. Feroze	3.72	1.09	2.89	6.43	59.90	0.60	57.71	0.71	5.12	0.00	12.45	4.61	1.46	1.84	13.93
Shaheed Benazirabad	3.99	0.00	3.19	6.24	50.71	0.69	62.78	0.71	3.99	0.00	26.19	4.50	1.45	1.42	15.19
Sanghar	3.67	1.28	3.01	7.76	55.15	0.59	54.99	0.73	4.58	0.00	11.37	4.14	1.98	0.69	11.03
Tharparkar	2.65	0.00	0.00	6.15	48.63	0.59	47.56	0.55	6.60	0.87	13.21	3.51	1.27	0.00	13.00
Mirpurkhas	3.55	1.25	2.60	6.78	61.78	0.59	54.96	0.69	5.84	0.00	11.33	4.42	1.86	1.21	9.33
Umarkot	2.95	0.00	0.00	5.97	58.32	0.59	53.93	0.77	1.25	0.67	12.60	5.09	2.03	0.59	9.50
Hyderabad	3.84	0.00	2.95	8.29	58.32	0.63	52.17	0.63	5.29	0.00	12.43	4.19	1.24	0.61	12.18
Matiari	3.86	0.00	2.56	8.19	59.31	0.59	56.39	0.74	7.87	0.00	11.97	4.11	1.13	0.69	10.22
Tando Allahyar	3.78	1.00	0.00	8.10	63.26	0.55	56.91	0.65	5.99	0.00	12.61	4.52	1.86	0.79	9.71
Sukkur Subregion	**3.68**	**1.25**	**2.99**	**6.95**	**58.20**	**0.59**	**54.27**	**0.57**	**6.15**	**1.54**	**12.76**	**4.73**	**2.51**	**4.86**	**12.40**
T.M.Khan	2.69	1.09	3.34	8.41	62.57	0.00	60.52	0.00	5.09	0.00	13.76	4.23	1.05	1.36	9.56
Badin	2.67	0.00	3.08	8.87	56.84	0.59	52.33	0.65	6.71	0.00	13.60	4.34	1.69	1.27	11.44
Thatta	2.78	1.28	2.99	7.55	53.57	0.50	51.97	0.64	7.08	0.00	11.38	4.15	1.61	1.35	8.69
Kotri Subregion	**2.70**	**1.28**	**3.07**	**8.68**	**57.26**	**0.58**	**53.95**	**0.64**	**6.57**	**0.00**	**13.28**	**4.26**	**1.65**	**1.29**	**10.36**
Total	**3.60**	**1.26**	**2.93**	**6.80**	**57.87**	**0.59**	**54.40**	**0.58**	**5.16**	**1.54**	**13.16**	**4.48**	**2.41**	**5.58**	**12.28**

Source: Unpublished Data from Department of Agriculture Extension 2011

Table 4.6 45: Average Yield of Main Crops (kg/ha) By Subregion and Zones

Zone	Crop	Subregion			Overall
		Ghotki	Sukkur	Kotri	
Zone A	Wheat	2,768	3,163	2,965	3,163
	Rapeseed	-	1,087	1,087	1,087
	Cotton	1,878	2,174	3,163	2,174
	Paddy	3,954	3,262	5,436	4,250
	Sugarcane	79,072	79,387	90,933	79,966
	Vegetables	24,710	16,309	31,826	20,855
Zone B	Wheat	2,866	3,558	3,064	3,459
	Rapeseed	692	1,384	-	1,384
	Cotton	2,273	2,570	3,361	2,669
	Paddy	3,459	2,965	-	3,064
	Sugarcane	74,130	81,029	84,492	82,525
	Vegetables	19,768	9,983	2,965	9,983

Table 4.6 46: Summary of Net Returns (Gross Margins) of Main Crops (PKR/Ha)

Zone	Crop	Subregion			Overall
		Ghotki	Sukkur	Kotri	
Zone A	Wheat	34,898	38,738	33,183	38,105
	Rapeseed	-	22,138	45,822	28,073
	Cotton	93,503	116,779	226,531	123,666
	Paddy	53,706	44,306	82,994	62,009
	Sugarcane	181,866	259,218	323,194	261,276
	Vegetables	117,751	364,292	61,446	274,227
Zone B	Wheat	28,661	49,719	38,985	46,764
	Rapeseed & Mustard	25,130	42,160	-	42,042
	Cotton	131,652	128,877	187,371	138,077
	Paddy	70,727	41,086	-	47,926
	Sugarcane	196,939	295,396	286,616	291,277
	Vegetables	159,688	245,800	200,077	232,590

Table 4.6 47: Fertilizer Off Take and Per Ha Use in The Study Area (000 mt)

Subregion/District	Nutrient N	Nutrient P	Nutrient K	Total (NPK)
Ghotki	48,929	15,337	749	65,015
Sukkur	22,928	10,321	401	33,650
Guddu Sub region	**71,857**	**25,658**	**1,149**	**98,665**
Khairpur	37,311	14,443	561	52,315
Naushehro Feroz	44,518	16,553	485	61,556
Shaheed Benazirabad	46,660	20,413	740	67,812
Sanghar	55,370	20,778	834	76,982
Mirpurkhas	53,437	20,979	1,048	75,464
Umerkot	4,851	1,798	47	6,696
Hyderabad	27,283	12,881	732	40,897
Tando Allahyar	29,197	13,395	650	43,242
Sukkur Sub region	**298,627**	**121,240**	**5,096**	**424,963**
Badin	40,873	11,794	481	53,149
Thatta	23,002	6,910	493	30,405
Kotri Sub Region	**63,876**	**18,704**	**975**	**83,554**
Total Left Bank	**434,360**	**165,602**	**7,220**	**607,182**
Average Fertilizer Use In The Left Bank of Indus In Nutrient kg/ha				
Guddu Subregion	136	43	2	180
Sukkur Subregion	164	66	3	233
Kotri Subregion	95	28	1	124
Total Left Bank	**152**	**58**	**3**	**212**

Source: Computed from Development Statistics of Sindh 2008

Table 4.6 48: Cost of Production of 1 ha of Wheat By Subregion and Zones (PKR)

Zone	Cost and Revenue	Subregion			Total
		Ghotki	Sukkur	Kotri	
Zone A	Plowing cost	7,198	7,952	7,299	7,863
	seed cost	8,065	6,385	6,748	6,496
	sowing labor cost	959	640	1,240	704
	FYM cost	-	183	-	161
	Fertilizer cost	9,795	14,492	24,287	14,319
	Harvesting labor cost	3,089	2,572	3,183	2,646
	Weedicides (PKR/ha)	17	5	5	5
	Threshing cost	4,594	4,942	5,715	4,986
	Total cost	33,729	37,176	39,425	37,186
	Wheat Yield (kgs)	2,768	3,163	2,965	3,163
	Wheat value	64,135	69,813	65,909	69,220
	Wheat straw (kgs)	2,768	3,163	3,262	3,163
	Wheat straw value	4,495	6,101	6,701	6,069
	Gross income	68,627	75,914	72,610	75,291
	Net return	34,898	38,738	33,183	38,105
Zone B	Plowing cost	8,233	9,125	8,451	8,972
	Seed cost	7,608	6,778	6,257	6,778
	Sowing labor cost	650	603	642	610
	FYM cost	-	489	1,087	524
	Fertilizer cost	14,399	16,002	30,401	15,548
	Weedicides (PKR/ha)	7	5	5	5
	Irrigation cost	17	2	37	10
	Harvesting labor cost	2,896	3,328	4,183	3,400
	Threshing cost	4,082	5,093	5,429	5,056
	Total cost of production	37,893	41,426	39,395	40,902
	Wheat Yield (kgs)	2,866	3,558	3,064	3,459
	Wheat value	62,116	82,534	69,601	79,356
	Wheat straw (kgs)	2,965	3,558	3,064	3,459
	Wheat straw value	4,438	8,611	8,779	8,310
	Gross income	66,554	91,145	78,380	87,666
	Net return	28,661	49,719	38,985	46,764

Table 4.6 49: Cost of Production of 1 ha of Paddy By Subregion and Zones (PKR)

Zone	Cost and Revenue	Subregions			Overall
		Ghotki	Sukkur	Kotri	
Zone A	Plowings	10,544	6,711	10,017	8,772
	Seed cost	3,180	1,759	2,155	2,179
	Sowing cost	5,271	4,129	3,190	3,946
	Fertilizer cost	30	79	72	67
	Pesticide cost	3,459	1,836	3,837	2,958
	Hired labor cost	4,282	4,935	3,660	4,290
	Irrigation cost	907	820	729	798
	Harvesting cost	6,919	5,043	7,060	6,215
	Total production cost	34,592	25,310	30,719	29,225
	Yield (kgs)	3,954	3,262	5,436	4,250
	Income	88,296	69,615	113,713	91,234
	Net return	53,706	44,306	82,994	62,009
Zone B	Plowing cost	7,826	7,907	-	7,887
	Seed cost	2,933	1,730	-	2,006
	Sowing cost	3,749	4,942	-	4,665
	Fertilizer cost	339	57	-	121
	Pesticide cost	1,317	1,483	-	1,446
	Hired labor cost	5,189	4,942	-	4,999
	Irrigation cost	749	494	-	554
	Harvesting cost	5,189	4,077	-	4,334
	Total production cost	27,290	25,632	-	26,015
	Yield (kgs)	3,459	2,965	-	3,064
	Income	98,017	66,717	-	73,940
	Net return	70,727	41,086	-	47,926

Table 4.6 50: Cost of Production of 1 ha of Cotton By Subregion and Zones (PKR)

Zone	Cost and Revenue	Subregions			Overall
		Ghotki	Sukkur	Kotri	
Zone A	Plowing cost	9,884	8,520	11,070	8,720
	Seed cost	5,337	3,580	3,015	3,580
	Sowing cost	3,459	2,913	4,547	3,034
	FYM cost	-	-	-	-
	Fertilizer cost	16,370	15,594	17,999	15,772
	Pesticide cost	10,872	9,827	12,849	10,054
	Inter-culturing	10,872	8,777	1,779	8,350
	Irrigation cost	680	830	692	818
	Picking	6,178	13,808	11,120	13,462
	Total cost	63,653	63,848	63,070	63,791
	Yield	1,878	2,174	3,163	2,174
	Income	157,156	180,628	289,601	187,460
	Net return	93,503	116,779	226,531	123,666
Zone B	Plowing cost	9,844	9,857	8,068	9,580
	Seed cost	4,433	2,338	1,853	2,417
	Sowing cost	1,530	2,560	2,394	2,459
	FYM cost	-	72	-	57
	Fertilizer cost	16,556	16,561	16,296	16,521
	Pesticide cost	15,345	8,841	8,097	9,204
	Inter-culturing	6,600	13,054	18,723	13,455
	Irrigation cost	754	1,520	1,539	1,468
	Picking	11,764	12,874	16,916	13,415
	Total cost	66,826	67,681	73,890	68,573
	Yield	2,273	2,570	3,361	2,669
	Income	198,478	196,558	261,261	206,650
	Net return	131,652	128,877	187,371	138,077

Table 4.6 51: Cost of Production of 1 ha of Sugarcane By Subregion and Zones (PKR)

Zone	Cost and Revenue	Subregions			Overall
		Ghotki	Sukkur	Kotri	
Zone A	Plowing cost	13,838	10,843	4,942	10,588
	Seed cost	39,536	45,919	39,536	45,499
	Sowing cost	4,942	6,995	3,385	6,783
	FYM cost	0	0	0	0
	Fertilizer cost	15,320	24,878	9,921	23,979
	Pesticide cost	3,707	2,696	1,853	2,669
	Inter-culturing cost	0	14,357	6,548	13,744
	Harvesting cost	25,698	12,775	24,512	13,563
	Irrigation cost	11,614	660	741	830
	Production cost	114,654	119,122	91,439	117,654
	Yield (tons/ha)	79	79	91	80
	Income	296,520	378,337	414,634	378,933
	Net Return	181,866	259,218	323,194	261,276
Zone B	Plowing cost	14,826	11,087	11,680	11,359
	Seed cost	49,420	38,024	38,580	38,298
	Sowing cost	2,965	3,099	398	1,917
	FYM cost	0	309	1,972	1,035
	Fertilizer cost	21,004	29,096	19,261	24,769
	Pesticide cost	0	2,246	956	1,675
	Inter-culturing cost	10,872	8,938	18,189	12,993
	Harvesting cost	22,239	22,059	18,891	20,675
	Irrigation cost	494	1,772	2,797	2,216
	Production cost	121,820	116,629	112,729	114,939
	Yield (tons/ha)	74	81	85	83
	Income	318,759	412,024	399,346	406,213
	Net Return	196,939	295,396	286,616	291,277

Table 4.6 52: Cost of Production of 1 ha of Vegetables By Subregion and Zones (PKR)

Zone	Cost and Revenue	Subregions			Total
		Ghotki	Sukkur	Kotri	
Zone A	Plowing cost	11,861	8,434	7,687	8,335
	Seed cost	9,884	4,324	1,707	3,778
	Sowing cost	6,178	1,596	3,788	2,333
	FYM cost	1,977	-	-	59
	Fertilizer cost	19,491	12,026	17,603	13,773
	Inter-culturing labor cost	5,560	39,842	7,028	29,855
	Harvesting labor cost	12,355	4,737	8,787	6,074
	Irrigation cost	272	717	781	719
	Production cost	67,577	71,674	47,384	64,926
	Yield (kgs)	24,710	16,309	31,826	20,855
	Value	185,325	389,311	89,230	301,289
	Net return	117,751	364,292	61,446	274,227
Zone B	Plowing cost	5,560	11,016	9,884	10,391
	Seed cost	37,065	3,536	1,483	6,304
	Sowing cost	4,942	3,556	3,707	3,699
	FYM cost	1,977	1,030	-	991
	Fertilizer cost	23,536	26,951	13,220	24,999
	Inter-culturing labor cost	3,954	8,429	22,239	9,681
	Harvesting labor cost	9,884	5,654	2,224	5,624
	Irrigation cost	494	558	865	591
	Production cost	87,412	60,732	53,621	62,277
	Yield (kgs)	19,768	9,983	2,965	9,983
	Value	247,100	272,578	200,151	261,615
	Net return	159,688	245,800	200,077	232,590

Table 4.6 53: Cost of Production of 1 ha of Rabi Oilseeds By Subregion and Zones (PKR)

Zone	Cost and Revenue	Subregions			Overall
		Ghotki	Sukkur	Kotri	
Zone A	Plowing cost	-	6,743	5,276	6,375
	Seed cost	-	477	230	415
	Sowing labor cost	-	168	519	255
	Fertilizer cost	-	9,768	3,239	8,132
	Hired labor cost	-	895	1,334	1,006
	Harvesting cost	-	983	1,979	1,233
	Irrigation cost	-	687	89	536
	Production cost	-	19,721	12,666	17,952
	Mustard yield (kgs)	-	1,087	1,087	1,087
	Total income	-	41,859	58,489	46,027
	Net Return	-	22,138	45,822	28,073
Zone B	Plowing cost	5,189	6,889	-	6,877
	Seed cost	198	440	-	437
	Sowing labor cost	309	319	-	319
	Fertilizer cost	2,533	5,276	-	5,256
	Hired labor cost	1,236	867	-	870
	Harvesting cost	-	2,212	-	2,197
	Irrigation cost	-	425	-	423
	Production cost	9,464	16,425	-	16,378
	Mustard yield (kgs)	692	1,384	-	1,384
	Total income	34,594	58,585	-	58,417
	Net Return	25,130	42,160	-	42,042

Table 4.6 54: Average Number of Different Animals Per HH By Subregion and Zones

Zone	Type of Animal	Subregion			Overall
		Ghotki	Sukkur	Kotri	
Zone A	Buffalos per HHs	1.51	0.74	0.86	0.83
	Buffalo calves per HHs	0.36	0.17	0.29	0.21
	Cows per HHs	0.70	0.40	0.57	0.47
	Cow calves per HHs	0.29	0.22	0.19	0.22
	Goats per HHs	0.92	0.70	0.32	0.62
	Sheep's per HHs	0.44	0.09	0.09	0.12
	Total per HHS	**4.22**	**2.32**	**2.32**	**2.47**
Zone B	Buffalos per HHs	0.67	0.88	1.24	0.90
	Buffalo calves per HHs	0.86	0.38	0.26	0.42
	Cows per HHs	0.47	0.41	0.20	0.39
	Cow calves per HHs	0.35	0.15	0.07	0.17
	Goats per HHs	3.62	2.02	0.74	2.06
	Sheep's per HHs	0.67	0.10	0.25	0.19
	Total per HHS	**6.64**	**3.94**	**2.76**	**4.13**

Table 4.6 55: Livestock Population in 2007/08 in The Study Area (000)

Subregion/Districts	Cattle	Buffaloes	Sheep	Goats	Camels	Horses	Mules	Asses	Poultry
Ghotki	282	247	74	375	10	2	1	26	437
Sukkur	212	197	47	250	8	1	1	10	435
Guddu Region	493	443	121	624	18	3	2	37	872
Khairpur	493	528	109	900	18	3	1	44	1,449
Naushehro Feroze	335	531	52	820	4	1	1	36	932
S. Benazirabad	339	390	102	878	5	4	0	42	863
Sanghar	370	324	84	697	6	2	1	46	437
Mirpurkhas	202	234	68	666	3	1	0	15	365
Umerkot	197	98	149	536	6	0	0	29	180
Tharparker	752	46	1,185	2,218	135	9	1	247	263
Hyderabad	79	309	29	296	1	2	0	16	315
Tando Allahyar	58	139	17	213	1	0	0	12	239
Matiari	267	235	52	330	1	1	0	20	214
Sukkur Region	**3,093**	**2,834**	**1,846**	**7,554**	**180**	**21**	**6**	**506**	**5,259**
Tando M Khan	57	158	24	136	2	0	0	8	239
Badin	315	498	223	578	9	2	0	19	612
Thatta	411	367	162	351	11	3	1	19	973
Kotri Region	**726**	**865**	**385**	**930**	**19**	**5**	**1**	**38**	**1,585**
Total Left Bank	**4,313**	**4,142**	**2,352**	**9,108**	**218**	**29**	**8**	**581**	**7,716**

Source: Computed from Development Statistics of Sindh 2008

Table 4.6 56: Income/Expenditure of One Cow By Subregion and Zones (PKR)

Zone	Cost and Revenue	Subregion			Overall
		Ghotki	Sukkur	Kotri	
Zone A	Dry fodder cost	158	377	218	316
	Concentrates cost	1,855	1,465	1,343	1,479
	Medicinal cost	224	488	603	485
	Production cost	2,237	2,330	2,163	2,281
	Milk Income	7,513	5,524	4,733	5,559
	Net return	5,276	3,194	2,570	3,278
Zone B	Dry fodder cost	529	409	366	407
	Concentrates cost	1,853	1,588	1,927	1,636
	Medicinal cost	794	429	305	423
	Production cost	3,176	2,426	2,598	2,466
	Milk Income	6,000	5,492	7,049	5,695
	Net return	2,824	3,066	4,451	3,229

Table 4.6 57: Income/Expenditure of One Buffalo By Subregion and Zones (PKR)

Zone	Cost and Revenue	Subregion			Overall
		Ghotki	Sukkur	Kotri	
Zone A	Dry fodder cost	210	122	61	108
	Concentrates cost	350	1,059	1,426	1,132
	Medicinal cost	168	265	348	286
	Production cost	727	1,446	1,836	1,525
	Milk Income	2,937	2,090	3,326	2,556
	Net Income	**2,210**	**645**	**1,491**	**1,031**
Zone B	Dry fodder cost	857	1,146	24	1,036
	Concentrates cost	414	208	681	258
	Medicinal cost	243	315	584	334
	Production cost	1,514	1,669	1,288	1,629
	Milk Income	2,571	4,563	3,672	4,388
	Net Income	**1,057**	**2,894**	**2,384**	**2,759**

Table 4.6 58: Fish Catch During 2004 to 2007 In The Study Area (mt)

Subregion/Districts	2004	2005	2006	2007
Ghotki	1,147	1,218	2,728	4,360
Sukkur	3,412	3,672	3,975	3,750
Guddu Sub Region	**4,559**	**4,890**	**6,703**	**8,110**
Percent	12.7%	12.8%	16.6%	24.4%
Khairpur	2,487	2,642	1,242	5,840
Naushehro Feroze	6,194	6,582	6,890	4,631
Shaheed Benazirabad	1,107	1,168	1,182	1,588
Sanghar	2,215	2,351	2,470	2,500
Mirpurkhas	10	8	8	3,235
Umer Kot	0	0	2	0
Tharparkar	0	4	5	10
Hyderabad	5,080	5,372	1,185	1,200
Matiari	0	0	2,810	0
Sukkur Sub Region	**17,093**	**18,127**	**15,794**	**19,004**
Percent	29.7%	29.6%	25.1%	31.5%
T.M Khan	0	0	1,424	0
Badin	14,949	15,959	16,225	9,404
Thatta	20,982	22,355	22,665	23,770
Kotri Sub Region	**35,931**	**38,314**	**40,314**	**33,174**
Percent	62.4%	62.5%	64.2%	55.0%
Total Left Bank	**57,583**	**61,331**	**62,811**	**60,288**
Percent	100%	100%	100%	100%

Source: Computed from Development Statistics of Sindh 2008

Table 4.6 59: Number Fisher Folks And Type of Boats In the Study Area

Subregion/districts	Number of fisher folks			Number of boats		
	Full time	Part time	Total	Sail	Row	Total
Ghotki	800	1,200	**2,000**	40	200	**240**
Sukkur	1,960	680	**2,640**	42	225	**267**
Guddu Sub Region	**2,760**	**1,880**	**4,640**	**82**	**425**	**507**
Share in Total	11.9%	21.4%	14.5%	4.5%	24.3%	14.2%
Khairpur	1,760	800	**2,560**	79	25	**104**
Naushehro Feroze	462	720	**1,182**	112	82	**194**
Shaheed Benazirabad	700	350	**1,050**	280	110	**390**
Sanghar	2,300	1,500	**3,800**	480	10	**490**
Mirpurkhas	70	31	**101**	8	0	**8**
Tharparkar	7	10	**17**	18	0	**18**
Umer Kot	0	0	**0**	0	0	**0**
Hyderabad	400	706	**1,106**	205	20	**225**
Sukkur Sub Region	**5,699**	**4,117**	**9,816**	**1,182**	**247**	**1,429**
Percent	24.6%	47.0%	30.7%	65.3%	14.1%	40.1%
Badin	4,212	2,020	**6,232**	46	328	**374**
Thatta	10,500	750	**11,250**	500	750	**1,250**
Kotri Sub Region	**14,712**	**2,770**	**17,482**	**546**	**1,078**	**1,624**
	63.5%	31.6%	54.7%	30.2%	61.6%	45.6%
Total Left Bank	**23,171**	**8,767**	**31,938**	**1,810**	**1,750**	**3,560**
Percent	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Computed from Development Statistics of Sindh 2008

Thematic Area 4.7

Social Issues of Drainage Operations and Flooding

Project Pamphlet Front Side

SOLUTIONS — YOUR SAY MATTERS

The Phase II of the Regional Plan will identify structural and non-structural solutions for issues stakeholders and communities brought up during the first phase of the study. The solutions will be derived from the extensive consultations with affected communities and other major stakeholders. We want to hear from you. Write to us or call us!

Our **Hotline** number is : 0302-258-2711

Monday to Wednesday 10am—1pm

Email us on: wsip.mplan.comments@gmail.com

Office address: B-37, Defence Housing Society, Hyderabad, Pakistan

If you decide to visit us, please phone for an appointment so we can be available for you.



Village water purification—Can poor afford it ?



Irrigated farm in Nawab Shah. How is drainage helping the farmer?



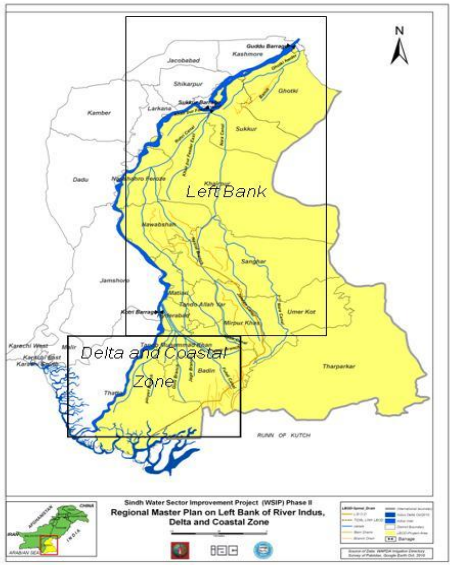
LBOD—Badin District How to improve its performance?

Louis Berger Group and Indus Associated Consultants office address:

B-37, Defense Housing Society, Hyderabad, Pakistan

Fax: + 92-22-272-0112

WATER SECTOR IMPROVEMENT PROJECT (WSIP) - PREPARATION OF A REGIONAL PLAN



Sindh Irrigation and Drainage Authority (SIDA)

The Louis Berger Group Inc.

Indus Associated Consultants

Project Pamphlet Back Side



Effluent from sugar-mills. What does it mean to you?

The Sindh Water Sector Improvement Project (WSIP) is funded by the World Bank and it is being implemented by the Government of Sindh and Sindh Irrigation and Drainage Authority (SIDA). It covers drainage and the canals on the Left Bank of Indus River and the Delta and Coastal area.

Among other components, the Project includes management plans for major irrigation and drainage infrastructure and preparation of a **Regional Plan** for the Left Bank, Delta and the Coastal Zone. The **Louis Berger Group** in association with the **Indus Associated Consultants** is preparing the Master Plan .

The Phase I of the Regional Plan study was based on consultations with affected communities and other major stakeholders. The main goal was to identify issues related to impact of drainage system, floods and storm water damage and sea water intrusion. Our team visited 142 villages, conducted 15 stakeholders workshops, 16 case studies , 94 community consultations with men and women and interviewed 44 Key Informants. In total, we talked to 4400 persons.



Flood evacuation—What do people think? Do you have a better solution?



Consultations in villages. We listen!

The **REGIONALPLAN study** comprises four phases:
Phase I— Inventory and assessment of existing conditions and identification of issues and problems
Phase II— Identification of solutions covering structural and non-structural solutions and preparation of the pre-feasibility study
Phase III— Preparation of a detailed feasibility study including technical, economic, environmental and social viability considering stakeholders' suggested interventions
Phase IV— Preparation of detailed designs and bidding documents

The REGIONALPLAN study will address the following issues :

1. Storm water and sea intrusion damages
2. Address deficiencies in the LBOD system and safe disposal of drainage and flood waters
1. Potential enhancements of dhands, wetlands and mangroves
2. Effort to enhance environmental and economic capacities of wetlands and mangroves for the local communities
3. Environmental and economic importance of wetlands
4. Strengthen institutional capacity to ménage and respond to flood and other damaging events.



Women have their say too — We listen to them.

ISSUES COMMUNITIES AND OTHER STAKE-HOLDERS INDENTIFIED DURING THE PHASE - I OF THE REGIONAL PLAN STUDY

The stakeholders and communities identified the following issues :

- Deficiencies in the LBOD/drainage system
- Inadequate management and operation and maintenance of the drainage system
- Lack of access to clean drinking and shortage of irrigation water
- Disposal of poisonous industry effluents in the canals and drains
- Sea intrusion, water logging and salinity
- Widespread poverty and waterborne diseases
- Seriously affected agriculture, diminished livestock, and livelihoods
- Degraded ecology and environment
- Extensive damage to wetlands and water bodies
- Ineffective early flood warning system
- Institutional strengths and weaknesses
- Inadequate meaningful consultations with communities and stakeholders during all stages of any project.

Thematic Area 4.8

Review Capacities of Provincial Agencies Involved In Execution of the Irrigation and Drainage Project and Its Management

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Table 4.8.1 NGOs Active in Sindh

No.	NGO	Contact	Capacity	Activities\Capabilities
1	AWARE (Umar Kot)	A. Akbar 0333-7092067 info@aware.org.pk **Location of Offices** District umerkot AWARE Office, Ward # 311 Gharibabad Mohalla Umerkot, District Umerkot - 69100 Tele/Fax: + 92 238 500039 District Tharparkar AWARE Office Near National Bank, Chachro, District Tharparkar Sindh, Pakistan Tele/Fax:+ 92 232273054	**Permanent staff** Executive Director (01) Finance $ Admin officer (01) Monitoring &Evaluation officer (01) Social mobilizers - Male (02) Social mobilizers – Females (02) DR. MBBS (01) Lady Health Visitor (01) Health Technicians (01) Drivers (03) Supporting staff (04) **Associated Staff** DR. MBBS, Health Technicians (04) Supporting staff for CHC Trados (04) **Vehicles** 03 4x4 jeeps, 01 bike, 01 4x4 jeep owned by AWARE, 02 jeeps rented, Honda CD70 is owned by AWARE) **Equipment & Computers** Laptops (04), PCs (07), Printers (02), Photocopier (01), Multimedia(01), Fax(01), Scanners(02), Digital, camera(02)Handy cam camera (01)	To promote, awareness, and to strengthen and empower the marginalized sectors of population for enabling them to influence social, political and economic policies and decision making to make possible establishment of a society based on social justice, equity, equality and human dignity

No.	NGO	Contact	Capacity	Activities\Capabilities
2	Badin Rural Development & Organization - BRDO (Badin)	M. Khan Samo 0333-2524272 mail@bdro.org	Permanent staff (10) Associated staff (08) Equipments (Desk top computers 04) Laptop (02) Digital camera (02) GPS coordinates (02) Multimedia (01) Scanner (01) Fax (01) Vehicle (01 Coure car) Offices (1 head office) Seerani Road Badin Sindh 2 Field office Near MRSP office, Main road JATI	Established in 2000 by a group of energetic youngsters representing the both sexes of Badin .The organization registered under Social Welfare voluntary Organization Act: 1961 with Directorate of Social Welfare / Community Development Department Government of Sindh. The Organization has been working, since its inception, on different sectors of social development focusing on education, agriculture, women development, youth problems and environment for the betterment of the poor and needy peoples of the area through their active participation and the help of various donors.

No.	NGO	Contact	Capacity	Activities\Capabilities
3	Indus Community Development Organization (Mirpurkhas)	Murtza Arain 0300-3010135 icdo_moro@yahoo.com www.icdomoro.webs.com	Consultants and Trustee (07)	Working for the improvement of literacy and health care in the society. Creation of such atmosphere in the society where people can develop the skills of technical education by setup of center Introducing I P M technology in agriculture sector. Up gradation of economical condition of small businesses for males and females.
4	International Union for Conservation of Nature and Natural Resources - IUCN	Bath island road Karachi 755303. Pakistan Tel +92(21)5861540/41/42 Fax +92(21)5861448 Mobile +92(300)2031257 Tahir.qureshi@iucnp.org www.iucn.org	More than 1,000 member organizations in 140 countries including 200+ government and 800+ non-government organizations Almost 11,000 voluntary scientists and experts, grouped in six Commissions A neutral forum for governments, NGOs, scientists, business and local communities to find pragmatic solutions to conservation and development challenges undid by governments, bilateral and multilateral agencies, foundations, member organizations and corporations Official Observer Status at the United Nations General Assembly. CVs are on file at LBG\INDUS	IUCN, International Union for Conservation of Nature, helps the world find pragmatic solutions to our most pressing environment and development challenges. It supports scientific research, manages field projects all over the world and brings governments, non-government organizations, United Nations agencies, companies and local communities together to develop and implement policy, laws and best practice. Influence: IUCN supports governments, NGOs, international conventions, UN organizations, companies and communities to develop laws, policy and best-practice. Empowerment: IUCN helps implement laws, policy and best-practice by mobilizing organizations, providing resources and training, and monitoring results.

No.	NGO	Contact	Capacity	Activities\Capabilities
5	Jaggarta Organization (Mirpurkhas)	Khalid Babar 0302-3319533 0334-3553908 jaggarta@yahoo.com **Location Of Offices** 1: Head office: Karimabad, District Mirpurkhas. 2: Hyderabad Office: F-100, Al-Rehman Cottages, Qasimabad, Hyderabad, 3: Dadu Office: Bhitai Muhallah, Mehar District Dadu.	**Permanent Staff** (85) **Associated Staff** (06) **Vehicle** Suzuki Cultus (01), Coure (02) Suzuki, Bolan (01), Motor Bikes (03) **Equipments and Computer Programs** Laptop (03) Desktop (06) Laser Jet Printer (03) Scanners (02) Digital Camera (03) GPS (02) Fax (01)	To mobilize communities by conducting training, motivational programs and enlighten them about Health, Education, Agriculture, Human Rights & income generation by increasing participation in these activities and involvement of communities for better future.
6	Marvi Welfare Association (Pano Aquil)	Allah Wadhayo 0300-3145048 Marvi.org@gmail.com	Permanent staff (05) Associated staff (15) Type of vehicle(2 motor bikes 1 rent a car - 3) Equipments &, Computer program (1 computer/laptop, printer, scanner, phone, furniture, Almari, Generator) Location of office (Korai colony near BHELLAR road PANO AKIL district Sukkur) Cell: +92-300-3145048.	Shikarpur district activities: Establish different learning center and a . legal resource center. Provide purposeful, measureable services to rural community. To work for the quality of education, health and better environment while decreasing illiteracy rates. To arrange informative entertaining programs for boys & girls. To bring awareness among people about their basic rights. To form volunteer groups in villages. To introduce farmers about the latest methods/tools of agriculture. To create alternate sources of income to decrease unemployment situation. To publish informative material on different

No.	NGO	Contact	Capacity	Activities\Capabilities
				social issues. To sensitize and train the local populace & political representatives for their good participation for the development of society. To work for the betterment of prisoners that they can play positive role for the development of society.
7	Management and Development Center - MDC (Karachi)	Yameen Memon, ph.D. Tel: +92-22-265-2290 Cell: +92-300-937-6995 Fax: +92-22-2670-440 info@mdckpk.org www.mdcpk.org	**Professional staff (**11**)** **Specialties in**: Monitoring Evaluation Expert, Socio Economic Expert, Health Specialties, Livestock Specialist, irrigation and drainage Specialist, Agriculture economics, Statics & Data Management, Environmental Specialist, Gender and Development Specialist, Livelihood Specialist, IT &GIS Specialist.	Management & Development Center (MDC) is registered under section 32 of the Companies Ordinance, 1984 (XLVII of 1984) in Pakistan. MDC is a development support organization mandated to provide research, training and policy analysis services to the public and private sector organizations seeking expertise in different development fields. It provides consulting services with commitment, contributing to the socio-economic development at national and international levels. The headquarter of MDC is based at Hyderabad, Sindh Pakistan whereas its regional offices are located at Islamabad, Karachi and Quetta. It has associated professionals, having an excellent record of delivering services to the national and international development organizations. They have an ample experience in development consultancy, project/program management, public administration, applied research, and training. They have served at important committees/task forces aimed to promote development and alleviate poverty, presented papers at national and international conferences/ seminars and remained team leaders of different development projects as well as served on higher positions in the government and private organizations. They are well acquainted with

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				international development system including the working of UN and other international development agencies.
8	National Rural Support Program - NRSP (Hyderabad)	info@nrsp.org.pk www.nrsp.org.pk	Awaiting details of personal equipment & offices.	NRSP works to release the potential abilities, skills and knowledge of rural men and women, to enable them to articulate their aspirations and to effectively marshal the resources they need. The purpose is poverty alleviation - enabling people to break the cycle of poverty, which begins with lack of opportunity, extends to the well-known miseries of economic and nutritional poverty and leads new generations to endure the NRSP is currently working with more than one million poor households organized into a network of more than 102,000 Community Organizations conditions.
9	Root Work Foundation - RWF	Mr. Sartaj Abbasi info@rootwork.org.pk	Awaiting details of personal equipment & offices.	The Vision of Root Work Foundation is "an empowered, democratic & discrimination-free society; which is guided by the values of equity, participation, peace & tolerance"
10	SAWFCO (Hyderabad, Sanghar, Mirpurkhas)	0235-841242 sawfco@hyd.paknet.com.pk www.safwco.org	Awaiting details of personal equipment & offices.	SAWFCO envisions 'sustainable communities achieving equitable economic, social, political and cultural development through grass roots development of institutions
11	Seeda Khair Pur Mir's	0300-3181901, 0333-3615422	Awaiting details of personal equipment & offices	20 BEC Schools (NEF) Islamabad. Beneficiaries. 16 Female & 04 Male Teachers, 20 Villages, 857 Enrolled Students Installation of three Tube Well Donor TVO Islamabad. Beneficiaries, 250 farmers families, a water logging & Salinity decreased, Monthly income of farmers was increased. T.B Dots awareness programme (The Asia Foundation). Beneficiaries, 12574 community

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				members aware, Stage Theater programmes and International T.B Day was arranged. Three Primary Health Care Clinics at three villages With own resources, Medical Camps, Blood and Eye camps were arranged. Base line Survey of HIV Aids. Flood Activities 2010: Survey of flood affected people at District Khairpur Mir's volunteer bases. Management, 2011 of KHEEMA BASTI at old KTM ground Khairpur about 150 families were living in 60 tents.

No.	NGO	Contact	Capacity	Activities\Capabilities
12	Shah Abdul Latif Bhitai Welfare Society(SALBWS) Registration: Shah Abdul Latif Bhitai Welfare Society is a national, public interest, non-governmental and non-profit organization registered as a Provincial level organization with the Department of Social Welfare, Government of Sindh since 2001(REGD 1833 DSW). (Registration and Control) Ordinance 1961 (XL VI of 1961).	Contact person: Danish Channa (President) Shah Abdul Latif Bhitai welfare society, Pakistan. D-3,4th floor, Amir chamber, Block13-A, Gulshan_e_iqbal, Karachi, Sindh, Pakistan. Phone:+92-21-34824210-34978281 +92-21-34978281 Cell:0321-237-4426 0300-234-1043 www.salbwspk.org salbws@yahoo.com. District sub offices: Ghotki, Sukkur, Sheikarpur, Larkana, Thatta, Badin, Nawab Shah, Mirpurkhas, Dadu, Jacobabad, Tharparka, Hyderabad, Khairpur, Kashmore. Address in document on file.	Note: an organization chart is inc in a 29 page prequalification docu on file with LBG/INDUS. Title of bank account: shah abdul latif bhitai welfare society. Bank detail: abl limited, university road branch, sultan building, block-13c, gulshan-e-iqbal, Karachi Sindh, Pakistan NTN certificate no: 1863403-6. STAFFING: Executive Body (08), Penal Consultants (17) Legal Advisory (06) Technical staff (13) World Flood Program (10) Chief Minister Inspection Team (Bhitai Medical Center Karachi (1 Education Project Project (09)	In Sindh, working since 1999 in health,HIV/AIDS, Education, Poverty Alleviation, Domestic Violence against women, water and sanitation and infrastructure development, Human Rights through capacity building and direct interventions. SALBWS is benefiting more than 10 million populations of 16,940 villages in 18 Districts, Province of Sindh. It has been given the assignment of Monitoring and evaluation of developmental project & Service delivery CHEQUE and Balance executed by different departments, Education, Health, Water and Sanitation, Irrigation and Public Health. This team will work in three districts of Sindh namely Ghotki, Larkana & Kamber Sindh. Also Shah Abdul Latif welfare Society is currently working For Government: of Sindh and project is BEHAN BENAZIR BASTI in three districts of Sindh i.e. Mirpurkhas, Badin, Dadu project Duration one year Project Target 1200 houses Target area Mirpurkhas, Dadu, Badin Implementing Agencies SALBWS & Youth Welfare Society