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IMPLEMENTATION COMPLETION AND RESULTS REPORT
(IBRD-79000)

ON A

CREDIT

IN THE AMOUNT OF US$145.6 MILLION

TO THE

ISLAMIC REPUBLIC OF PAKISTAN

FOR A

PUNJAB BARRAGE IMPROVEMENT PHASE-II PROJECT (PBIP-II)

January 25, 2018

Water Global Practice
South Asia Region

CURRENCY EQUIVALENTS
(Exchange Rate Effective date – June 30, 2017)

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PKR 106= US$1
US$0.00095 = PKR 1

FISCAL YEAR
July 1 -- June 30

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ABBREVIATIONS AND ACRONYMS

BHU	Basic Health Unit	KHD	Kalabagh Head Works Division
BMO	Barrage Management Organization	KPK	Khyber Pakhtun Khuwa (formerly NWFP)
BP	Bank Procedures	M&E	Monitoring and Evaluation
CAS	Country Assistance Strategy	MAF	Million acre feet
CBO	Community Based Organization	MOU	Memorandum of Understanding
CCTV	Closed Circuit Television	MTR	Mid-Term Review
CFS	Cubic feet per second	NA	Not Applicable
CPS	Country Partnership Strategy	NCB	National Competitive Bidding
DA	Designated Account	NGO	Non-Governmental Organization
DO	Development Objectives	O&M	Operations & Maintenance
DRB	Dispute Review Board	OP	Operational Policy
DPR	Delivery Performance Ratio	PC-1	Planning Commission Performa 1
DSS	Decision Support System	PCIAP	Pothohar Climate-Smart Irrigated Agriculture Project
EA	Environmental Assessment	PDO	Project Development Objective(s)
ECNEC	Executive Committee of the National Economic Council	P&D	Planning and Development
EPD	Environmental Protection Department	PAD	Project Appraisal Document
ERR	Economic Rate of Return	PHED	Public Health Engineering Department
ESIA	Environmental and Social Impact Assessment	PIC	Project Implementation Consultants
ESMMP	Environmental and Social Management and Monitoring Plan	PID	Punjab Irrigation Department
FGW	Fresh Groundwater	POE	Panel of Experts
FY	Fiscal Year	PSRSP	Punjab Rural Support Program
GDP	Gross Domestic Product	PMIU	Program Monitoring and Implementation Unit
GIS	Geographic Information Systems/Sciences	PMO	Project Management Organization
GOP	Government of Pakistan	PSC	Project Steering Committee
GoPunjab	Government of Punjab	QAG	Quality Assurance Group
GRM	Grievance Redress Mechanism	RAP	Resettlement Action Plan
HSE	Health, Safety and Environment and	Rs	Pakistani Rupees
IBRD	International Bank for Reconstruction and Development	RTFM	Real Time Flow Monitoring
IBWS	Indus Basin Water System	SCADA	Supervisory Control & Data Acquisition
ICB	International Competitive Bidding	SDAP	Social development Action Plan
ICR	Implementation Completion and Results Report	SGW	Saline Groundwater
IDA	International Development Association	US$	United State Dollar
IRSA	Indus River System Authority	WAPDA	Water and Power Development Authority
ISEA	Integrated Social & Environmental Assessment	WRMIS	Water Resources Management Information System
IWMI	International Water Management Institute	WWF	Worldwide Fund for Nature
JHPP	Jinnah Hydro-Power Project		

PAKISTAN

PUNJAB BARRAGE IMPROVEMENT PHASE-II PROJECT (PBIP-II)

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A. Basic Information			
Country:	Pakistan	Project Name:	Punjab Barrages Improvement Phase-I1 Project (PBIP-11)
Project ID:	P096745	L/C/TF Number (s)	IBRD-79000
ICR Date:	01/15/2017	ICR Type:	Core ICR
Lending Instrument:	Specific Investment Lending	Borrower:	Government of Pakistan
Original Total Commitment:	US$ 145.60 M	Disbursed Amount:	US$ 132.51 M
Environmental Category: *Full (Category A)*			
Implementing Agencies: Punjab Irrigation and Power Department (PID), Government of Punjab			
Cofinanciers and Other External Partners: *None*			

B. Key Dates				
Process	**Date**	**Process**	**Original Date**	**Revised / Actual Date(s)**
Concept Review:	09/06/2005	Effectiveness:	09/30/2010	01/21/2011
Appraisal:	01/30/2009	Restructuring:		05/09/2016 05/01/2017
Approval:	07/01/2010	Mid Term Review:	01/31/2014	12/16/2013
		Closing	O6/30/2016	06/30/2017

C. Ratings Summary	
C.1 Performance Rating by ICR	
Outcomes:	Satisfactory
Risk to Development Outcome:	Moderate
Bank Performance:	Satisfactory
Borrower Performance:	Moderately Satisfactory

C.2 Detailed Ratings of Bank and Borrower Performance (by ICR)

Bank	Ratings	Borrower	Ratings
Quality at Entry:	Satisfactory	Government:	Satisfactory
Quality of Supervision:	Satisfactory	Implementing Agency/Agencies:	Moderately Satisfactory
Overall Bank Performance:	Satisfactory	***Overall Borrower Performance:***	Moderately Satisfactory

C.3 Quality at Entry and Implementation Performance Indicators			
Implementation Performance	**Indicators**	**QAG Assessments (if any)**	**Rating**
Potential Problem Project at any time (Yes/No):	No	Quality at Entry (QEA):	NA
Problem Project at any time (Yes/No):	No	Quality of Supervision (QSA):	NA
DO rating before Closing/Inactive status:	Satisfactory		

D. Sector and Theme Codes		
	Original	**Actual**
Major Sector/Sector		
Agriculture, Fishing and Forestry		
Irrigation and Drainage	70	70
Public Administration		
Other Public Administration	1	1
Transportation		
Other Transportation	1	1
Water, Sanitation and Waste Management		
Other Water Supply, Sanitation and Waste Management	6	6
Public Administration - Water, Sanitation and Waste Management	14	14

Water Supply	8	8

Major Theme/Theme/Sub Theme		
Environment and Natural Resource Management		
Climate change	41	41
Adaptation	41	41
Water Resource Management	25	25
Water Institutions, Policies and Reform	25	25
Private Sector Development		
Enterprise Development	15	15
MSME Development	15	15
Urban and Rural Development		
Rural Development	60	60
Rural Infrastructure and service delivery	60	60

E. Bank Staff		
Positions	At ICR	At Approval
Vice President:	Annette Dixon	Isabel Guerrero
Country Director:	Patchamuthu Illangovan	Yusupha Crookes
Practice/Sector Manager:	Michael Haney	Simeon K. Ehui
Task Team Leader:	Toru Konishi	Masood Ahmad
ICR Team Leader:	Masood Ahmad	
ICR Primary Author/s:	Usman Qamar	

F. Results Framework Analysis

Project Development Objectives (from Project Appraisal Document)

The project objectives are to assist the Borrower in:

(i) rehabilitating and modernizing Jinnah Barrage and carrying out affiliated works to enable reliable and uninterrupted supply of water for over 2.1 million acres of farmland benefitting about 600,000 farm families for irrigation and domestic water users; and

(ii) build Punjab Irrigation and Power Department's (PID's) capacity in improved water resources and irrigation system management.

Revised Project Development Objective

The PDO was not revised.

(a) PDO Indicator(s) — from Project Appraisal Document

PDO Outcome

PDO Outcome Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Values Achieved at Completion or Target Years
PDO Indicator 1	Barrage able to supply reliable and uninterrupted water for over 2.1 million acres of farmland benefitting about 600,000 farm families for irrigation and domestic water users. The barrage able to pass floods safely.			
Value (quantitative or Qualitative)	2009--- unreliability in supply of water to the target area. Delivery Performance Ratio (DPR) was 0.58	Less Interruption in water supplies to the Thal Canal area.		Less interruption in water supplies to the Thal Canal area. Water supply to the Thal Canal that serves 2.1 million acres benefitting about 600,000 farm families has improved after barrage rehab. DPR value after completion of main works is 0.72.
Date achieved	01/30/2009	06/30/2016		06/30/2017
Comments (incl. % achievement)	100% achieved. Since completion of barrage improvement works the Thal canal has received uninterrupted supplies from the barrage except during routine closure of 21 days in Jan 2016 for annual maintenance.			
PDO Indicator 2	PID's increased functional capacity to manage water /irrigation system in the province using modern tools and equipment.			

Value (quantitative or Qualitative)	2009 (Current level of water management)	Better water allocation and accounting over 50 percent of the area		PMIU is now maintaining improved water accounts based on modern systems over 100% of the irrigation system. PMIU is now responsible for intra-Punjab water allocations. The water allocation system is now implemented over 100 % of the irrigation system.
Date achieved	01/30/2009	06/30/2016	-	06/30/2017 for water accounts and 07/31/2017 for water allocations using DSS
Comments (incl. % achievement)	100% achieved. PID has created a new cadre of staff for operation of barrages, and strengthened its PMIU for maintaining the WRMIS. PMIU now maintains water accounts of all canals in Punjab and is responsible for water allocation decisions.			

(b) Intermediate Outcome Indicator(s) - from Project Appraisal Document

Intermediate Outcome Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Values Achieved at Completion or Target Years
Indicator 1	**Component A** Timely progress of component A, - no reduction to water supplies in the Thal Canal area - retrogression is stopped - operation of gates is smooth			
Value (quantitative or Qualitative)	2009 No rehabilitation Not specified	All rehabilitation works completed No reduction in water supplies in Thal Canal area		All rehabilitation works have been completed There has been no reduction in water supplies to the Thal Canal.

	2009 Level of Retrogression Gates did not function smoothly and had tendency to be stuck	Retrogression is checked Operation of Barrage gates is smooth		Retrogression is checked Operation of Barrage gates is smooth
Date achieved	09/30/2010	12/31/2015		12/31/2016
Comments (incl. % achievement)	100% achieved. Flows to the Thal canal are being maintained in accordance with the water share allocated for the canal. Bathymetric survey carried out after completion of the main works shows that retrogression has stopped. Barrage gates work smoothly			

Intermediate Outcome Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Values Achieved at Completion or Target Years
Indicator 2	**Component B** Management information - Water accounting system - Modern equipment in monitoring and management of hydraulic infrastructure			
Value (quantitative or Qualitative)	2009 No system	100% development of the system and training in its use		100% development of water accounting system completed, and staff has been trained
Date achieved	09/30/2010	12/31/2015		07/31/2017
Comments (incl. % achievement)	100% achieved. A WRMIS has been operationalized at the PMIU; DSS has been operationalized. SCADA system has been commissioned at Jinnah Barrage and other major barrages; flow monitoring and recording systems have been installed on all main canals			

Intermediate Outcome Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Values Achieved at Completion or Target Years
Indicator 3	**Component C** Baseline of monitoring is prepared and supervision of EMP and SDAP is carried out			
Value (quantitative or Qualitative)	2009 No baseline	Project impact assessment		Project impact assessment reports completed; and supervision of ESMMP and SDAP completed
Date achieved	09/30/2010	12/31/2015		10/31/2015
Comments (incl. % achievement)	100% achieved. A baseline survey was carried out in 2012 followed by repeat surveys at the mid-term in 2013 and a final assessment in 2015. M&E of the ESMMP and SDAP was also carried out and completion reports were prepared for these components.			

Intermediate Outcome Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Values Achieved at Completion or Target Years
Indicator 4	**Component D** Project implementation is coherent and contracts are awarded. No interruption to river and canal supplies			
Value (quantitative or Qualitative)	2009 No contracts awarded	-Construction concluded and normal operation of barrage commenced -Normal supplies to the canal- river system		-Construction concluded and normal operation of barrage ongoing -Normal supplies to the canal-river system
Date achieved	09/30/2010	12/31/2015		12/31/2016
Comments (incl. % achievement)	100% achieved: Project implementation completed on schedule and operation of barrage is taking place with normal supplies to the Thal Canal and the river downstream of the barrage.			

G. Ratings of Project Performance in ISRs

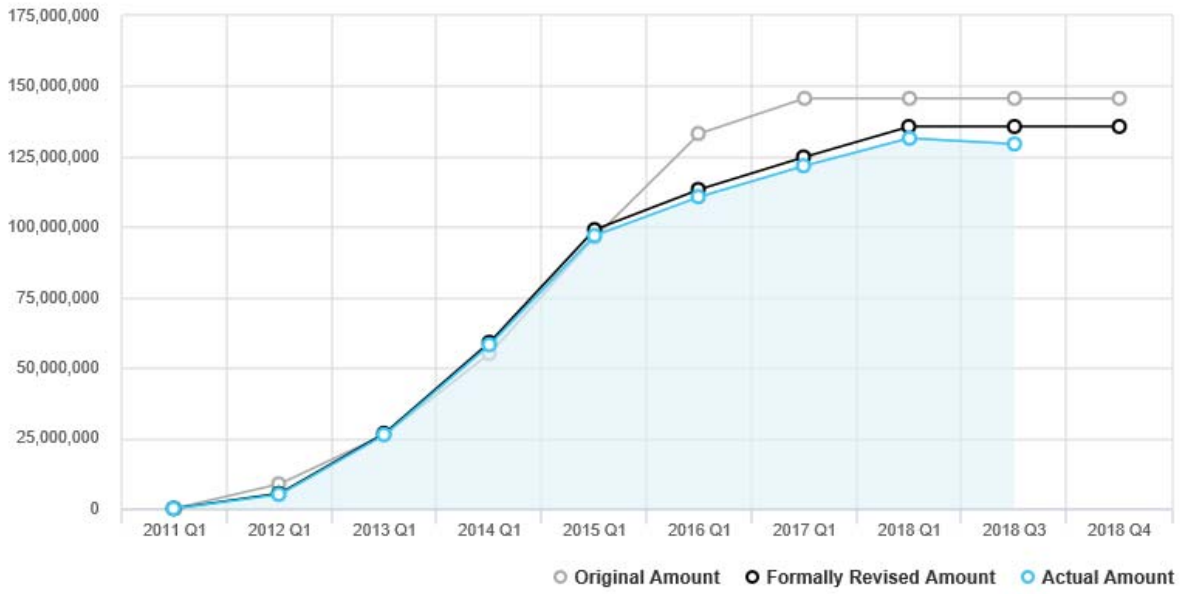
No.	Date ISR Archived	DO	IP	Actual Disbursements (US$ millions)
1	April 8, 2011	Satisfactory	Satisfactory	5.00
2	Nov. 27, 2011	Satisfactory	Satisfactory	5.00
3	April 29, 2012	Satisfactory	Satisfactory	5.67
4	Nov. 30, 2012	Satisfactory	Satisfactory	29.19
5	June 10, 2013	Satisfactory	Satisfactory	50.15
6	Dec. 29, 2013	Satisfactory	Satisfactory	66.35
7	June 24, 2014	Satisfactory	Satisfactory	86.55
8	Dec. 6, 2014	Satisfactory	Satisfactory	96.89
9	June 16, 2015	Satisfactory	Highly Satisfactory	104.37
10	Dec. 21, 2015	Satisfactory	Highly Satisfactory	112.18
11	May 26, 2016	Moderately Satisfactory	Satisfactory	120.67
12	Dec. 13, 2016	Satisfactory	Satisfactory	126.10
13	April 13, 2017	Satisfactory	Satisfactory	126.57
14	June 16, 2017	Satisfactory	Satisfactory	130.94

H. Restructuring (if any)

Restructuring Date(s)	Board Approved PDO Change	ISR Ratings at Restructuring		Amount Disbursed at Restructuring in USD Millions	Reason for Restructuring & Key Changes Made
		DO	IP		
05/09/2016	No	S	HS	116.00	To allow extension of the project closing date by one year to June 2017 to provide training and capacity building of PID staff in operating the new systems (SCADA, RTFM, DSS, etc.) and for the preparation of a pilot for reviving degraded river channels.

05/01 /2017	No	S	S	126.57	To cancel US$10 million from the IBRD loan that was expected to remain unutilized

I. Disbursement Profile



Note: Based on January 25, 2018 data in the project portal

1. Project Context, Development Objectives and Design

1.1 Context at Appraisal

1. **Cycles of Growth and Stagnation**. Following a period of instability and low growth in the 1990s, Pakistan saw a period of relative stability and economic growth, after the turn of the century. Per capita income and social indicators improved. In the latter part of the first decade of the 21st century, however, the country again started to face complex challenges, including severe terrorist attacks accompanied by political upheaval and a near economic collapse. The macro-economic performance deteriorated significantly; inflation accelerated to double digits; and the fiscal and current account deficits increased substantially. The key challenge for Pakistan was to develop resilience to shocks and sustain economic growth and poverty reduction instead of the cycles of growth and stagnation.

2. The aim of the **Bank's Country Assistance Strategy (CAS) for FY10-14** was *sustained growth recovery and building resilience to shocks*. The CAS's strategic objectives focused on three core areas: improved governance and performance of the public sector; improved human development and reduced vulnerability; and improved infrastructure to support private sector investment and growth. To achieve the third strategic objective, among other things, investments were required in improved water management to support agriculture productivity and growth. *A critical prerequisite of this was an efficient and well run irrigation system*. The irrigation and drainage system suffered from deteriorating infrastructure and weak governance. To reduce volatility of growth, Bank support, therefore, included rehabilitation of major assets such as barrages and continued capacity development for managing water resources.

3. **Irrigated Agriculture is Critical for Pakistan.** Although its share is declining, agriculture is still a key sector of Pakistan's economy and a major source of livelihood. It generates about 21 percent of GDP, 45 percent of jobs, and about 80 percent of export earnings, directly and indirectly. Agriculture is almost wholly dependent on irrigation. Irrigated land accounts for more than 90 percent of agriculture production. Agriculture is not possible in most areas of the country without irrigation. This is because the climate is arid to semi-arid and rainfall is low and variable, averaging about 150 mm per annum while evaporation rates range from 1,250 mm to 2,800 mm per annum.

4. **Barrages are Strategic Assets**. The Indus Basin Water System (IBWS) is the largest contiguous inter-linked water system in the world and serves over 18 million ha of land from the waters of the Indus River and its tributaries. Barrages are used to raise the water level in the rivers so that water can be diverted to the main canals and inter-river link canals. Consequently, safe operation of barrages is critical for serving millions of acres locally as well as hundreds of miles away. Barrages are also used for flood management and are a source of water supply for all sectors of the economy. They also serve as road and rail bridges and crossings for oil, gas, and power transmission lines. For example, the Jinnah Barrage provides a bridge over the Indus River that

links the Khyber Pakhtun Khuwa (KPK) and Punjab provinces. Even a partial failure of a barrage would be disastrous for all productive sectors as well as the environment and social stability in large areas. While the newer barrages, built as a part of the Indus Basin Project in the 1960s, are in relatively good condition, many of the older barrages in Punjab, built 60 to 100 years ago, need rehabilitation. Most of the problems stem from design and construction defects, aging, and changes in hydrological conditions. The main problems encountered in the older barrages are: (a) erosion at the downstream toe, due in part to changes in river hydrology after the construction of the Tarbela Dam that traps sediment and releases relatively sediment free water downstream, which causes erosion; (b) the need for renovation or replacement barrage gates and hoists that have deteriorated in strength; and (c) the need for improvement in river training works upstream of the barrages. These problems are present to varying degrees of severity at all the older barrages.

5. **Wakeup call**. Failure of a major water regulation structure in 1998 on the Balloki-Sulemanki Link Canal was a wake-up call for the country. This link canal transfers water from the western rivers (Jhelum and Chenab) to the eastern most Sutlej River, whose water was allocated to India under the 1960 Indus Treaty. Water supplies to over 2 million acres of land were affected. In response to this situation, the GoP engaged consulting firms to review the structural and hydraulic condition of six barrages built between 1890 and 1958 and prioritize their rehabilitation. The priority was determined based on the: (i) severity of the current problem; (ii) extent to which failure would cause agricultural and other economic and social losses; and (iii) level of difficulty that would be faced in restoring service through temporary measures. Restoration of barrage failure on the Indus River would be much more difficult than on other rivers in the Indus Basin because the Indus has high flows for most of the year. The Taunsa Barrage on the Indus was assigned the first priority for rehabilitation because it had the most serious weaknesses and needed attention urgently. Rehabilitation of Taunsa Barrage was completed in 2009 under a World Bank emergency loan. The Jinnah Barrage was taken up for rehabilitation next.

1.2 Project Objectives

Original Project Development Objectives (PDO) and Key Indicators (*as approved*)

6. As per the Loan Agreement[1], the objectives of the project are to assist the Borrower in: (i) rehabilitating and modernizing Jinnah Barrage and carrying out affiliated works to enable reliable and uninterrupted supply of water for over 2.1 million acres of farmland benefitting about 600,000 farm families for irrigation and domestic water users; and (ii) building the institutional capacity of PID[2] to improve management of water resources and the irrigation system.

[1] There was a minor difference in the wording of the PDO reflected in the PAD though there was no material difference.

[2] At the time of project approval, the main implementing agency was the Irrigation and Power Department (IPD). In 2011, it was split into the Punjab Irrigation Department (PID) and the Punjab Energy Department. For the ICR, Punjab Irrigation Department (PID) has been used.

The key outcome indicators were:
PDO Indicator 1: Barrage able to supply reliable and uninterrupted water for over 2.1 million acres of farmland benefitting about 600,000 farm families for irrigation and domestic water users.

PDO Indicator 2: PID's increased functional capacity to manage water /irrigation system in the province using modern tools and equipment

1.3 Revised PDO (as approved by original approving authority) and Key Indicators, and reasons/justification

7. The original PDO and key indicators remained relevant and were not revised.

1.4 Main Beneficiaries

8. The main beneficiaries of the project are some 600,000 farm families (or about 5 million people) who depend on the water received from the Jinnah Barrage through the Thal Canal for irrigation, drinking and other domestic uses. They are farmers and other residents of the districts of Mianwali, Khushab, Bhakkar, Layyah and Muzafargarh in Punjab. Prior to the project the water supply to these areas was unreliable and there were risks of interruptions due to failure of the Barrage. After the rehabilitation of the barrage the beneficiaries are receiving more reliable and uninterrupted supplies. In addition, some 92,000 people living in areas with brackish underground water in the Khushab District have benefitted from the 36 drinking water supply schemes, and 64,000 small famers all over the project area received improved early germinating varieties of wheat and canola seed under the SDAP. Other project beneficiaries include the people who use the bridge over with Jinnah Barrage and the Kalabagh Bridge for personal and commercial purposes. Finally, about 1420 skilled and 690 unskilled workers were employed by various contractors during the peak of construction period.

9. On the institutional side, the main beneficiary is the PID that received support for adopting modern tools and technology for water accounting and allocation; SCADA systems; RTFM system, bathymetric equipment for river surveys; and on-the-job training as well as scholarships for post-graduate degrees. Another direct beneficiary is WAPDA's Jinnah Hydro-power Plant (JHPP) that now receives more reliable water from the pond upstream of the Barrage.

1.5 Original Components *(as approved)*

10. The project has four components[3]:

Component A: *Rehabilitation and Modernization of Jinnah Barrage*

11. *Sub-components A1 and A2: Civil, mechanical and electrical works*. These sub-components consisted of: (Al) civil works comprising: (i) construction of a subsidiary weir about 800 feet downstream of the barrage main weir and associated works to address retrogression and

[3] Further details can be seen in Annex 10 of the PAD.

energy dissipation problems; (ii) repairs to the downstream barrage floor, impact and friction blocks, and guide banks; (iii) alteration to the main barrage structure, such as extension of abutments and downstream divide walls, (iv) construction of river training works upstream (an inverted hockey spur) to improve the river approach towards the barrage; (v) temporary works for carrying out the main rehabilitation works; and (vi) renovation of building and management infrastructure; and (A2) *mechanical and electrical works* consisting of: (i) renovation of the barrage gates and hoist system and automation of gate operation; and (ii) upgrading of the barrage monitoring system and basic operation and maintenance facilities.

12. *Sub-component A3: Implementation of Social and Environmental Management Plans*. As the project involves large-scale construction on the Indus River it is categorized as Environmental Category "A". Based on the experience of the Taunsa Barrage Project, a "development assistance" approach instead of a narrowly focused "mitigation and compensation" approach was adopted for the project to address the likely social and environmental issues.

13. Although construction activities were planned in a manner to ensure no unusual interruption in the water supply to the Thal Canal, there was still a risk of interruptions in emergency situations, for example, breaching of a cofferdam. This could severely impact areas underlain by saline groundwater where the local population typically relies on canal water for drinking and domestic needs. In order to plan for any possible interruption of water supplies during the construction period and deal with other environmental issues, a Social Development Action Plan (SDAP) and an Environmental and Social Management and Monitoring Plan (ESMMP) were developed. This sub-component supported the implementation of the SDAP and ESMMP, and if the need arose, Land Acquisition and Resettlement Framework (LARF) and Resettlement Action Plan (RAP) would have been prepared. The SDAP involved distribution of improved seed, water supply schemes, development initiatives at the barrage area, including establishment of social infrastructure (a public park, primary schools, a BHU, and access roads). This sub-component also supports implementation of an information dissemination and communication program, particularly regarding canal closure and implementation of the SDAP program.

14. *Sub-component A4*: *Construction Supervision and Implementation Support*. This component covered the cost of consulting and other services for implementation of the project, including construction supervision and project management support. It also covered implementation of all activities under the project: procurement, contract administration, quality control, certification of payments, financial management, preparation of any additional designs, and bidding documents, etc.

15. **Component B*:*** *Improvement and Modernization of the Irrigation and Water Management System*. This component consisted of: (B1) *Improvements in irrigation and water management systems*, including development of a WRMIS, monitoring systems and a DSS; and *modernization of water management equipment and facilities*; and (B2) *preparation of future water sector improvement projects*. The progress in continued transfer of irrigation management to FOs, and

their performance was also to be monitored. This task was carried out by the consultants recruited for M&E, under Component C of the project.

16. *Component B1*: *Improvements in Irrigation and Water Management*. The purpose of this component was to advance the improvements in irrigation and water management already initiated by the PMIU and to provide equipment and facilities to modernize irrigation and water management planning.

17. *Component B1*, included further upgrading and modernization of the PMIU systems; use of modern databases; GIS Systems; mathematical models; a DSS; and WRMIS for improving planning and operation of the complex irrigation system of Punjab. It also includes forecasting and planning and operational tools for seasonal and 10-day planning forecasts and demand management systems. These tools will aid in irrigation planning and provide a link with the reservoir operation decisions of IRSA. A system of water measurements, accounting and transmission was to be introduced at key locations in the river and link canal system and the main and branch canals. A data communication network was also to be installed to gather information to be sent to central locations and the PID's headquarters.

18. The sub-component provided technical assistance; training and equipment, including hardware and software; latest discharge measurement equipment; echo-sounders with geo-positioning system for taking cross- sections of rivers and canals; and modern equipment for measuring water flows, stage, velocities, etc.

19. *Component B2*: *Preparation of Future Projects*. This included feasibility studies and preparation of designs for future projects identified during the project implementation period.

20. **Component C:** *M&E Project Impact and Social and Environmental Management Plans*. The M&E activities included continuous feedback to all stakeholders on the project's performance and impact of its various components, so that corrective actions could be undertaken in a timely manner. M&E Consultants carried out the M&E activities. These consultants also supervised implementation of the overall ESMMP, provided independent monitoring of various activities, and assessed positive and negative impacts.

21. The M&E activities, *inter alia,* included: (i) the impact of the project; (ii) environmental impact of construction activities in the project area; (iii) possible acquisition of public and/or private land and assets; (iv) evaluation of the SDAP at completion; (v) estimation of the project's economic rate of return at completion and preparation of the Borrower's ICR, etc; and (vi) monitoring of progress of the irrigation management transfer reforms.

22. **Component D:** *Project Management Coordination Technical Assistance and Training*. This component included support for: (i) the operation of the PMO, including procurement, contract management, implementation of social and environmental management plans, operation of the river and irrigation systems, communication and liaison with stakeholders; (ii) building the capacity of the PMO to develop into a Barrage Management Organization (BMO); (iii) technical assistance and training in various fields, including post graduate programs, seminars, workshops,

and study tours; (iv) an independent POE to assist with design and construction related issues; (v) strategic studies and pilot projects identified during the project implementation; and (vi) financing of incremental staff salaries, operating expenditures, consulting services, equipment and software.

1.6 Revised Components

23. The project components remained the same as in the original design except for the following changes: (a) instead of renovating the old barrage gates, as originally envisaged, it was decided to install new gates. At the start of the project upon the advice of the POE a detailed condition survey of the gates' skin-plates and trusses was conducted through ultrasonic thickness measurement devices. The skin plates and the trusses were found to be alarmingly worn out and beyond economical repairs. It was, therefore, decided to replace the gates instead of rehabilitating them[4]. Stoney type gates, that have girders instead of trusses, were installed. The cost of this component, however, remained unchanged as the need for bulkhead gates and the launching jetty originally envisaged was eliminated; (b) some residential quarters that were to be rehabilitated, were found to be in a poor and risky state. It was, therefore, decided to construct new buildings without a change in cost; and (c) repairs of damages caused by the 2010 floods to the barrage, including the left guide bund, the left marginal bund and downstream floor of the barrage) were added to the project scope.

1.7 Other Significant Changes

24. The project closing date was extended from June 30, 2016 to June 30, 2017 to provide more time for training and capacity building of PID staff in operating the new systems (SCADA, RTFM, DSS, etc.) and for the preparation of a pilot for reviving degraded river channels. Initially it was envisaged that the closing date would be extended by 18 months to also allow time for actual implementing the pilot but later GOP limited the extension to 12 months, which precluded actual implementation of this pilot during the life of the project. Another change that affected initial progress was the merging of civil and mechanical/electric works under one ICB contract instead of two separate contracts as planned earlier. The rationale was that coordination between civil works and mechanical-electrical works is easier if the same contractor is responsible for both type of works. Several design changes were also suggested by the POE, including shifting of the sub-weir to 800 feet downstream of the barrage (instead of 600 feet) and postponement of the river training works upstream of the barrage, i.e. the proposed *inverted hockey spur*.

2. Key Factors Affecting Implementation and Outcomes

2.1 Project Preparation, Design and Quality at Entry

25. **Assessment of Project Objective.** The PDO statement: "Assist the Borrower in: (i) rehabilitating and modernizing Jinnah Barrage and carrying out affiliated works to enable reliable and uninterrupted supply of water for over 2.1 million acres of farmland benefitting about 600,000

[4] Besides the worn out condition of old gates, another reason for this change was that installing new gates was much easier and quicker than removing, repairing and re-installing existing gates.

farm families for irrigation and domestic water users; and (ii) building PID's capacity in improved water resources and irrigation system management", was in line with the Bank's 2010-2014 CAS that aimed to *sustain growth recovery and build resilience to shocks.* It was also aligned to the Government's poverty reduction strategy and supported the strategic objective of *Restoring Stability and Maintaining Growth for Sustainable Development*.[5]

26. Water delivery to the project area depends on several factors, not only the condition of the barrage. For example: (a) water availability in the Indus River and the share of Punjab as determined by IRSA; (b) the share of Thal Canal within the share of Punjab; and (c) the condition and management of the Thal main canal and the irrigation distribution system downstream of the barrage. These factors were clearly outside the control of the project[6]. The project aimed to reduce interruptions in water delivery to the head of the Thal Canal *arising from any deficiencies in barrage operations*.

27. **The project design incorporated lessons learned.** The project design incorporated lessons learnt from infrastructure rehabilitation projects both outside and inside Pakistan, in particular the Taunsa Barrage project. The Bank's global experience shows that reconstruction of damaged infrastructure is imperative, and measures are needed to reduce the risk of future disasters and to safeguard people and property. Other lessons incorporated include: (i) project design should be based on thorough hydrological and hydraulic analyses; (ii) detailed design (and bidding documents) of key works should be completed prior to loan negotiations; (iii) detailed assessment and plans for addressing social and environmental issues should be carried out early in project preparation; (iv) prior consultation should be carried out with various stakeholders and alternatives considered to minimize adverse effects; (v) detailed construction planning should be carried out to identify and minimize negative impacts during construction and operation; (vi) implementation of large civil works contracts should follow contract management models whereby competent consultants with adequate resources provide onsite resident construction supervision; (vii) resettlement and land acquisition issues should be dealt with upfront; (viii) contingency planning should be based on risk analysis so that people are not be affected by the construction works; and (ix) strong government leadership and a properly staffed Project Office are indispensable.

28. **Specific lessons from the Taunsa Barrage Project were fully internalized** in the design as well as operation and construction plans, including: (i) more thorough consideration of environmental and social issues and preparation of ESMMP and SDAP using a "development enhancement approach" instead of a "mitigation and compensation approach"; (ii) well planned

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5 A critical requisite for achieving this strategic objective is an effective irrigation system including fully functional barrages. A full or partial failure of a barrage would result in major economic disruptions as well as adverse environmental and social impacts.

6 The project did not include improvement of the main canal and the distribution system. All that the project could do was to efficiently supply water at the head of Thal canal in accordance with the water share allocated to the canal.

and detailed construction schedule, including the location of construction plants, traffic movement, identification of areas for borrowed material, land required for contractor's camps and other construction purposes; (iii) more thorough assessment of risks, including safeguarding operation of canal and downstream river flows during construction, including contingency plans for unexpected interruption of water supply. This included (iv) alternative arrangements for supplying water to Thal Canal by building a separate feeder channel and appropriate cofferdams, and implementing a program of distributing early germinating seed varieties of wheat and canola oil[7]; (v) comprehensive prior consultations and implementation of an effective communications strategy to interact with stakeholders; and (vi) a thorough monitoring program to identify issues early on. The monitoring program consisted of: (a) monitoring by PMO with dedicated staff for engineering, environment and social aspects; (b) monitoring by the PIC; (c) independent M&E consultancy to monitor progress and supervise the ESMMP and SDAP activities; (d) independent third party audits; and (e) having a condition in the bidding documents requiring the contractor to appoint and field dedicated staff for monitoring ESMMP implementation.

29. **The Project design, components and implementation arrangements were tried and tested** and built upon the experience of the Taunsa Barrage. The concept of building a downstream subsidiary weir to ensure efficient energy dissipation and check retrogression had been successfully tested at Taunsa[8]. Also, a two-stage methodology (similar to the one used at Taunsa Barrage) was used to construct the sub-weir in two low-flow periods (January-June). The SDAP and a well-designed communication strategy helped to avoid social issues such as those that had been faced during the rehabilitation of the Taunsa Barrage. On the institutional side, the PMO that had the experience of successfully implementing the Taunsa Barrage Rehabilitation Project was retained and further strengthened. Similarly, the PRSP that had successfully implemented a seed distribution program under the Taunsa Barrage Project was made responsible for the same component of SDAP. Finally, PHED that had developed a culture of community participation under various rural water supply programs was made responsible for implementing the drinking water supply component.

30. **Rationale for the Bank's intervention.** In Pakistan, the Bank is seen as a trusted partner in the water sector and a coordinator of international financial institutions and other development partners. Bank's past partnership and collaboration with Pakistan, included: the brokering of the Indus Waters Treaty between India and Pakistan; administration of the Indus Basin Trust Fund for the execution of the massive Indus Basin Replacement Works, including two major dams (Tarbela and Mangla dams) as well as several barrages and inter-river link canals; support for numerous

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[7] The rationale for supplying seed of early germinating wheat varieties was that if any unscheduled stoppages of water supply did take place the crops would be better able to cope with them as germination would have already taken place. It was also believed that people in the command area of the Thal Canal, including those far away from the Barrage will become more aware and supportive of the project objectives. Canola oil seed was introduced to promote crop diversification.

[8] This concept was challenged by some individuals who resorted to seeking stay orders by the Lahore High Court. However, the PMO successfully defended the concept and the stay orders were vacated.

water sector projects; and several key sector studies, of which the most recent was the Country Water Resources Strategy prepared in 2005 (Report no. 34081-PK). An important recommendation of this Strategy was preparation of asset management plans, including rehabilitation of strategic assets, especially barrages. Most recently the Bank supported the rehabilitation of the Taunsa Barrage that was completed in 2009.

31. GoPunjab requested Bank support for the rehabilitation of the Jinnah Barrage to help ensure: (i) a systematic approach in the design; (ii) thorough planning to minimize risk of interruptions to water supply to the Thal Canal during construction and implement an effective communication strategy to interact with stakeholders; (iii) proper attention to environmental and social concerns; (iv) efficient procurement and high quality construction within budget and on schedule; (v) enhanced capacity for O&M; and (vi) enhanced capacity of the PID for improved management of water resources.

32. **The Government's commitment to the Project was strong from the beginning.** Various critical tasks that were necessary for getting the Project ready for implementation were accomplished before appraisal. These included: (i) timely completion of the feasibility study, detailed design and draft PC-1[9] as well as an Environmental Impact Assessment (EIA) and its clearance by the EPD; (ii) maintaining continuity of key staff of the PMO during the project (for example, there was only one change of the Head of PMO in six years); (iii) timely prequalification of contractors for the major works contract (Component A) and preparation of draft bidding documents for the ICB works contract; (iv) timely release of counter-part funds, except once during the early part of the project when there were delays.

33. **There was no formal review of Quality at Entry by the Bank**. The project had no outstanding issues or special conditions for effectiveness when it was approved, indicating its readiness for implementation.

2.2 Implementation

Some of the key factors affecting project implementation are discussed below by project components.

34. ***Component A***: Following a slow start, implementation of sub-components A1 and A2 went smoothly and the main civil works and electromechanical contracts were completed on or ahead of schedule. Initially, however, several factors slowed down implementation. First, major floods in 2010 caused damages to the downstream apron of the barrage and the river training works and protective bunds upstream that required immediate attention for repairs. Second, the decision to carry out civil works and mechanical/electrical works under one ICB contract (instead of two separate contracts) delayed the award of the main ICB contract by six months. Third, the decision

[9] Government's internal project document

to install new gates instead of renovating the existing ones also caused some delay. In retrospect, it seems that the poor state of the gates and the need for a single contract should have been identified at the feasibility or detailed engineering design stage. Good team work among the PMO, the contractor and PIC, and timely inputs of the POE and Bank staff, however, enabled the main ICB contract to be completed on schedule. Implementation of sub-component A3 (SDAP and ESMMP) followed a participatory approach and was completed satisfactorily. The renovation of the Kalabagh Bridge and other social infrastructure (public park, girls and boys schools, one BHU, etc.) helped to secure stakeholder and local public support for the project. Implementation of sub-component A4 also went well. The responsibility for review of detailed designs and the role of the Engineer was assigned to PIC that consisted of a joint venture of three firms and was different from the joint venture of firms that had prepared detailed engineering designs about a year earlier. This situation resulted in a serious issue as to which joint venture would be responsible and liable for the engineering designs. Ultimately it was agreed that the PIC would be responsible instead of the joint venture of firms that has prepared the engineering designs.

35. ***Component B1*** had a slow start because of delay in recruitment of consultants for the WRMIS-DSS preparation and procurement of RTFM and bathymetric equipment due to poor response from bidders. The WRMIS-DSS consultants also faced difficulties in recruiting and retaining staff with requisite qualifications[10]. Ultimately, these difficulties were overcome.

36. ***Component B2***, preparation of future projects, included two projects: (a) *Pothohar Climate-Smart Irrigated Agriculture Project (PCIAP)*; and (b) a pilot project for *Revival of Degraded River Channels in Punjab*. The preparation of PCIAP culminated in a detailed feasibility study and design report, albeit after some delays. The second project, however, faced delays by PID in selecting a site for the pilot, and by the PIC in preparing the feasibility studies and design. Ultimately, detailed design and bid documents for constructing a rubber weir on a degraded channel on the Sutlej River near the city of Bahawalpur were completed. Slow progress on Components B1 and B2 necessitated an extension of the Loan Closing date. However, since the pilot involved considerable land acquisition and possible resettlement, it was agreed that its actual implementation would be undertaken under a future operation. Implementation of **Component C** is discussed under the section on M&E in subsequent paragraphs.

37. ***Component D***: Implementation of this component proceeded generally satisfactorily and fulfilled its intended purpose of providing support for: (i) the operation of the PMO; (ii) technical assistance and training; detailed designs; contract administration and construction supervision; procurement; operations and management planning; asset management plans; financial management; legal issues; irrigation and drainage; and water resources development. (iii) fielding an independent POE for advising on design, construction and safety issues. Twenty PID staff completed post-graduate degrees. The POE provided timely and invaluable inputs at critical stages of project design and implementation. One sub-component that PID did not pursue was the

[10] Apparently software developers with knowledge of hydraulics and irrigation systems are difficult to find.

transformation of PMO into a Barrage Management Organization (BMO)[11]. The concept of BMO involves creation of an independent body within PID with resources and autonomy delegated to ensure safe and efficient operation of all the barrages in Punjab. PID intends to pursue this matter further in the future.

38. The Bank team conducted close supervision throughout project implementation. Due to the pro-activity of the Bank team, most issues of project design and implementation were addressed early in the project without waiting for the mid-term review (MTR). Consequently, the MTR did not result in major changes.

39. There was no QAG review for quality of supervision.

2.3 M&E Design, Implementation and Utilization

40. **M&E design:** The M&E design incorporated specific, measurable outcome indicators that were aligned to the PDO. The objective of Component C (M&E) was to provide timely and regular feedback to the implementing agencies as well as the Bank on the project's performance and outcomes, so that corrective actions could be undertaken in a timely manner. The PMO assigned M&E responsibility to consultants selected in accordance with the relevant Bank guidelines. Five tasks were included in the Consultant's contract: *Task A- M&E of the rehabilitation works and development of an MIS* for monitoring the progress; *Task B- Impact Evaluation*, including surveys for establishing the baseline values with repeat surveys at mid-term and at completion; *Task C: Monitoring of implementation of ESMMP and SDAP*; *Task D- Monitoring of Irrigation Sector Reform* in Punjab; and *Task E- provision of support to the PMIU* in establishing the WRMIS, including preparation of TOR for the preparation of a DSS and setting up equipment for RTFM. The detailed design and the methodology followed for all tasks was satisfactory except the impact evaluation design which could have been strengthened by stronger alignment with the indicators in the Results Framework. The surveys were designed on the pattern of conventional irrigated agricultural development projects, which provided useful inputs for the re-estimation of the cost/benefit analysis.

41. **M&E implementation**: The contractor and the PIC maintained separate MIS independently which helped in project monitoring. The implementation of the project monitoring was robust and effective. The PMO provided reliable data during project implementation The PMO and the Barrage operations staff were well placed to estimate DPR values by monitoring water diversions to the Thal Canal using the SCADA system, and carry out river surveys using the bathymetric equipment to monitor downstream retrogression. Quarterly monitoring reports provided useful feedback on the implementation of SDAP and ESMMP. The task of monitoring of irrigation sector reforms was completed and culminated in a report that indicated mixed performance of the PID on the irrigation sector reforms. The M&E Consultants helped to draft

[11] This was apparently due to institutional inertia within PID that tends to resist changes. However, recently, a Hydraulic Structure Safety Evaluation Unit and a Flood Risk Assessment Unit have been established.

the TOR for the selection of consultants for WRMIS and DSS and assisted the PMIU in the installation and commissioning of the RTFM system.

42. **M&E utilization**: The M&E system established for the project was appropriately used to track progress toward achieving project outcomes. The regular M&E feedback, particularly the quarterly reports, proved very useful, especially for the monitoring of SDAP and ESMMP. The WRMIS has been developed and operationalized. The indicators reflected in the Results Framework have been successfully institutionalized as part of the Service Contract awarded by the PMO for the O&M of SCADA and RTFM systems to a private contractor in June 2017. The criteria and indicators by which performance of the Jinnah Barrage and the PID as an institution would be monitored and evaluated in the future are similar to those in the Results Framework. For the barrage this would include: smooth operation of gates, safe passage of floods, no interruption of flows to the Thal Canal due to deficiencies in barrage operations; and for PID: continued training/capacity building activities in new technologies, equipment and facilities, improved irrigation service delivery, and improved asset management, etc.

2.4 Safeguard and Fiduciary Compliance

43. The Project triggered the following Bank safeguard policies: (i) Environmental Assessment (OP/BP/GP 4.01); (ii) Safety of Dams (OP/BP 4.37); (iii) Involuntary Resettlement (OP/BP 4.12); and (iv) Projects on International Waterways (OP/BP 7.50). Key safeguard issues related to: (a) social and environmental impacts of large scale construction; and (b) possible disruption of water supplies to the Thal Canal and the downstream water requirements on the Indus River during the construction phase. An EA, including an ESMMP was prepared and implemented and an independent panel of experts (POE) was established to review the engineering designs and advise on implementation issues at critical stages. Notification to other riparians of the Indus River was not considered necessary as the project was essentially rehabilitation of existing facilities. Due to the carefully prepared project design and diligent planning of construction, no land acquisition was needed. A Land Acquisition and Resettlement Framework (LARF) including an entitlement matrix was, nonetheless, developed, to be used in the unlikely event of any private land acquisition due to any design changes during project implementation. All the project sites were either within the river, or on land owned by PID that had no encumbrances or squatters. Hence no land acquisition or involuntary resettlement issues were encountered.

44. ***Environmental Aspects:*** The ESMMP addressed the following issues, among other: (a) management of borrow areas and coffer dams; (b) waste generation and disposal; (c) establishment and operation of labor camps, material and equipment yards and access roads; (d) linkage with the JHPP[12] to avoid cumulative impacts; (e) construction activities, handling of fuels, lubricants and chemicals; (f) public health and safety measures; (g) protection of the Indus Blind Dolphin (*Plantanista minor*)[13]; and (h) installation and operation of batching plants. The ESMMP also

[12] The JHPP, with a capacity of 96 MW, was under construction on the right bank of the barrage.

[13] The WWF reports presence of a thin population of the Indus Dolphin between the Jinnah and Chashma barrages. A population count conducted in 2001 indicated only two dolphins in the Indus River stretch between the Jinnah and Chashma barrages.

provided for training of field staff of PMO and all site personnel of contractors, consultants; and drivers, mechanics, camp staff and restoration teams. Bank staff also carried out training of PMO and other staff in social and environmental monitoring. The ESMMP also included "Effects Monitoring" covering: (i) Ambient air quality; (ii) Quantity and quality of ground water used for domestic purposes; (iii) quality of surface water used for construction activities; (iv) emission of dust, smoke and potential air pollutants from the construction machinery and vehicles; (v) visual check for vegetation loss; (vi) noise pollution; (vii) soil erosion; (viii) solid waste generation, wastewater generation and oil wastes/spills; (ix) protection of the Indus Dolphin; (x) water flows in the river and Thal Canal; and (xi) monitoring of cumulative impacts vis-a-vis JHPP. At the end of the construction phase the following were monitored: (a) restoration of borrow areas and other construction sites; (b) surface water quantity and quality; (c) ground water quality; (d) soil erosion; (e) habitat disturbance; and (f) compensatory tree plantation.

45. Monitoring of ESMMP implementation was comprehensive. Clauses regarding contractors' responsibilities on environmental issues were built into the bidding documents that included appointment of an environmental monitor. In addition to monitoring by Bank staff during periodic site visits, well trained team of the PMO, PIC and M&E consultants monitored compliance with the ESMMP. Quarterly ESMMP monitoring reports were produced by the M&E Consultants, PIC and PMO. An adequately equipped and trained Dolphin Rescue Team[14] was maintained at site. However, no Dolphins were sighted during the project. An MOU was signed among PMO, M&E Consultants and World Wide Fund (WWF) for Nature to monitor the project impact on air quality, surface and groundwater, land use and flora and fauna, etc. According to the final monitoring report of WWF, there have been no significant adverse impacts on the flora and fauna due to the Project activities.

46. The Project maintained excellent record keeping on occupational health and safety, including work-related accidents. The contractor had prepared a robust emergency preparedness plan, and carried out periodic mock drills to test the system. Non-compliance with safety provisions were observed by Bank staff during site visits, including instances of staff not using personal protective equipment (PPE) and steep slopes of borrow pits without fencing. These observations were promptly attended to. Finally, Independent Third Party Audits on compliance with Health, Safety and Environmental (HSE) issues mandated under the Pakistan Environmental Protection Act 1997 were carried out. These audits found the project to be generally in compliance with the requirements.

47. ***Social Aspects:*** Based on the lessons learnt from the Taunsa Barrage Rehabilitation Project the Project design built in various measures to avoid adverse social impacts. And, instead of following a "mitigation and compensation" approach, a development approach was adopted in the project design and an SDAP was prepared. The key objectives were to: (a) avoid extended closure

[14] This team was trained during the rehabilitation of the Taunsa Barrage.

of the Thal Canal during construction[15]; (b) maintain adequate flow in the river to meet downstream water requirements; (c) keep all stakeholders informed about any foreseen or unforeseen changes to the canal closure program; (d) mitigate possible adverse impacts on small farmers due to extended closure should that become unavoidable; (e) arrange for alternate source of drinking water in areas where canal water is the only source of drinking water (e.g. SGW areas served by the Mohajir Branch of Thal Canal); (f) ensure good traffic management during construction; and (g) provide other social/community infrastructure for the local residents.

48. Objectives (a) and (b) were met through: (i) detailed advance construction planning that included preparation of detailed day-to-day work schedules; (ii) careful design of coffer dams that ensured continued operation of the Thal Canal and passage of downstream water requirement, during construction and (iii) keeping a fall back option of feeding the Thal canal through an upstream feeder channel.

49. Objectives (c) to (g) were met by: (i) developing and implementing an effective communication strategy to keep all stakeholders informed about the project activities; (ii) carrying out a seed distribution program; (iii) establishing drinking water supply schemes; and (iii) constructing social/community infrastructure. Small land holders with 5 acres or less were provided with early germinating variety of Wheat and Canola seed to minimize risks arising from any unscheduled extended closure of the Thal Canal. The PRSP that had successfully carried out seed distribution under the Taunsa Barrage Project implemented this component. The PHED constructed 36 drinking water supply schemes in SGW areas following participatory approaches and establishing CBOs for their O&M after completion. Two middle schools, a BHU, a public park, a mosque and local access roads were constructed as part of the social infrastructure. An old railway bridge[16] was rehabilitated to provide an alternative crossing over the Indus River during the construction phase when the Jinnah Barrage Bridge could not be used. This not only enabled effective traffic management during the construction phase but also proved to be a major boon for local inhabitants who needed to travel across the Indus for personal needs as well as trade and commerce. The SDAP produced positive results and all its objectives were met. The SDAP is now being used as a model by other similar projects.

50. Although the project did not involve any land acquisition or resettlement, **a grievance redress mechanism** was established to receive and address stakeholders concerns during implementation of the Project. This proved useful in addressing grievances concerning construction related issues and employment of local people by the contractor.

51. ***Procurement:*** The fact that major civil and electro-mechanical works on the Indus River were successfully completed on time and with good quality reflects well on the overall procurement and contract management performance by the PMO and the Bank team. The NCB contracts for emergency repairs of the downstream floor of the barrage and upstream flood protection bunds were awarded quickly and completed on schedule. However, there were delays in the award of works and consultants' contracts. The award of the main ICB contract for civil works and electro-

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15 Under normal conditions the Thal canal is closed for 3 weeks during January/February for annual inspections and repairs.

16 The bridge was in such a dilapidated condition that it had become unsafe.

mechanical components was delayed by almost one year because of changes in the scope of work[17]. Similarly, there was delay in the award of the consultancy contract for PIC[18], which was ultimately signed in March 2011, followed by the signing of the M&E Consultants' contract in May 2011. Delay in the signing of the PIC contract and the major floods in 2010 delayed the start of the construction of the sub-weir by one year. Similarly, the contract for the award of the RTFM system was awarded only after three rounds of bidding after equipment and works were placed in separate packages based on feedback from prospective bidders. Considerable time could have been saved had the PMO held pre-bid conferences earlier.

52. Procurement staffing in the PMO remained stable with only one change of Director Procurement during the project period. Procurement staff was generally diligent and prompt in acting upon the Bank's review comments. Unfortunately, PMO staff could not avail specialized procurement training arranged by the World Bank at Turin, Italy through the ILO, as GoPunjab policy allows training expenditure to be made only under grant funds.

53. The PMO maintained a website, which included a link that provided access to the project procurement plan, procurement notices, bid opening and award data, etc., and a complaint mechanism. Only one complaint relating to short-listing of consultants was received during the project, and handled appropriately. The Bank hired consultants to carryout annual reviews of procurement falling below the Bank's prior review threshold. No major issues were identified during these reviews. **A Disputes Review Board (DRB)** was established early in the project. At the time of the ICR mission there were no disputes awaiting settlement.

54. ***Financial Management:*** Financial management performance of PMO was weak in the initial stages of the project but improved towards the end. The key staff position of Director Finance remained vacant and was not filled until May 2014, that is, more than half-way through the project. In FY2011/12 GoPunjab failed to release adequate counter-part funds for the project and PMO resorted to using Loan funds to make payments to contractors for GoPunjab's share also. These two weaknesses resulted in downgrading of FM rating to Moderately Unsatisfactory. Subsequently, the situation improved and the FM rating was upgraded to Satisfactory. The financial management systems, internal controls and related processes at the PMO provided reasonable assurance that loan proceeds were used for the intended purposes. The quarterly and annual interim financial reports (IFRs) were submitted to the Bank in a timely manner with adequate form and substance. However, it has taken a long time for PID to settle outstanding audit observations for the Taunsa Barrage as well as this project. As the time of writing of the ICR, some of the audit observations were still outstanding and remain to be settled. The main audit issues relate to weak contract management, including payments made beyond approved variation order (VO) amounts. Subsequently, however, the competent authority approved the VOs on an ex-post basis.

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17 As indicated earlier also, there were two main changes: (a) civil works and electrical/mechanical components were combined under one ICB contract instead of two separate contracts as envisaged earlier; this necessitated a second round of pre-qualification and bidding; and (b) instead of renovating the existing barrage gates and hoisting mechanism, it was decided to install new gates.

18 The contract for PIC was delayed partly because some redesign work was added to the TOR based on the recommendations of the POE, and it took some more time to settle the issue of responsibility of designs prepared by the consultants who were engaged earlier for preparing detailed engineering designs.

55. ***Disbursements***: Reflecting the overall good progress on the main contracts, disbursements remained close to the forecast although there was with some lag during the first few years. PMO staff reported some difficulties in seeking direct payment to vendors due to the restriction on direct payment for invoices less than 20 percent of the outstanding advance in the Designated Account. Bank staff advised PMO to indicate direct payments separately in Designated Account Activity Statement, which would reduce the outstanding Designated Account advance as well as minimum size of direct payment application of 20 percent of outstanding DA advance. At the end of the project, US$10 million remained unused and were canceled in response to GoP's request. The main reasons for the savings are less than expected cost of Component A and interest during construction, due to lower LIBOR.

2.5 Post-completion Operation/Next Phase

56. Prior to the start of the Project the Kalabagh Head works Division (KHD) of PID, headed by an Executive Engineer, was responsible for the O&M of the Jinnah Barrage. At the start of the project this O&M responsibility was taken over by PMO to enable efficient implementation of project works while maintaining normal barrage operations in accordance with the rules and regulations. Similar arrangements also existed at other ongoing and previously completed barrage projects[19] and have helped to build PMO capacity to ultimately transition to an autonomous Barrage Management Organization (BMO) in the future. PMO prepared a post-completion operation work plan detailing transition arrangements, including budget, staffing needs, monitoring arrangements and performance indicators to monitor and evaluate the Project in the future and follow-up required from the Bank that will contribute to sustaining benefits, including the desirability of follow-on projects.

57. Since the creation of BMO has been deferred to allow more time for deliberations and building of consensus among various stakeholders within PID, upon completion of the project the O&M responsibility has reverted to the KHD. The KHD has taken over the old and new facilities and the associated staff, budgetary arrangements, various manuals[20] and as-built drawings for all civil, mechanical and electrical and residential facilities, and SCADA, CCTV & Radio Systems. GoPunjab has allocated adequate budget for O&M during FY17/18 in accordance with the approved "budgetary yardsticks". The post-transition arrangements are thus adequate for smooth and safe operation of the barrage.

58. Upon completion and commissioning, the RTFM system has been taken over by the respective irrigation divisions and the PMIU for future O&M. One issue the project is facing is the transfer of bathymetric equipment procured for the Jinnah Barrage to the Inland Water

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[19] Besides Jinnah Barrage, this includes barrages at Taunsa (on the Indus River), Khanki, Trimmu, Panjnad (on River Chenab), Ballocki (on River Ravi) and Islam Head works (on the Sutlej River).

[20] This includes O&M Manuals for the Barrage; Gates & Allied Structures; Power Supply / Lighting System; and SCADA System.

Transportation (IWT) Company by GoPunjab. It is unclear how and when this equipment will be returned to PID.

59. **O&M Service Contracts**. Since retaining qualified and experienced staff at remote locations such as the Jinnah Barrage may prove to be difficult, the PMO has awarded a Service Contract for the O&M of SCADA and RTFM systems to a private contractor whereby the contractor will have responsibility for periodic preventive maintenance and repairs. The contract became effective on June 23, 2017.

60. The criteria and indicators by which performance of the Jinnah Barrage and the PID as an institution would be monitored and evaluated in the future are similar to those in the Results Framework. For the Jinnah Barrage this would include: smooth operation of gates, safe passage of floods, no interruption of flows to the Thal Canal due to deficiencies in barrage operations; and for PID: continued training/capacity building activities in new technologies, equipment and facilities, improved irrigation service delivery; and improved asset management, etc.

61. Further support is required for establishing and strengthening the BMO, further refining the WRMIS and DSS and enhancing M&E capacity within PID.

3. Assessment of Outcomes

Rating: Satisfactory

3.1 Relevance of Objectives, Design and Implementation

62. ***The relevance of the project development objective remains High.*** The PDO reflects the Government and Bank's development priorities prevailing at the time of appraisal and which continue to remain relevant. As Pakistan is an arid country in which irrigated agriculture is a major contributor to the economy, the objective of keeping strategic irrigation infrastructure and related institutions functional and efficient is clearly a high priority.

63. Irrigated agriculture contributes about 80 percent of Pakistan's export earnings directly and indirectly. However, as noted in the Bank's 2014-19 Country Partnership Strategy for Pakistan (CPS, Report 84645-PK, April 4, 2015), agriculture suffers from low water productivity and remains vulnerable to climate change. Barrage improvement projects and advocacy notes on water-related climate change issues are explicitly mentioned in the CPS. The PDO supports Outcome 2.2 under the Results Area II Private Sector Development by providing stable water distribution and supporting sustainable agricultural production in the barrage command area. Improvement of the Guddu Barrage has already commenced and options for improving or replacing the Sukkur Barrage with a new barrage are being considered. Protecting the integrity of barrages also remains high among GoPunjab's development priorities and a major barrage improvement program is continuing with the Asian Development Bank's support. It is consistent with the country's Vision 2025, which aims at transforming Pakistan into a developed and export-

led economy with strong social values by promoting inclusiveness, peace and security, and greater inter-provincial harmony. It contributes to the following pillars of Vision 2025: (a) sustained and inclusive higher growth, (b) private-sector-led growth, and (c) modernization of existing infrastructure.

64. ***The relevance of project design and implementation is Substantial.*** The project design and its components directly support the development objectives. The design has an appropriate balance between the infrastructure improvement and institution building objectives. While focusing on improving the barrage safety and operational aspects the project also supports building capacity of the PID. Timely completion of major components of the project bears witness that the implementation arrangements were well designed and enabled early detection and resolution of design and implementation issues. For example, the need for combining civil works with electrical mechanical works under one contract and to install new gates instead of renovating the old gates was identified early and necessary actions were taken quickly. The design and implementation of SDAP and EMP through participatory approaches ensured stakeholder support. A PMO staffed with qualified and dedicated professionals, a competent team of supervisory consultants with adequate powers for decision making, a strong and experienced contractor, timely availability of adequate funds, and timely guidance from the POE all helped to achieve the project objectives. The Results Framework was adequate and incorporated specific, measurable outcome indicators that were aligned to the PDO.

65. During the course of implementation there were court petitions from individuals challenging the concept of building a subsidiary weir to control retrogression[21]**.** However, the PMO with the guidance of the design and supervisory consultants successfully defended the technical design and the petitions were dismissed.

3.2 Achievement of Project Development Objectives[22]

66. The project substantially achieved it development objectives as discussed below.

67. ***PDO#1: Rehabilitating and modernizing Jinnah Barrage and the carrying out of affiliated works to enable reliable and uninterrupted supply of water for over 2.1 million acres of farmland benefitting about 600,000 farm families for irrigation and domestic water users***: (***Substantial):*** The first part of the PDO was to be achieved by making the barrage operation safer by constructing a sub-weir to improve energy dissipation and stop downstream retrogression; improving operation of the gates; installing a modern SCADA system; training operators; and providing detailed O&M Manuals. The outcomes targets set for this part of the PDO and their current status is as follows:

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21 The same design concept had worked very well at the Taunsa Barrage also.

22 For analyzing project outcomes, the ICR team has used data available in various project M&E reports and the Project Completion Report prepared by PIC. This was supplemented by first-hand observations and consultation carried out during the ICR mission.

(a) *Less interruption in water supplies to the Thal canal area*. After the completion of the improvement works, there have been no interruptions to the Thal canal on account of deficiencies in barrage functionality. Table 1 below shows that the total number of days in a year the canal was closed[23] has reduced and the average flow at the head of the canal has improved after completion of the improvement works. As noted earlier the amount of water diverted to the Thal canals depends on several factors some of which are outside the control of the project and the project can only be held accountable for interruptions caused due to any problems in the functionality of the barrage. Reliability of water supply is measured by the Delivery Performance Ratio (DPR) --which is the ratio of actual water supplies as a fraction of the designed water supplies. When the average DPR value is equal to or greater than 0.7 the water supply is considered reliable. Before the rehabilitation of the barrage the supply to the Thal canal was unreliable. The DPR value measured at the time of baseline survey in 2009 was 0.58. After rehabilitation of the Barrage the DPR has increased to 0.72 as a result of more efficient operation of gates and maintenance of proper water levels in the pond above the barrage.

Table 1: Thal Canal Closure and Average Flow

Year	No of days canal was closed	Average flow at head of Thal Canal (cfs)
2010	32	4894
2011	43	5886
2012	21	5640
2013	26	5906
2014	24	6429
2015	36	6025
2016	18	6592

Source: PMO

(b) *Downstream retrogression is checked*. After the completion of the sub-weir the retrogression downstream of the main barrage has stopped. This has been confirmed by data from bathymetric surveys that were carried out to observe river cross sections.

(c) *Safe passage of floods*. While there have been no major floods after the completion of improvement works, no damages have been reported since the completion of the project. It should be noted that the upstream flood protection bunds have a "breaching section" that is used as a safety valve to pass high floods. Therefore, the barrage should remain safe even in the event of floods higher than its design capacity of 950,000 cfs.

[23] Normally canals are closed for 21 days during the month of January for inspection and repairs.

(d) S*mooth operation of barrage gates:* Installation of new gates and hoists that can be operated manually, mechanically through local controls at the barrage, and mechanically through remote control from the SCADA control room, has made the operation of gates smooth and efficient.

The improved reliability of water supply from the Jinnah Barrage delivered to the project area through the Thal Canal has helped benefit more than 600,000[24] families for irrigation and water use over 2.1 million acres of farmland. This indicates reliable water delivery to the Thal Canal. Thus, b*ased on the above evidence it is concluded that the first objective has been fully achieved*.

68. ***PDO#2: Building PID's capacity in improved water resources and irrigation system management (Substantial):*** The second part of PDO was predicated upon introduction of new tools and technology and WRMIS for improved water measurement, management and accounting; provision of bathymetric equipment for river surveys, introduction of DSS for improved water allocation among various canal commands in Punjab, and training of PID staff in operating and maintaining new systems. The outcome targets set for this part of the PDO and their current status is as follows:

69. *Better water accounting and allocation over 50 percent of the area*. The target set for the first element of this objective–better water accounting over 50 percent of the irrigation system- has been surpassed. Prior to the project, PID operated the irritation system and allocated water to various canal command areas based on outdated, traditional (manual) and non-transparent methods and processes. Flow measurement and water accounting were based on erratic, unreliable and not real time data. There were no systems in place for real time flow monitoring (RTFM), data transmission, storage, retrieval and analysis. The PMIU maintains water accounts of all canals in Punjab and ensures transparency by posting canal entitlements, actual deliveries and balance shares on its website http://irrigation.punjab.gov.pk/entitlement.aspx. This increased functional capacity has been made possible by the modern technology and tools introduced under the Project, including SCADA, for management of barrages and main canals; RTFM for data acquisition, storage and transmission. Installation of modern flow measurement devices at key locations of the irrigation system has increased the reliability and accuracy of the water accounts, and posting of the data on the PMIU website has increased transparency of the system. *The target set for the second element of this objective, that is --better allocation of water over 50 percent of the irrigation system- has, also been achieved*. The modern DSS has been developed and is operational from July 2017. At that time the responsibility for water allocation decisions was transferred from PID's Directorate of Regulation to the PMIU. PMIU is continuing to train its staff and gradually expanding the use of DSS for all water allocation decisions. In addition to these two elements of the second part of the PDO, strengthening of PID also took place through the provision of bathymetric equipment and training of staff as well completion of post-graduate degrees by twenty staff. Thus, the second element of this part of the PDO is also considered to be fully achieved.

[24] As per client estimates, it is now around 700,000 families based on an estimated growth rate of 2% from 2009 to 2017 (Refer Borrower Completion Report)

3.3 Efficiency (High)

72. At the time of project appraisal, it was determined that the Jinnah Barrage was unsafe and major floods could potentially result in full or partial failure with catastrophic consequences for the people living in the command area of the Thal canal. It was feared that even if high floods did not occur the Barrage would continue to deteriorate and the water supply to the Thal Canal will decrease gradually.

73. The quantifiable benefits of rehabilitating the Barrage were estimated by comparing the value of agricultural production in the with- and without-project scenarios. The without-project scenario assumed that the cropping intensity of 103 percent in the Thal canal command area, prevailing in 2009, would gradually decrease to 87 percent over a period of 10 years. This decline was estimated based on the prediction that the flow in Thal Canal would be reduced to 6,000 cusecs over this period. The with-project scenario assumed that the Thal Canal would get water supply at its designed capacity and the cropping intensity would increase by 10 percent over a period of ten years, reaching 113 percent in 10 years. The losses associated with catastrophic failure of the Barrage were not considered. Similarly, the potential loss of power production at the JHPP was not considered. The economic rate of return (ERR) of the Project was estimated as 21.7 percent. The ICR has adopted the same assumptions and the ERR at completion is re-estimated at 26.4 percent and the net present value (NPV) at rupees17,350 million. The total cost of the project (capital and O&M costs) has been considered in the analysis. The ERR at completion is higher than estimated at appraisal because of lower than the estimated completion cost. The ERR is robust and remains higher than the opportunity cost of capital in Pakistan (12 percent) even if there is simultaneous increase of 20 percent in cost and 20 percent decrease in benefits (details are included in Annex 3). Similarly, the financial rate of return (FRR) at completion is 21.8 percent compared to the appraisal estimate of 17.7 percent.

74. It is also noted that the project completion cost is comparable to that of the Taunsa Barrage[25] (US$ 137 million) that was completed in 2009, that is eight years earlier. This shows that the project was cost effective. The project implementation efficiency was satisfactory as the project was completed with only one year extension and savings of US$10 million from the IBRD loan due to reduced costs.

75. It was expected that with the rehabilitation of the barrage it would be possible to: (a) maintain normal water supplies to the Thal canal; (b) manage floods in the Indus River; (c) ensure continued functionality of the bridge over the barrage; (d) maintain water supplies to the 96 MW Jinnah Hydropower Plant (JHPP) on the right side of the barrage; and (f) avoid high costs of major repairs or reconstruction of the Barrage. These expectations have been met. The estimates of ERR, FRR, NPV and cost effectiveness also confirm the **high efficiency and good value for the money** achieved by the project. Besides the significant contributions of the Bank team during the design and implementation stages, a major factor that helped in achieving these good results was the

[25] The Taunsa Barrage is also located on the River Indus and the design and scope of work were similar to the Jinnah Barrage.

experience that the PMO, as well as the construction and consulting industries had gained from the implementation of the Taunsa Barrage project.

3.4 Justification of Overall Outcome Rating

Rating: *Satisfactory*

76. Given the *High* relevance of objectives, *Substantial* relevance of design and implementation, *Substantial* achievement of the development objective and *High* efficiency, the **overall outcome** is rated as **Satisfactory**.

3.5 Overarching Themes, Other Outcomes and Impacts

(a) ***Poverty Impacts, Gender Aspects, and Social Development***

77. No specific study was carried out to assess the Project impact in terms of poverty alleviation or gender aspects. However, as a result of project activities over 2100 people were employed, which contributed to the economic uplift of the people living in areas surrounding the Jinnah Barrage. The Kalabagh Bridge (an old non-functional narrow-gauge railway bridge) was rehabilitated to manage traffic during the period the barrage bridge could not be used. This proved to be highly beneficial for, and earned goodwill of local residents for the project, who need to cross the river on a daily basis for personal, commercial and other needs. The SDAP also supported pro-poor activities, including: (i) distribution of seed (172,185 40 kg bags of wheat and 4,730 1 Kg bags of canola) among 64,000 small holders of less than five acres, sharecroppers and tenants; (ii) 36 drinking water supply schemes were completed in areas underlain with SGW benefitting some 92,000 people represented by 36 male CBO and 24 female CBOs organized under the project. The water supply schemes reduced the daily burden of women and children of fetching water from distant places that kept them occupied for hours; and (iii) construction of schools, a BHU and a public park.

(b) Other Unintended Outcomes and Impacts (positive or negative)

Not applicable.

3.6 Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops

Not applicable

4. Assessment of Risk to Development Outcome

Rating: Moderate

78. With the completion of the barrage improvement works[26] and various institutional strengthening measures[27] the probability of barrage failure is now negligible. PID has prepared a post-completion O&M plan to ensure adequate inputs in the form of staffing, equipment and operational budget based on barrage specific O&M yardsticks that are based on the actual requirements. Given the remote location of Jinnah Barrage and other facilities that support the WRMIS, RTFM, and DSS there is a risk that PID may experience attrition of trained staff that may be detrimental to future O&M of these systems. To guard against this eventuality, PID has awarded service contracts for the O&M of SCADA and RTFM systems. The risk to the development outcomes primarily relates to the second development objective, that is the institutional strengthening of PID and the risk of non-sustenance of the modern systems established. Experience from past projects with significant institutional development objectives has shown that PID is a highly traditional institution with considerable inertia that resists changes and adoption of modern tools, equipment and systems. For example, the institutional reforms supported under the NDP implemented in the 1990s and the Irrigation Sector Development Policy Loans during 2005-2007 were not fully sustained[28] and some were even reversed. While the institutional culture of PID is gradually changing with the induction of new young and qualified staff, the overall risk to the development outcomes is considered *Moderate*.

5. Assessment of Bank and Borrower Performance

5.1 Bank Performance

(a) Bank Performance in Ensuring Quality at Entry

Rating: Satisfactory

79. The Bank's performance during project identification, preparation and appraisal was satisfactory. The Project is the second in a series of operations that were identified and designed to safeguard Punjab's strategic irrigation assets. The Bank ensured that the Project was fully aligned with Bank's CPS for Pakistan and the Government's Poverty Reduction Strategy. The

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26 These include: repairs to the barrage floor, rectification of downstream retrogression, installation of new gates and hoists for the barrage, the Thal canal head regulator and downstream cross regulator, with three control mechanisms, installation of instruments to monitor the performance of the barrage structures and its foundation, SCADA system, CCTV cameras, etc.)

27 These include: provision of equipment and instruments; training of operational staff in O&M of the improved facilities in accordance with various updated manuals; and award of service contracts for future operation of the SCADA and RTFM systems.

28 Under the NDP and two Irrigation DPLs, PID had committed to support establishment of Farmer Organizations (FOs) and to turn over to them irrigation management responsibility. While FOs have been established they have not received whole hearted support from PID.

project objectives, design and implementation remain relevant to the GoPunjab's current development priorities. The Bank fully internalized the lessons learned from the first project (Rehabilitation of Taunsa Barrage) in the design of this second Project and ensured that social and environmental aspects received the required attention. The right combination of institutional and infrastructure support was included in the project. The Project components supported the development objectives. The design of the results framework was adequate and aligned to the PDO. The fact that no major changes were required at the time of the MTR is a testimony to the fact that the original design was generally right.

80. A minor shortcoming was that more thorough investigations at the time of detailed design preparation would have precluded the need for the changes made later, (combining civil works and mechanical/electrical works in a single contract; and installing new gates instead of refurbishing the old ones).

(b***) Quality of Supervision***

Rating: Satisfactory

81. The Bank team conducted a total of 15 implementation assistance missions including the ICR mission. During most missions the Bank team visited the project site and interacted with various stakeholders**.** The team was proactive and helping the client achieve satisfactory project performance; all stakeholders recognized and appreciated its role of filling knowledge gaps and resolving issues. Bank missions focused on early identification of issues and facilitating smooth implementation to help achieve the development objectives. The team was prompt in responding to PMO's request for approval of procurement plans, and extensively advised on procurement, disbursement, and financial management issues. The team remained stable with the same TTL continuing from identification to completion. The Team was well equipped to deal with technical, fiduciary and safeguard aspects and generally included the required expertise in these fields. The team made important changes during early stages of implementation. For example, the team rightly agreed to: (a) include repair of damages caused by the 2010 floods in the project scope; (b) combine civil works and electrical/ mechanical works in one contract; (c) install new gates instead of renovating the old gates; and (d) improve the specification of stones used for the downstream apron and filter and for flood fighting. The team also facilitated arrangements for transition from construction to the operation stage, and introduced PID with the concept of maintenance service contracts.

(c) Justification of Rating for Overall Bank Performance

Rating: **Satisfactory**

82. As explained in the preceding sub-section Bank performance was *Satisfactory* both during project identification, preparation and appraisal as well as supervision. Accordingly, the ICR rates the Bank's Overall Performance as *Satisfactory*.

5.2 Borrower Performance

(a) Government Performance

Rating: Satisfactory

83. Although the Borrower (the Islamic Republic of Pakistan) had a limited role in the preparation and implementation, it fully owned the project and was committed to its objectives. The Borrower's main contributions to the project were: (a) securing approval of the ECNEC[29] for the Project PC-1[30]; (b) liaising with the Bank in negotiating and processing the Loan; and (c) processing of GoPunjab's request for extension of the Loan Closing date. The Borrower carried out these functions generally satisfactorily, except that it sought a one-year extension instead of eighteen months originally requested by GoPunjab.

84. GoPunjab, represented by the Planning & Development (P&D) Board, was generally responsive to the project requirements and performed its role satisfactorily. Among other things, the P&D Board facilitated timely processing of the PC-1 at the provincial level; chaired the Project Steering Committee (PSC) meetings to monitor progress and resolve issues not settled at the PID/PMO level; chaired wrap-up meetings with Bank Missions; ensured timely release of counter-part funds, except for a brief period in 2011/2012, when there were delays in release of funds[31]; and facilitated decisions at the policy level.

(b) Implementing Agency Performance

Rating: Moderately Satisfactory

85. The PID, represented by the PMO and PMIU, the main implementing agencies, performed their respective roles admirably during all stages of the project and achieved completion of major contracts more or less on time. The staff in the PMO is composed of dedicated professionals who handle a high work load involving all ongoing barrage projects. PMO staffing remained relatively stable during the project, with only one change of Head of PMO. The PRSP and PHED performed their respective roles satisfactorily in implementing the SDAP. PRSP exercised due diligence and transparency in identifying farmers eligible to receive the Wheat seed, according to the agreed criteria. Similarly, the PHED performed its function of organizing male and female CBOs, who established drinking water supply schemes, following participatory approaches. During field visits the ICR team received positive feedback from the beneficiaries about the roles of PMO as well as PRSP and PHED.

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[29] The Executive Committee of the National Economic Council (ECNEC) is the highest government forum for approving development projects.

[30] PC-1 stands for Planning Commission Proforma 1. It is the principal project appraisal document used by the government for securing approval of development projects.

[31] During this period PMO resorted to using Loan proceeds to finance the government contribution as well. This led to the downgrading of the Project's rating for Financial Management to MU.

86. Areas in which and the PID/PMO could have performed better include: (i) the transition of PMO to BMO, which has yet to take place primarily due to institutional inertia; (ii) long delay in the appointment of Director Finance in PMO, which did not happen until 2014, that is more than halfway through the project[32]; and (iii) transfer of bathymetric equipment procured for Jinnah Barrage to the Inland Water Transportation (IWT) Company at the directive of GoPunjab[33].

(c) Justification of Rating for Overall Borrower Performance

Rating: **Moderately Satisfactory**

79. Given the Satisfactory performance of the Government, and Moderately Satisfactory performance of the Implementing Agency, the Borrower's Overall Performance is rated as *Moderately Satisfactory*.

6. Lessons Learned

Some of the key lessons offered by the project include the following:

- ***Implementation Readiness:*** Various critical tasks that were necessary for getting the Project ready for implementation were accomplished before appraisal. Detailed advance planning for the construction phase (for example, determination of location for contractor's camp site, configuration of coffer dams and temporary works, bidding documents, day-to-day construction schedule), and inclusion of this information in the PAD pays dividends in terms of avoiding social and environmental issues and achieving timely completion.

- ***Sound procurement strategy***: Close cooperation and team work among the implementing agencies, contractors and supervisory consultants is the key to timely and successful completion of large contracts. To ensure clarity of responsibility/liability for engineering design of major works, wherever possible, the consultants who prepare detailed engineering design should be made responsible for construction supervision also. Also, in this project the combining of Component-A (Civil Works) and Component B (Electro Mechanical Works) contracts led to effective implementation of works. Where feasible, the civil and electro-mechanical works should be included under one contract to ensure close coordination during actual implementation.

- ***Effective implementation of safeguards:*** Preparation of site-specific social development action plans following a development based approach, supported by an effective communication strategy, is highly effective in addressing social issues and maintaining good relations with local communities.

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32 While there were difficulties in identifying good candidates, PID/PMO should have used contacts within the government system to locate good candidates.

33 The ICR Mission has informed GoPunjab that works, goods and services financed from the Bank Loan should be used only for the purposes of the Project.

- ***Independent Panel of Experts for smooth implementation:*** An independent Panel of Experts was established to review the engineering designs and advise on implementation issues at critical stages. Timely guidance from the POE on design, construction and safety issues helped solve critical issues and facilitate smooth implementation. Periodic consultations on design and implementation issues with an independent POE is an effective tool for taking timely corrective measures and ensuring quality.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners

(a) Borrower/implementing agencies

All the comments from the Borrower have been addressed in the ICR with one exception. The Borrower believes that the *Borrower Performance* rating should be Satisfactory. The ICR has maintained the rating of Moderately Satisfactory due to reasons stated in Section 5.2.

(b) Cofinanciers (Not Applicable)

(c) Other partners and stakeholders (Not Applicable)

Annex 1: Project Cost and Financing

(a) Project Cost by Component in USD Million (equivalent)

Sr.	Components	Appraisal Estimates	ICR Estimate	Percentage of Appraisal
A.	**Rehabilitation and modernization of Jinnah Barrage**			
A1.	Civil works implementation support	57.5	110.6 a/	117.6 a/
A2.	Mechanical and electrical works	36.5	-	-
A3.	Implementation of social and environmental management plans	9.0	6.7	74.4
A4.	Construction supervision, and Implementation Support	8.0	8.0	100.0
	Subtotal (Component A)	**111.0**	**125.3**	**112.9**
B.	**Improvement and modernization of the irrigation and water management system information, monitoring & decision support system**			
B1.	**Improvements in irrigation and water management**			
B1.1.	Management information, monitoring & decision support system	5.0	4.1	82.0
B1.2.	Modernization of water management equipment and facilities	5.0	2.8	56.0
B2.	Preparation of future water and irrigation improvement projects	5.0	1.7	34.0
	Subtotal (Component B)	**15.0**	**8.6**	**57.3**
C.	**Monitoring and evaluation of the project impact; Social and environmental management plans**	**3.0**	**2.3**	**76.6**
D.	**Project management coordination and technical assistance and training studies**			
D1.	Project management and coordination	5.5	2.7	49.1
D2.	Technical assistance, training and strategic	1.5	1.3	86.6
	Subtotal (Component D)	**7.0**	**4.0**	**57.1**
	Interest During Construction	18.6	2.7	14.5
	Up-front Fee	0.4	0.4	100.0
	Total Project Cost	**155.0**	**143.3**	**92.5**

a/ Includes cost of Components A1 and A2 that were implemented under the same contract.

(b) Financing

Source of Funds	Type of Co-financing	Appraisal Estimates (USD million)	ICR Estimate (USD millions)	Percentage of Appraisal
Borrower	NA	9.4	10.7	113.5
IBRD	NA	145.6	132.6	91.0
TOTAL		**155.0**	**143.3**	**92.5**

Annex 2. Outputs by Component

The Project has four components[34]:

Component A: Rehabilitation and Modernization of Jinnah Barrage that includes four sub-components;

Component B: Improvement and Modernization of the Irrigation and Water Management System, with two sub-components;

Component C: Monitoring and Evaluation of the Project Impact and Social and Environmental Management Plans comprising several tasks; and

Component D: Project Management Coordination Technical Assistance and Training, comprising several tasks

The Table below summarizes Project Component/sub-component-wise targets; the actual achievement or outputs by component; and the linkage or attribution between the outputs and the outcomes achieved.

Outputs by Component				
	Output/Target	**Actual Output**	**Linkage with outcomes**	**Remarks**
Component A/*Sub-component A1-* *Civil works*	(i) Construction of a subsidiary weir about 600 ft downstream of the barrage main weir	Subsidiary weir constructed 800 ft. downstream of the Barrage main weir and left and right under sluices.	Efficient energy dissipation achieved; downstream retrogression checked	Location of sub-weir was changed based on POE's recommendation
	-Navigation bay adjacent to right abutment.	Completed per design	Boat traffic facilitated	Boats can go across the weir
	-Water way adjacent to left abutment.	Completed per design	Safety feature	
		Completed per design	Safety feature	

[34] The PAD contains a detailed description of the Project Components

	-Left and right abutments. -Left and right D/S guide bank extension. - Fish ladders on both sides. -Flared out walls on banks. -Strengthening of river training works. -Road on the crest of left marginal bund (LMB). -Rehabilitation/ Repair of existing barrage bridge.	Completed per design Completed per design Completed per design Completed per design Completed per design Completed per design	Flood protection Fish movement facilitated Safety feature Enhanced barrage safety Safe access to Barrage Traffic management and Safety	Fish ladders permit seasonal fish migration
	(ii) repairs to the barrage floor, impact and friction blocks, and guide banks	Repairs completed per design	Enhanced safety of barrage	Safe passage of floods
	(iii) alteration to main barrage structure - extension of abutments and downstream divide walls	-Separate left and right divide walls constructed for sub-weir.	Barrage safety	
	(iv) construction of river training works upstream (an inverted hockey spur) to improve river approach towards the barrage	Postponed based on POE recommendation	These works are required to achieve the required angle of approach of the river to the barrage structures to improve its efficiency.	Design of river training works will be reviewed after monitoring the situation for a few years
	(v) associated and temporary works for	Care & Handling of water including construction and	Maintaining uninterrupted flows to the Thal	Design and successful completion of

	carrying out main rehabilitation works;	removal of Coffer Dams	canal and to the river downstream	these works was key to timely completion of sub-weir and installation of gates without interruption of flows to Thal canal and river downstream
	(vi) Renovation of building and management infrastructure;	Rehabilitation and Up-gradation of buildings and offices. Construction of new buildings including furnishing. Road Network Water Supply System Sewerage System Boundary Wall Electrification	Providing facilities to project staff	
	Construction of social infrastructure	Construction of Boys & Girls Middle Schools. Construction of BHU and Staff Residential Buildings. Construction of New Mosque in Colony and Rehabilitation of Mosque at left side of Jinnah Barrage	Improved project relationship with local communities	

		Rehabilitation of Kalabagh Railway Bridge Construction of Public Park Construction of New Toll Plaza 36 Water Supply Schemes in the Khusab area		
Component A/ *Sub-component (A2)-* *Mechanical and Electrical Works*	Mechanical and electrical works consisting of: (i) renovation of the barrage gates and hoist system and automation of gate operation; and	Completed as per design and included: -Condition Survey of gates with modern equipment. -Replacement of all barrage gates and head regulator and cross regulator gates of Thal Canal with new gates. --Installation of local and central control units for Automatic Operation. -Replacement of sill beams for Barrage gates. - Installation of bulkhead gate guides. -Modification of groove and rocker assembly, for Barrage gates. -Construction of New Workshop.	Smooth operation of gates. Enhanced safety with redundancy of operating systems: manual, local motor control and remote control. Improved O&M of barrage	Instead of renovating old gates, that were found to be highly worn out, new Stoney type gates, that have girders instead of trusses, were installed.

		- Installation of 30 ft. wide gate on left side of subsidiary weir and navigation lock gates on right side. -Construction of 11 KV Power Feeders on both banks of the Indus River.		
	(ii) upgrading of the barrage monitoring system and basic operation and maintenance facilities.	Completed as per design. Instrumentation and sensors to monitor gate opening, water levels and flows and pressure pipes to monitor subsurface flows installed. SCADA, CCTV systems installed	Barrage safety enhanced through, improved monitoring and controls.	Staff trained in operating new systems
Component A/ *Sub-component A3*:*Implementation of Social and Environmental Management Plans*	Implementation of ESMMP and SDAP	Seed distribution program; 36 water Supply schemes; Social infrastructure, implemented	Government and World Bank safeguard requirements were met fully met	Project performance on implementing ESMMP and SDAP is exemplary
Component A/ *Sub-component A4*: *Construction Supervision, Preparation and Implementation Support*	Consulting and other services for implementation of the project, including construction supervision and project management support. It also covers implementation of all activities under the project: procurement, contract administration, quality control,	--Contract with PIC (2612 m/m), with outputs relating to construction supervision; project management support; procurement and contract management; quality control; certification of payments; financial	Ensuring timely completion and quality of works	There was excellent team work among the contractor, PIC, PMO and Bank team

	certification of payments, financial management, preparation of any additional designs, and bidding documents,	management; preparation of additional designs; and bidding documents.		
Component B:*sub-component B1-* *Improvements in irrigation and water management systems, including development of MIS, monitoring and DSS; modernization of water management equipment and facilities;*	Development and use of modern databases; GIS Systems; models; DSS; and MIS for improving planning and operation of the complex irrigation system of Punjab.	*Contract with WRMIS/DSS consultants (977 m/m)* with outputs including databases; GIS Systems; models; DSS; and MIS for improving planning & operation of the irrigation system of Punjab.	Institutional strengthening of PID	
	Forecasting; planning; and operational tools for seasonal and 10-day planning forecasts and demand management systems with client interfaces.	Forecasting; planning; and operational tools for seasonal and 10-day planning forecasts and demand management systems with client interfaces. These tools aid in irrigation planning and link with the reservoir operation decisions of IRSA.	Improved water management capability in PID	
	A system of water measurements, accounting and data transmission will be introduced at key locations in the river and link canal system and the main and branch canals.	Outputs include a system of water measurements, accounting and data transmission introduced at key locations in the river and link canal system and the main and branch canals.	Improved water measurement and accounting	

	A data communication network installed to gather information to be sent to central locations and the Punjab Irrigation and Power Department's (PID's) headquarters.	Outputs include a data communication network installed to gather information to be sent to central locations and PID's headquarters.	Improved water management through RTFM	
***Component B**: Sub-component B2 preparation of future water sector improvement projects.*	Preparation of feasibility studies and designs for future projects identified during project implementation for further improvement of irrigation and water management in the province	Feasibility Studies, detailed design prepared for: (a) Potohar Climate Smart Irrigated Agriculture Project; and (b) Pilot for improvement of degraded river channels using a rubber weir.	Preparation of high priority projects for future pipeline	The Projects will be undertaken later.
Component C: *M&E*	(i) Provide continuous feedback on project implementation performance.	Contract with M&E consultants (698 m/m) with outputs including Quarterly monitoring reports; baseline, mid-term, final impact evaluation reports; SDAP completion report.	The objective of the M&E was to improve implementation based on continuous feedback and various studies	
	(ii) environmental impact of construction activities in the project area, particularly on any ecologically important sites;	Outputs include Environmental monitoring reports, including QPRs by M&E consultants, PIC and contractor. Monitoring reports by WWF. Third Party Audit Reports	The objective of the M&E was to improve implementation based on continuous feedback and various studies	
	(iii) monitor possible acquisition of public and private land and assets, agreements reached and	As a result of careful planning land acquisition was not required.	Adverse social impacts avoided	This is a major achievement

	arrangements made for acquisition of assets			
	(iv) estimate socio-economic impacts including impact on the level of employment, livelihood and household incomes in the project area;	Impact evaluation reports produced	Positive impact of fewer interruptions in water supplies to the Thal Canal	There is a positive impact on farm incomes
	(v) evaluate the SDAP program implementation at completion	Evaluation Report on SDAP prepared	Project implementation was facilitated by stakeholder support gained through the seed distribution among small holders, water supply schemes, and social infrastructure and good communication with stakeholders	Project had a very positive social impact
	(vi) estimate the project's overall benefits and economic rate of return at completion;	Economic analysis completed. ERR is 26.4%.	Reflects the **high efficiency** of the project	Project is cost effective &good value for money -- cost is less than Taunsa Barrage Project completed in 2009
	(vii) prepare Borrowers ICR, etc.	Borrower's ICR Prepared by consultant hired by PMO	Ensuring timely delivery of ICR	
	(viii) Monitor progress of irrigation management transfer and timeliness in addressing issues in making FOs effective organizations in irrigation management	Report on evaluation of irrigation management transfer reforms prepared	Progress of reform was monitored and feedback provided to PID	Performance of FOs is mixed. PID needs to provide more support to FOs

Component D: *Project Management Coordination Technical Assistance and Training.*	Support for: (i) operation of the PMO	PMO engaged professionals for managing: procurement; contract management; implementation of social and environmental management plan; barrage management; communication with all stakeholders; etc.	Smooth implementation of project	
	(ii) building the capacity of the PMO for transition to a Barrage Management Organization (BMO);	Transition to BMO postponed; however, PMO considerably strengthened and now has many elements that would be needed in future transition to BMO	Part of institution building of PID	PID wishes to build internal consensus before formalizing BMO
	(iii) technical assistance and training.	TA provided as required; 20 staff received post-graduate degrees from international universities	Part of institutional strengthening of PID	
	(iv) an independent panel of experts; and	An independent POE was hired early in the project and provided invaluable assistance to improve design and address implementation issues		
	(v) strategic studies and pilot projects.	Feasibility Studies, detailed design prepared for: (a) Potohar Climate Smart Irrigated Agriculture Project; and (b) Pilot for		

		improvement of degraded river channels using a rubber weir.		
	(vi) financing of incremental staff salaries, operating expenditures, consulting services, equipment and software.	Financing provided for incremental staff, office equipment, etc.	Support to PMO for project management	

Annex 3. Economic and Financial Analysis

A. Background

1. The Jinnah Barrage diverts a part of the Indus River flow to the Thal Canal that has a maximum design discharge capacity of 950,000 cusecs. This canal was commissioned in 1946 when the Barrage was constructed. It irrigates about 2.1 million acres of agricultural land in five districts of Punjab (Mianwali, Khushab, Bhakar, Layyah and Muzaffargarh) and meets domestic water requirements of some 600,000 families living there. At the time of project appraisal, it was considered that the Jinnah Barrage was unsafe and major floods could potentially result in full or partial failure with catastrophic consequences for the people living in the command area of the Thal Canal. Such an eventuality would also have major adverse impact on the regional and national economies. It was further considered that even if high floods did not occur and the Barrage was sustained with routine maintenance, it would continue to deteriorate and the water supply to the Thal Canal will gradually decrease. It was expected that with the rehabilitation of the Barrage it would be possible to: (a) maintain normal water supplies to the Thal Canal; (b) manage floods in the Indus River; (c) ensure continued functionality of the bridge over the barrage; (d) maintain water supplies to the 96 MW Jinnah Hydropower Plant (JHPP) on the right side of the barrage; and (f) avoid high costs of major repairs or reconstruction of the barrage.

B. Methodology

2. At appraisal, the quantifiable benefits of rehabilitating the Barrage were estimated by comparing the value of agricultural production in the with- and without-project scenarios. The without-project scenario assumed that the cropping intensity of 103 percent in the Thal Canal command area, prevailing in 2009, would gradually decrease to 87 percent over a period of 10 years. This decline was estimated based on the prediction that the flow in Thal Canal would be reduced to 6,000 cusecs over this period. The with-project scenario assumed that the Thal Canal would get water supply at its designed capacity and the cropping intensity would increase by 10 percent over a period of ten years reaching 113 percent in 10 years. The losses associated with catastrophic failure of the Barrage were not considered. Similarly, the loss of power production at the JHPP was not considered. The economic rate of return (ERR) of the Project was estimated as 21.7 percent. The ICR has followed the same methodology in re-estimating the ERR at completion.

C. Project Costs

3. *Capital Cost*. The project was completed in seven years, including an extension of one year in the Loan Closing date. The estimated cost of the Project at completion is US$143.3 million compared to the appraisal estimate of US$155 million. Annex 1 provides component-wise comparison of the cost estimates at appraisal and completion.

4. *O&M Cost*. At appraisal, the O&M costs were assumed to be 0.75 percent of the capital costs. The ICR has used the actual O&M expenditures incurred during the implementation of the

project and the estimated O&M budget over the project evaluation period. The O&M cost comprises the cost of electric power and skilled labor required after rehabilitation. The O&M costs associated with SCADA system have been added to arrive at total O&M costs.

Project Benefits

5. *Quantifiable Benefits*. The Project's quantifiable benefits comprise of the incremental agricultural production that would be achieved in the with-project scenario compared to the without-project scenario. The methodology and assumptions used at appraisal (paragraph 2 above) have also been used in estimating the quantifiable benefits at the time of ICR.

Table 3.1: Assumptions for Economic Analysis

Sr.	Description	At Appraisal	At ICR
1.	Cropping Intensity Actual (weighted Average of 5 Districts)	103%	151% [35]
3.	Cropping intensity (without-Project) after 10 years	87%	127.5%
4.	Cropping intensity (with-Project) after 10 years	113%	165.7%
5.	Canal Command Area	2.1 m acres	2.1 m acres
6.	Price level	Sept 2009	March 2017

6. As was done at appraisal, a conservative approach has been adopted in the economic analysis; no change in crop yields or inputs level has been assumed for both with- and without-Project scenarios. Table 3.2 below shows the cropping intensities used in the analysis.

[35] Cropping intensities have increased significantly in the project area during the last 8 years, mainly because of increase in use of groundwater as evidenced by a major increase in the number of private tube wells that have increased from 97,000 in 2008 to 125,000 in 2015.

Table 3.2: Cropping Intensities in Canal Command Area of Thal (Percent)

Sr.	Crops	ICR Baseline	FWOP	FWP
1	Wheat	49.5	41.8	54.3
2	Rice	3.5	2.9	3.8
4	Jawar/Bajra for grain	4.2	3.5	4.6
5	Barley	1.5	1.3	1.7
6	Cotton	9.7	8.2	10.6
7	Sugarcane	3.4	2.8	3.7
9	Oilseeds	1.5	1.3	1.7
10	Pulses	62.0	52.4	68.1
11	Fodders	11.9	10.1	13.1
13	Other Crops[36]	3.5	3.0	3.9
14	Orchards	0.3	0.3	0.3
15	Total	**151.0**	**127.5**	**165.7**

Key: FWOP = Future-without Project; FWP = Future with-Project

7. *Non-Quantifiable Benefits*. Non-quantified benefits identified at appraisal included avoided losses due to: land erosion, land reclamation, loss of retail trades, interruption of social services, and the cost of restoring these services. The value of lost energy production from the 96 MW JHPP was also not accounted for. The same non-quantifiable benefits are identified at the ICR stage also.

D. Other Assumptions

(i) Crop budgets have been developed to estimate per acre net benefits using the level of inputs and yields prevailing in the project area.

(ii) The opportunity cost of capital is considered to be 12 percent, being the rate used by the Planning and Development Department, GoPunjab and GoP for project evaluation.

(iii) The farm gate prices for internationally traded goods are based on international prices, while those of non-traded goods are based on domestic financial prices. Among traded goods, export parity prices have been used for cotton and rice and import parity prices for wheat, and all fertilizers.

[36] This is the sum of cropping intensities of minor crops.

(iv) Derivation of economic price of wheat is included in Table 3.1; fertilizers (Urea, DAP and Potassium Chloride) in Table 3.2. Whereas the farm gate prices of all the commodities have been illustrated in Table 3.3.

(v) Similar to appraisal, useful life of the Barrage has been assumed to be 50 years including the rehabilitation period.

(vi) All costs and benefits are taken at nominal prices and no increase is assumed, either in benefits or costs, over the period of analysis.

(vii) All the project investments have been brought to the level of 2017 by using MUV Index Values[37].

(viii) The analyses and the cash flows have been drawn in the local currency and conversion rate of US$1.0 = Rs 106 has been used;

(ix) Financial prices were converted into economic values by removing taxes and subsidies from input and output prices and calculating import and export parity prices of major inputs and outputs (wheat, cotton and fertilizers). Standard conversion factor (SCF) of 0.9 was used to convert financial prices into economic prices for non-tradable goods. A shadow wage rate factor (SWRF) of 0.78 was used for unskilled labor given the competitiveness in the labor market within the Project area.

8. **Database:** The economic analysis is based on data drawn from multiple sources: (i) M&E Reports; (ii) Project Completion Report, prepared by PIC in December 2016; (iii) Punjab Statistics 2014-15; and (iv) Bank staff estimates.

9. Economic price data and labor wages are taken from price bulletins[38]. Crop budgets have been prepared for major crops (wheat, Cotton, Sugarcane, Gram, and Fodders).

10. Year-wise investment costs have been provided by PMO.

E. Results of Economic Analysis

11. At appraisal, the EIRR was estimated at 21.7 percent. Based on similar assumptions and methodology the EIRR has been re-estimated at ICR at 26.4 percent. The increase in EIRR at completion compared to appraisal is due to the lower completion cost of the project as compared to the appraisal estimate. Detailed cash flow is placed at Table 3.4.

F. Sensitivity Analysis

12. Table 3.3 below summarizes the impact of increase in costs and reduction in benefits on the EIRR.

Table 3.3: Economic Analysis (EIRR)

Description	Appraisal Estimates	ICR
a. Base Case	21.7	26.4
b. Increase in costs by 20%	19.3	23.5

[37] World Bank Price Forecast Bulletin March 2017.

[38] Price Bulletins 2016, Bureau of Statistics Government of Pakistan

c. Decrease in benefits by 20%	18.8	22.0
d. Combination of b. & c.	16.7	19.6

Key: EIRR = economic internal rate of return.

G. Conclusion

13. It is evident from Table 3.3 that the EIRR is robust and the project remains economically viable even if benefits decrease by 20 percent and costs increase by 20 percent simultaneously.

H. Financial Analysis

14. As done at appraisal, the financial analysis of the project has been carried out by developing cash flows of costs and benefits in financial terms. The agricultural benefits have been estimated using the farm-gate market prices prevailing within the project area, with similar approach and methodology expressed above under the economic analysis.

15. The results of the financial analysis are summarized in the Table below:

Table 3.4: Financial Analysis (FIRR)

Description	Appraisal Esimates	ICR
a. Base Case	17.7	21.8
b. Increase in costs by 20%	15.6	19.4
c. Decrease in benefits by 20%	15.2	18.1
d. Combination of b. & c.	13.4	16.2

Key: FIRR = financial internal rate of return.

I. Project Impacts

16. *Beneficiary Families and Employment*: The command area of Thal canal is 2.1 million acres[39]. The number of agricultural farms in the command areas in year 2010 was 717,000[40]. Taking into account past trend of fragmentation this number is estimated to have increased to 1,032,000 farms by 2017. At appraisal, the number of families benefitted by the project was estimated to be 600,000. The ICR estimates that the number of beneficiary families now is more than 700,000. Total farm labor in the project area is estimated at 1.6 million, including 0.64 million part-time labor. This includes 0.4 million female labor that works at family farms.

[39] Source: Department of Irrigation and Power, Government of Punjab

[40] Agricultures Census 2010, Statistical Division Agriculture Census Organization, Government of Pakistan,.

Appendix 3.1: Import Parity Price of Wheat

Item	Wheat
CIF Price, (at US Gulf Port) US$/mt (A)	176.30
Add: Freight and insurance charges, US$/mt (B)	46.97
Net CIF Price (C = A-B)	223.27
Official Exchange rate (Rs/US$)	106.00
Net CIF Price at local currency (Rs)	23,666.62
Less: Port charges (Rs/mt) (0.28% of Net CIF price)	662.67
Net CIF price less port charges (Rs/mt)	24,329.29
Add: Sales Tax @16%	3,892.69
Add: Transport, handling, and marketing costs to Farm gate (Rs/mt) (10%) (K)	2,432.93
Import parity price at the farm gate (Rs/mt)	30,654.90
Parity price at the farm gate (Rs/kg)	30.65
Parity price at the farm gate (US$/mt)	289.20

Source: Commodity Markets Outlook – Pink Sheet, Commodity Prices, World Bank Quarterly Report, March, 2017

Appendix 3.2: Import Parity Prices of Fertilizers

Item	Commodities		
	Urea	**DAP**	**Potassium Chloride**
World Commodity Prices (US $/ ton)	199.3	345.3	245.6
Adjustment factor	1.0	1.0	1.0
Adjusted price US $ /ton	199.3	345.3	245.6
Freight charges US $ /ton	26.4	26.4	26.4
C&F price at Karachi US $ /ton	225.7	371.7	272.0
US Dollar conversion rate	106.0	106.0	106.0
C&F price at Karachi Rs /ton	23,922.4	39,398.4	28,830.2
Marine Insurance @ 0.23% of C&F price	55.0	90.6	66.3
CIF Karachi Price Rs /ton	23,977.5	39,489.0	28,896.5
Port Handling cost Rs /ton	800.0	800.0	800.0
Bank Markup @ 1% for one month	239.2	394.0	288.3
TCP Commission @ 2% of C&F value	478.4	788.0	576.6
Upcountry Expenses to the Project Area Rs /ton	4,000.0	4,000.0	4,000.0
Parity Price in the Project Area Rs/ton	29,495.1	45,471.0	34,561.4
Transport from farm to market Rs/ton	400.0	400.0	400.0
Parity Price at Farm gate Rs/ton	29,095.1	45,071.0	34,161.4
Parity Price at Farm gate Rs/ Kg	29.1	45.1	34.2
Parity Price at Farm gate Rs/50 Kg Bag	1,454.8	2,253.6	1,708.1

Source: Commodity Markets Outlook – Pink Sheet, Commodity Prices, World Bank Quarterly Report, March, 2017; Price Bulletin Dec 2016, Bureau of Statistics, Government of Pakistan

Appendix 3.3: Economic and Financial Prices Crop Outputs

Sr.	Description	Unit	Economic	Financial
	A. Yields (Outputs)			
1	Maize	Rs/Kg	30.38	33.75
2	Maize Stocks	Rs/Kg	3.38	3.75
3	Kharif Fodders	Rs/Kg	3.60	4.00
4	Rice	Rs/Kg	50.40	56.00
5	Husk	Rs/Kg	3.38	3.75
6	Sugarcane	Rs/Kg	3.08	4.05
7	Sugarcane tops	Rs/Kg	4.05	4.50
8	Wheat	Rs/Kg	30.65	30.38
9	Wheat Straws	Rs/Kg	11.25	12.50
10	R. Fodders	Rs/Kg	3.60	4.00
11	Pulses	Rs/Kg	52.45	67.50
12	Gram	Rs/Kg	33.84	37.60
	B. Inputs			
	I. Seed			
1	Maize	Rs/Kg	36.45	40.50
3	Kharif Fodders	Rs/Kg	90.00	100.00
4	Rice	Rs/Kg	270.00	300.00
6	Sugarcane	Rs/Kg	6.16	8.10
8	Wheat	Rs/Kg	39.85	39.49
10	R. Fodders	Rs/Kg	162.00	180.00
11	Pulses	Rs/Kg	81.00	90.00
12	Gram	Rs/Kg	91.13	101.25
	II. Fertilizers			
1	Urea	Rs/50 Kg Bag	1,455	1,200
2	DAP	Rs/50 Kg Bag	2,254	1,825
3	Potash	Rs/50 Kg Bag	1,708	1,470
4	FYM	Rs/ton	800	720
	III. Chemical sprays			
1	Weedicides	Rs/Spray/Acres	1,106.23	1,359.00

2	Insecticide/pesticide	Rs/Spray/Acres	1,005.29	1,235.00
IV. Farm Labor				
1	Hired	Per Day	351.00	450.00
2	Family	Per Day	280.80	360.00
V. Tillage Operations				
1	Ploughing/Planking	Per Pass	1,980	2,200
2	Deep Ploughing/ Leveling/Ridge Making	Per Pass	3,960	4,400

Source:

1, Price Bullions, Bureau of Statistics, Government of Pakistan

2. Pakistan Economic Survey, 2015-16, Ministry of Finance, Islamabad

Note: Family labor rate is priced at 80% of hired labor for conversion to economic values

Appendix 3.4: Economic Analysis: Cash Flow of Costs and Benefits – PBIP-II (Base Case) (Rs Million)

YEAR	Investment Costs	Incremental O&M		Total Costs	Agriculture Benefits			Net Incremental Benefits
		R&M	SCADA		Without Project	With Project	Incremental Benefits	
1	2,148.7	83.2	-	2,231.9	24,231.5	24,231.5	-	(2,231.9)
2	3,720.9	38.2	-	3,759.1	23,855.1	24,466.7	611.7	(3,147.4)
3	4,250.6	50.6	-	4,301.2	23,478.7	24,702.0	1,223.3	(3,077.9)
4	2,243.5	49.2	-	2,292.8	23,102.3	24,937.3	1,835.0	(457.8)
5	1,479.5	80.4	26.1	1,585.9	22,725.8	25,172.5	2,446.7	860.7
6	727.7	78.8	25.6	832.0	22,349.4	25,407.8	3,058.3	2,226.3
7	-	78.8	25.6	104.4	21,973.0	25,643.0	3,670.0	3,565.6
8		78.8	25.6	104.4	21,596.6	25,878.3	4,281.7	4,177.3
9		78.8	25.6	104.4	21,220.2	26,113.5	4,893.3	4,789.0
10		78.8	25.6	104.4	20,843.8	26,348.8	5,505.0	5,400.7
11		78.8	25.6	104.4	20,467.4	26,584.1	6,116.7	6,012.3
12		78.8	25.6	104.4	20,467.4	26,584.1	6,116.7	6,012.3
13		78.8	25.6	104.4	20,467.4	26,584.1	6,116.7	6,012.3
14		78.8	25.6	104.4	20,467.4	26,584.1	6,116.7	6,012.3
15		78.8	25.6	104.4	20,467.4	26,584.1	6,116.7	6,012.3
16		78.8	25.6	104.4	20,467.4	26,584.1	6,116.7	6,012.3
17		78.8	25.6	104.4	20,467.4	26,584.1	6,116.7	6,012.3
18		78.8	25.6	104.4	20,467.4	26,584.1	6,116.7	6,012.3
19		78.8	25.6	104.4	20,467.4	26,584.1	6,116.7	6,012.3
20-50		78.8	25.6	104.4	20,467.4	26,584.1	6,116.7	6,012.3
ENPV	10,544.2		151.2	11,267.2	183,615.5	212,239.6	28,624.2	17,357.0
							EIRR	**26.4%**

Annex 4. Bank Lending and Implementation Support/Supervision Processes
(a) Task Team members

Names	Title	Unit	Responsibility/ Specialty
Lending			
Masood Ahmad	Lead Water Resources Specialist	GEE06	TTL
Xiaokai Li	Lead Water Resources Management Specialist	GWA01	TTL
Shabir Ahmad	Program Assistant	SACPK	Team Member
Javaid Afzal	Sr Environmental Specialist	GEN03	Env. Safeguards
Anwar Ali Bhatti	Financial Analyst	SACPK	Financial Mgt
Pravin Karki	Sr. Hydropower Specialist	GEEDR	Team Member
Altaf Iqbal	Consultant	SACPK	Hydrology
Ghulam Ali	Program Assistant	SACPK	Team Member
Winston Yu	Sr. Water Resources Management Specialist	GWA03	WRM
Uzma Sadaf	Senior Procurement Specialist	GGO06	Procurement
Chaohua Zhang	Sr Social Sector Specialist	GSUSD	Social Safeguards
Supervision/ICR			
Masood Ahmad	Lead Water Resources Specialist	GEE06	TTL
Javaid Afzal	Sr Environmental Specialist	GEN03	Env. Safeguards
Shabir Ahmad	Program Assistant	SACPK	Team Member
Anwar Ali Bhatti	Financial Analyst	SACPK	Financial Mgt
S. Waseem AbbasKazmi	Financial Management Specialist	GGO24	Financial Mgt
Altaf Iqbal	Consultant	SACPK	Hydrology
Salma Omar	Financial Management Analyst	GSU06	Financial Mgt
Usman Qamar	Consultant	SASDA	Team Member
Uzma Sadaf	Senior Procurement Specialist	GGO06	Procurement
Chaohua Zhang	Sr Social Sector Specialist	GSUSD	Social Safeguards

(b) Staff Time and Cost

	Staff Time and Cost (Bank Budget Only)	
Stage of Project Cycle	**No. of staff weeks**	**USD Thousands (including travel and consultant costs)**
Lending		
Total:	78.57	$438.00
Supervision/ICR		
Total:	77.42	$558.56

Annex 5. Beneficiary Survey Results

(NA)

Annex 6. Stakeholder Workshop Report and Results

(NA)

Annex 7. Summary of Borrower's ICR and/or Comments on Draft ICR

Borrower's ICR

Attached below is the ICR prepared by the Borrower.

1. The Project

Barrages have always played a pivotal role in sustaining supplies to millions of hectares of irrigated land in different regions of the world. In Pakistan, there are fourteen barrages/head works and twenty four canals forming the present irrigation (2017) system in Punjab. This system is a part of the vast Indus River Basin with total capacity of 110,900 cusecs. These 14 barrages/head works have been constructed on the main Indus River and its tributaries; Jhelum, Chenab, Ravi and Sutlej. Fig 7.1 shows the location plan of the Barrages constructed on River Indus.

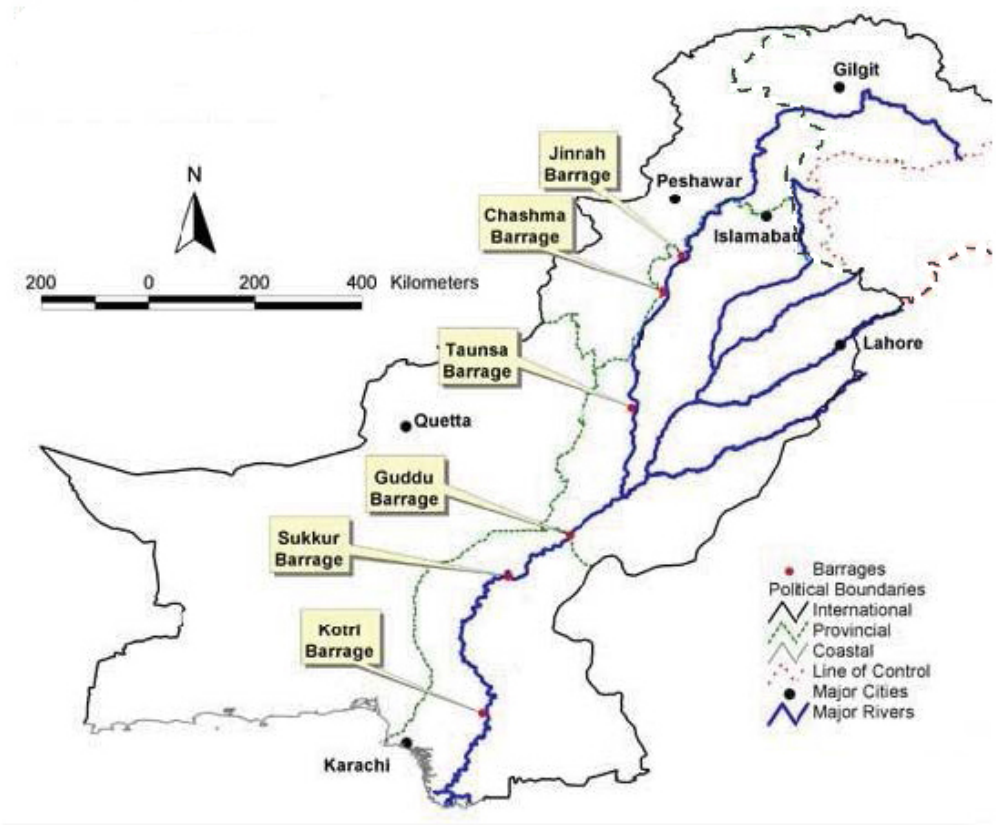


Figure 7.1: Location of Barrages on River Indus

Jinnah Barrage was built across River Indus which is located at about 3 miles downstream of the Kalabagh Town in Mianwali district, 126 miles downstream of Tarbela Dam, and 40 miles upstream of Chashma Barrage. It is the first diversion structure on the River Indus after it enters the northern plains of Punjab near Kalabagh Town. It has a design discharge capacity of 0.95 million cusecs (cubic feet per second) which corresponds to 100/- years return period flood. However, with the encroachment on the free board, it can pass 1.1 million cusecs (600-year return period flood).

Only one canal i.e. "Thal Canal" off-takes from the left side of the Jinnah Barrage. The canal had original design capacity of 6,000 cusecs but it has been enhanced to 9,000 cusecs through remodeling. The canal provides irrigation supplies to 2.1 million acres of land in Mianwali, Khushab, Bhakkar, Layyah and Muzaffargarh districts of Punjab. The entire command area lies in Thal desert. Thal canal is the lifeline for the people of the five districts as it not only supplies irrigation water but also drinking water for human, livestock and for recharging the aquifers from where water is pumped to meet supplemental irrigation requirements at critical times.

A run of the river Jinnah Hydro-Power Project has been constructed on the right bank with a maximum discharge requirement of 100,000 cusecs and the generation capacity of 96 MW. The hydropower consists of Eight (8) units each having 12 MW capacity. The powerhouse was completed in September 2013 and all units are in operation intermittently. The operation and maintenance of the barrage is being carried out by the Irrigation Department, Government of the Punjab while WAPDA is responsible for the Jinnah Hydropower.

1.1 Problems Identified in Operation of Jinnah Barrage

Commissioned in 1946, the barrage continued to offer inspection and repairs without any major problems until 1990, when 11 gates malfunctioned. In 2001, during very low flows, the barrage engineers noted significant damage to the friction blocks and the concrete base of the barrage and emergency repair works were carried-out.

Mainly, the following studies were carried out by renowned consulting firms/ individual consultants before start of rehabilitation works:

- Safety evaluation study (1998)
- Appraisal study (2001)
- Feasibility study (2003-05)
- Detailed design (2007-09)

Based on evaluation studies, it was concluded that:

- Retrogression resulted in occurrence of abnormally high velocities downstream of the barrage leading to repeated structural damages of friction blocks, inverted filter blocks and stone apron;
- Operational problems of gates and hoists:
  - ✓ Skin plate and trusses of gates damaged;
  - ✓ Erosion and corrosion of roller tracks, roller trains and rocking system; and
  - ✓ Cumbersome manual operation.

1.2 IBRD Loan Extended for Rehabilitation of the Barrage

The Government of Islamic Republic of Pakistan through the Government of the Punjab received an IBRD loan of US$ 145.6 million. The total project cost, at appraisal, was estimated at about US$ 155 million. The project completion cost comes to about US$ 145.3 million (latest estimates) including Borrower's contribution at about US$ 10.7 million against original envisaged at US$ 9.4 million. Bank has already cancelled US$ 10 million from the loan amount at request of the Borrower.

1.2.1 Project Components and World Bank Support

The World Bank provided assistance for disbursement of this loan to finance four components of the project, namely: (A) Rehabilitation & Modernization of Jinnah Barrage; (B) Improvement and Modernization of the Irrigation and Water Management System; (C) Monitoring and Evaluation of Project Impacts; and (D) Project Management, Technical Assistance and Training

The major contents of the loan has been illustrated in the Table below:

Table 7.1: Major Contents of the Loan – PBIP-II

Project Name	Punjab Barrages Improvement Phase II Project (PBIP-II)
Region	South Asia
Sector	Irrigation and drainage (80%): Flood Protection (20%)
Project ID	P096745
Borrowers	Government of Pakistan
Implementing Agency	Punjab Irrigation Department through Project Management Office for Punjab Barrages Rehabilitation and Modernization Projects Lahore, Pakistan.
Bank Approval Date	01-Jul-2010
Original Closing Date	30-Jun-2016
Revised Closing Date	30-Jun-2017

Mainly, the loan was utilized for payments under the contract JB/ICB-01 for Rehabilitation & Modernization of Jinnah barrage, which includes civil, mechanical and electrical works for rehabilitation & modernization of Jinnah barrage consisting of: (i) a subsidiary weir 800ft downstream of barrage main weir; (ii) rehabilitation to the barrage floor, impact and friction blocks, inverted filter, flexible stone apron and guide banks; (iii) extension of abutments and downstream divide walls; (iv) preparatory works; (v) replacement of barrage gates and hoisting system and automation of gates operation; (vi) upgrading of barrage monitoring system and basic operation and maintenance facilities.

Besides social, environmental and safeguard studies, a number of significant engineering studies were also undertaken during implementation of the project. A short list of these studies is appended as Appendix-A, which were also made available to the ICR Missions.

2. Borrower's Contribution and Project Completion Cost

The project completed all the components successfully with a total cost of about US$ 145.3 million including contribution of about US$ 10.7 million by the borrower against estimated (at appraisal) contribution of US$ 9.4 million. The savings in project completion costs were due to efficient use of funds, timely decision about any changes by the PMO and approvals by the Bank, timely advices by the POE and hardworking by the PIC, Contractor and all other project team members.

3. Project Development Objectives and Achievements

The development objectives as stated in the PAD are; (i) rehabilitating and modernizing Jinnah Barrage and carrying out affiliated works to enable reliable and uninterrupted supply of water for over 2.1 million acres of farmland benefitting about 600,000 farm families for irrigation and domestic water users; and (ii) build Punjab Irrigation and Power Department's capacity in improved water resources and irrigation system management.

3.1 Achievement of Project Development Objectives

At appraisal in year 2009, it was concluded that there are unreliability in supply of water to the target area. Delivery Performance Ratio (DPR) was estimated as 0.58. At completion the conclusion from the various studies (2016-17) has been drawn that; (i) there is less Interruption in water supplies to the Thal canal area. DPR value during 2016, i.e. after completion of main works, is estimated at 0.72, which means that water supply to the Thal Canal is comparatively more "reliable". The updated economic analysis concludes that the command area of Thal canal is 2.1 million acres[41.] The number of agricultural farms in the command areas in year 2010 was 717,000[42]. Taking into account past trend of fragmentation this number is estimated to have increased to 1,032,000 farms by 2017, which was to be 600,000 families in year 2009. It is estimated that the number of beneficiary families now is more than 700,000. Thus the project demonstrated clearly that it has completely achieved its development objectives.

3.2 Achievements by Components

The following paragraphs explain achievements by Components.

3.2.1 Component A: Rehabilitation and Modernization of Jinnah Barrage

All civil works and installation of gates have been completed. The Barrages is also equipped with the modern SCADA system for operation of barrage gates, discharge monitoring, automated data collection and transmission, central instrumentation observation system for piezometers to measure subsurface flows and CCTV based surveillance systems. SCADA is particularly important for Jinnah Barrage because of hydropower plant of about 96 MW capacity on right bank of the river. This hydropower plant passes a substantial discharge of around 100,000 cusecs and a sudden shutdown of hydropower plant could have a detrimental impact on the barrage and its operation if not handled properly. For this reason all the 58 gates of the Barrage, Thal Canal Head Regulator and Cross Regulator at Rd 2+300 (7 gates each) have been automated with SCADA control linked to the water levels upstream and downstream of the hydropower plant channel.

3.2.2 Component B: Improvement and Modernization of Irrigation and Water Management System

The review and updating of water resources management information systems (WRMIS) and Integration with Decision Support System (DSS) and a GIS based Crop Identification System (CIS) has been developed. Substantial progress is made in completing the Hydrological Modelling and the Real-Time Operational Modelling and the groundwater seasonal fluctuation maps have also been developed. The PID has acquired eight (8) sets of Bathymetric Equipment for measuring water depths and for collection of other data before, during and after floods. The PID has also initiated

[41] Source: Department of Irrigation and Power, Government of Punjab

[42] Agricultures Census 2010, Statistical Division Agriculture Census Organization, Government of Pakistan,.

the pilot project for revival of degraded river channels in Punjab province. The site for first pilot of inflatable rubber weir is selected at Bahawalpur which would provide over 10,000 acres feet of storage, covering about 2,000 acres of dry river bed and a supply of about 70 cusecs.

3.2.3 Component C: Monitoring and Evaluation of Project Impacts

This component is also financed by the loan. The Borrower appointed M&E Consultants with clear and elaborative TORs. The M&E Consultant were put on board on May 10, 2011 whereas the Project Implementation Consultants (PIC) came on board on April 01, 2011. The M&E Consultant could not establish baseline and any adequate mechanism to measure the project outcome indicators as described in the Project Appraisal Document. However, the TOR of M&E Consultants with regard to component A were to independently assess and report the progress besides looking for implementation issues and making suggestions to resolve the same. The M&E consultants used to visit site frequently (Usually once or twice a month) and gather information with respect to the overall progress achieved. The M&E Consultants also produced their independent Inception, Mid-term and Final Impact Assessment reports. Reports by the M&E Consultants have several gaps and weaknesses in parts of the portfolio.

3.2.4 Component D: Project Management, Technical Assistance and Training

This component was also fully financed by the World Bank/IBRD. PMO engaged a number of professionals for managing: procurement; contract management; implementation of social and environmental management plan; barrage management; communication with all stakeholders; legal issues; irrigation and drainage; and water resources development etc. under this component. Moreover, physical improvements and modern technology interventions were also introduced under the project (e.g. SCADA system, etc.). Under Environmental and Social Management and Monitoring Plan (ESMMP), trainings were provided to field staff of PMO; all site personnel of contractors and consultants; including drivers, mechanics, camp staff and restoration teams. Bank staff also carried out training of PMO and other staff in social and environmental monitoring. The ESMMP also included "Effects Monitoring" covering: (i) Ambient air quality; (ii) Quantity and quality of ground water used for domestic purposes; (iii) quality of surface water used for construction activities; (iv) emission of dust, smoke and potential air pollutants from the construction machinery and vehicles; (v) visual check for vegetation loss; (vi) noise pollution; (vii) soil erosion; (viii) solid waste generation, wastewater generation and oil wastes/spills; (ix) protection of the Indus Dolphin; (x) water flows in the river and Thal Canal; and (xi) monitoring of cumulative impacts vis-a-vis JHPP. Twenty IPD staff completed post-graduate degrees and received further overseas training.

Real Time Flow Measurement (RTFM) equipment were installed on all main canals and appropriate training was given to the staff for operating the system up to distributary canal level where one complete system was put into place.

Utilizing this loan, the Punjab Irrigation Department has established a new cadre of staff for operation of barrages, and also strengthened its Program Management and Implementation Unit (PMIU) that is responsible for maintaining a water resources management information system (WRMIS). The new technology introduced (e.g. RTFM, automatic data acquisition, storage, transmittal and retrieval; SCADA system, DSS; and acquisition of bathymetric equipment) coupled

with on-the-job training, and higher studies. The new staff will be trained for using the SCADA and other modern systems. All this has enabled the Irrigation Department to manage water resources better than before.

Unfortunately, PMO staff could not avail specialized procurement training arranged by the World Bank at Turin, Italy through the ILO, as GoPunjab policy allows training expenditure to be made only under grant funds.

4. Socio-Environmental Aspects and Impacts

Since the project involves large-scale construction on the Indus River and irrigation systems and the possibility of interruption of canal supplies for a short or long duration were expected, the project was categorized as Environmental Category "A" under the prevailing laws. This requires detailed environmental and social assessment, development of social and environmental management plans, public consultations and disclosures, and their diligent implementation and monitoring. Established along the experience with the Taunsa Barrage Project, a "development assistance" approach instead of a narrowly focused "mitigation and compensation" approach was taken up to address the social and environmental matters/ issues raised during implementation.

To comply with Pakistan as well as international financiers social and environmental safeguard policies, environmental impact assessment was formulated to address the social and environmental issues during construction as well as operation phases. The environmental management and monitoring plan (EMMP) and a resettlement action plan (RAP) was also prepared to mitigate the anticipated adverse social and environmental concerns.

The environmental and social impacts anticipated and identified during monitoring were:

- *Biological Impacts:* Impacts on Taunsa wildlife sanctuary; threats to Indus dolphin upstream or downstream; Impacts on algae and micro-invertebrates; impacts on fish fauna;
- *Physical Impacts:* change in river morphology; waterlogging; impacts on water quality; changes in ambient air quality; increased noise levels; and
- *Social Impacts:* Community displacement and resettlement; pending claims/grievances of project affected persons (PAPs); disturbance in fishing; disturbance in the business; economic stability to canal command area; social mixing; downstream fish catch.

All these issues were well addressed during the construction phase. The most significant positive impact of the project was envisaged about the sustainability of the agriculture, ecosystem in the canal command areas which otherwise could result in desertification at country level.

The seed distribution activity was implemented through Punjab Rural Support Program (PRSP), a NGO involved in community mobilization and development activities in the province. The program was divided into two phases as under:

- *Phase-I (2012)*; Distribution of 75941 bags of early wheat seed variety, “Sehar 2006” to 27951 small farmers located in 418 villages of nine tehsils of Khushab, Mianwali and Bhakkar districts during Rabbi 2012-13 cropping season.

- *Phase-II (2013)*; Distribution of 82000 bags of early wheat seed variety, "Sehar 2006" as well as Canola oilseed to 38000 small farmers located in 702 villages of four tehsils of Layyah and Muzaffar Garh districts for 2013-14 cropping season.

5. Sustainability

There are no serious concerns on the sustainability of the investment. Since the rehabilitation of the Barrage has eliminated the possible sources of failure, it is expected that the structure of the Barrage is safe for another 50 years. A number of mechanized instruments have been installed to monitor the performance of the barrage structures and its foundations. Moreover, institutional capacity of the Power and Irrigation Department (P&ID) is strengthened in carrying out operations and overall management of the water resources and the river system in the province through technical assistance and various components of the project, technical assistance have also been provided to develop adequate institutional capacity for operation and maintenance of project facilities. The P&ID is now fully capable and have capacity to oversee not only the Jinnah Barrage but also all the barrages in Punjab.

The only and primary risk to sustainability of the development outcome is, if an inadequate annual O&M budget for the rehabilitation work is allocated. Towards this end, the PMO is confident that the P&ID will not only be receiving the O&M budget allocation continued under the present yardstick but also the operation and maintenance model of Jinnah Barrage will be upgraded and strengthened as a model for safe and sustainable use of other barrages in Punjab.

6. Overarching Themes, Other Outcomes and Impacts

- The SDAP of Jinnah barrage encompassed distribution of improved seed, developed water supply schemes, development initiatives at the barrage area including establishment of social infrastructure (a public park, primary schools, a BHU, and access roads).
- One each for boys and girls Primary Schools were constructed and handed over to Education Department for operation and for up-gradation of existing primary schools to middle schools.
- The Old Kalabagh Railway Bridge was rehabilitated and handed over to Pakistan Railway. It has not only enhanced the economic activities and provided shortest route connecting suburbs in the area but also playing role to alleviate the poverty due to increased economic and business activities.
- More than 50 CBOs were established and trained in record keeping before handing over water supply schemes to them for operation at their own (out of 54 water supply schemes, 42 were handed over to whereas the remaining 12 schemes could not be handed over due to various reasons explained in the reports submitted by PIC). These schemes were completed by the PHED and financed for construction under the project. This impacted a new concept of ownership among the community at and surrounding the project area.

6.1 Poverty Impact Analysis

The distribution of economic benefits and costs analysis shows that against economic expenses of about Rs 7.4 billion by the government, distribution of benefits would be among farmers as Rs 23.6 billion; labor as Rs 90.6 million and country as Rs 175.9 million. Poverty impact analysis estimated poverty impact ratio as 32.5 percent as shown at Table below.

Table 7.2: Poverty Impact Analysis - Rs million

Particulars	Govt.	Labor	Farmers	Total
Benefits (Losses)	175.9	90.6	23,628.8	23,895.3
Financial Return to Government	(7,409.0)	n/a	n/a	(7,409.0)
Total Benefits (Losses)	(7,233.2)	90.6	23,628.8	16,486.3
Proportion of the Poor (%)*	22.3%	75.17%	29.2%	n/a
Benefits to Poor	(1,613.0)	68.1	6,899.6	5,354.7
Poverty Impact Ratio (%)				**32.5%**

Source: Estimates by Project Economist; * World Bank Development Indicators 2014

7. Lessons Learned

Lesson 1: The key lesson demonstrates the efficacy of integrating the potentially two contracts into award of one contract. By combining Component-A (Civil Works) and Component B (Electro Mechanical Works) the results were achieved with great success. It proved as an imperative mechanism that obliged for undertaking the same approach in similar projects in Pakistan. By integrating of these two project interventions (components), the PMO demonstrated high level of understanding, planning, administration and implementation of (i) infrastructure; (ii) installing of electro-mechanical equipment; (iii) institutional reforms, and (iv) a wide social and safeguard interventions can be much effective in a single project.

Lesson 2: With a high level of commitment of the Borrower it is possible to design and implement a project quickly with reasonable quality and fulfilling safeguard and fiduciary responsibilities. The Task Team also ably supported the client in fulfilling its responsibilities through quick decision making and informing the client about the decisions informally.

Lesson 3: Though the informal coordination and review arrangements are not a substitute for formal reviews and appropriate record keeping, yet it helps in expediting the progress and in timely achieving the targets if done with good reasons and with diligent intentions.

Lesson 4: For sustainability of the governance issues, staff available within the department should be deployed for the project, since contract based staff may not be available for long term for operation phase of the project.

Lesson 5: Monitoring and Evaluation (M&E) to be seen as a tool for project management, not as an obligation imposed from the outside, with project staff mechanically completing forms and others seeing their task merely as the collection of data for writing progress reports for the Bank, it needs to be improved. Capacity building in M&E system design and implementation is critical. M&E design, and implementation are critical not only for practical feedback to implementing agencies and review missions, but also as an important means to document results. It demands, more explicit attention for developing framework for M&E and further to periodically supervision

of M&E activities and extending guidance to the M&E teams during the study and implementation of the project. The importance of the baseline data collection and analysis thereof should be specifically part of the M&E reports.

8. Performance Evaluation (Rating) By PMO

8.1 Performance of World Bank

Rating: Satisfactory: The World Bank Task team provided all the required support to the project implementing entity with regular and scrupulous supervision and guidance where and whenever required. The Bank extended its commendable support to the project in the areas of fiduciary and quality control and quality assurance related issues. All the required NOL from Bank got well in time, withdrawal applications were processed in time by the Bank, close coordination throughout the project implementation was the key for timely completion of the task. The Bank performance during the project is avowed as "Satisfactory".

8.2 Borrower's Performance

Rating: Satisfactory: Irrigation Department appreciate the role of Borrower (Government of Pakistan) for their help and cooperation all the time. The Borrower's performance is weighed as "Satisfactory".

8.3 Implementing Agency's Performance

Rating: Satisfactory: The project has been implemented by PMO Punjab Barrages with the assistance of PMIU, PRSP and PHED. Performance of all implementing units has been rated "Satisfactory" and highly Satisfactory in some areas by the Bank while reviewing the Project implementation during supervisory mission visits. During the implementation of the project, PMO exercised effective control over implementation and coordination of the project. The performance of implementing agency during the project is therefore weighed as "Satisfactory".

9. Summary Conclusion

The project is a success story of Barrage Rehabilitation and Modernization, Institutional upgradation, System Integration, SCADA development and has a long lasting impact on the socio-economic condition by successful implementation of SDAP. The timely completion of project has eliminated the possibility of fatal incidents due to partial or complete failure of the Barrage.

A photo gallery is also appended as Appendix-B to the Borrower's ICR.

Appendix-A
Borrower's ICR

List of Key Reports Produced during Implementation of PBIP-II Project

Report Title	Year
M&E Strategy Report (Final)	November-11
Baseline Report	February-12
Training Report	May-12
Implementation Support for Improvement and Modernization of Irrigation Water Management System	May-12
Panel of Experts (POE) Report # 01	July-12
Quality Assurance Plan (QA / QC Manual) Part A, Civil Works,	December-12
Panel of Experts (POE) Report # 02	January-13
Quality Assurance Plan (QA / QC Manual) Part B, Mechanical & Electrical Works,	March-13
Geo-Physical Survey Report of Right Under Sluices and Main Weir	May-13
Impact Assessment of Seed Distribution Phase-I Program	November-13
Joint Condition Survey of Existing Bridge of Jinnah Barrage	November-13
Panel of Experts (POE) Report # 03	January-14
Mid Term Impact Assessment Report	July-14
Impact Assessment of Seed Distribution Phase-II Program	October-14
PMIS Development Report	October-14
Hydraulic and Structural Design Report (Draft),	February-15
Final Environmental Audit Report	June-15
Detail Design Report – Mechanical Works	October-15
Final Impact Assessment Report	December-15
Implementation Completion Report of SDAP	March-16
Final Report (Completion Report) – M&E Consultants	March-16
Project Completion Report – PICs	March-16
Operation & Maintenance (O&M) Manual for Jinnah Barrage	March-16
Operation & Maintenance (O&M) Manual for Gates of Jinnah Barrage & Allied Structure	March-16
Operation & Maintenance (O&M) Manual for Power Supply / Lighting System	March-16
Jinnah Barrage Piezometer System	March-16
Operation and Maintenance Manual for SCADA Operator & Administration	March-16
Potohar Climate Smart Irrigated Agriculture Project (Future Project) – All Reports	August-16
Final Report Water Resources Management and Information System (WRMIS) and Decision Support Systems (DSS)	June -17

Appendix-B
Borrower's ICR

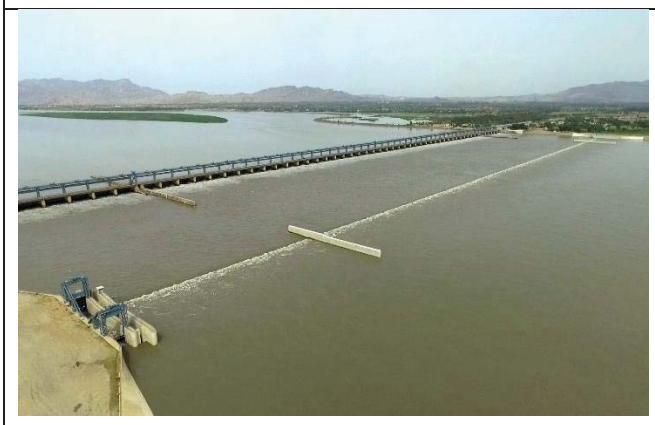
Photo Gallery of Jinnah Barrage Rehabilitation Project

VIEW OF COMPLETED WORKS D/S OF EXISTING BARRAGE (LEFT HALF)

REHABILITATION OF EXISTING BARRAGE COMPLETED

VIEW OF SUB-WEIR

REPLACEMENT OF BARRAGE GATES



AERIAL VIEW OF JINNAH BARRAGE

VIEW OF ROAD BRIDGE AT JINNAH BARRAGE

VIEW OF COMPLETED SUB WEIR

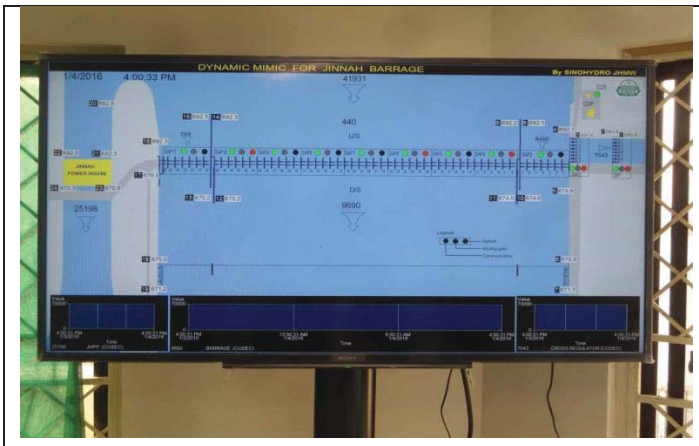
PAINTING OF GATE IN PROGRESS

HOISTING SYSTEM OF HEAD REGULATOR THAL CANAL

CONTROL ROOM

CONTROL ROOM

CCT SYSTEM



DYNAMIC MIMIC

KALABAGH RAILWAY BRIDGE

BOYS MIDDLE SCHOOL

GIRLS MIDDLE SCHOOL

BHU COMPLEX

BASIC HEALTH UNIT (BHU)

PUBLIC PARK

MOSQUE

OVERHEAD WATER TANK

WATER SUPPLY SCHEMES

WHEAT SEED DISTRIBUTION

POE VISIT TO JINNAH BARRAGE SITE (JANUARY 16, 2013)

Annex 8. Comments of Co-financiers and Other Partners/Stakeholders

NA

Annex 9 List of Supporting Documents

Bank Documents

1. Project Appraisal Document, June 4, 2010 (Report No: 51016-PK)
2. Bank Mission Aide Memoires (12)
3. Implementation Status and Results Reports (13)
4. Loan Agreement December 18, 2010
5. Project Agreement December 18, 2010

Reports related to Feasibility Study

1. Inception Report - 2003
2. Environmental & Social Impact Assessment Report - 2005
3. Feasibility Report - 2005
4. PC-I prepared by feasibility consultants - 2005

Reports on Detailed Design

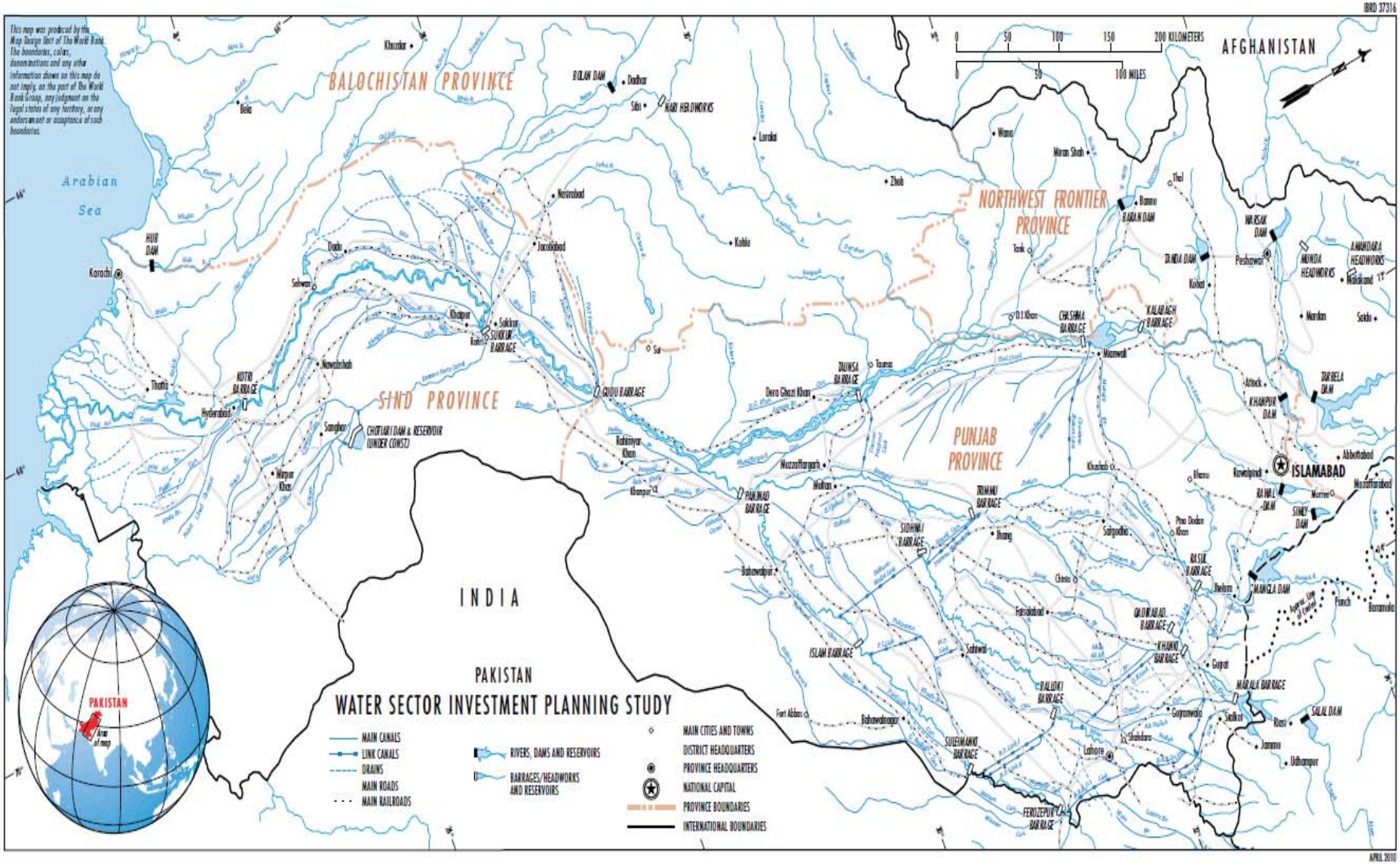
1. Inception Report - January 2008
2. Feasibility Review Report - Feb. 2008
3. GIS Data Development Report - March 2008
4. Geophysical Investigations Report - April 2008
5. Report on Survey of Gates, Hoists and Regulatory System - April 2008
6. Hydrological & Bathymetric Survey Report - May 2008
7. Geotechnical Investigations Report - May 2008
8. Design Criteria - July 2008
9. Draft Report on Impact of Flood 1992 - August 2008
10. GIS Analyses Report - November 2008
11. Draft Hydrological & Sedimentation Report of Terbela Flushing and Proposed Kalabagh
12. Alternatives Report - March 2009
13. Draft Report on Impact of WAPDA Hydropower Project - May 2009
14. Mechanical Design Report - July 2009
15. Draft Concept Design Report for Rehabilitation of abandoned Kalabagh Railway Bridge -
16. Environment and social Assessment Report (ESIA) - July 2009
17. Summary of ESIA report - July 2009
18. Project Main Report- August 2009
19. Project PC-I - August 2009
20. Social Development Action Plan - September 2009
21. Design Report - September 2009
22. Draft Bidding Documents for Civil, Electrical & Mechanical Works - August 2009

Other Documents

1. Jinnah Barrage: Environment and Social Assessment Report July 2009
2. Jinnah Barrage: Project PC-1 August 2009
3. Jinnah Barrage: Design Report September 2009

4. Executive Summary: Environmental & Social Impact Assessment & Action Plans, Nov. 2009
5. M&E Reports: (Baseline, Feb 2012, Mid-Term July 2014, Final Impact Assessment, Dec. 2015, SDAP Completion Report, March 2016)
6. Monthly Progress Reports Various
7. Quarterly Progress Reports Various
8. Panel of Experts' (POE) Reports (Three)
9. Environmental Audit Report
10. Third Party Audit Reports
11. Ecological Baseline and Monitoring-Final Monitoring Report 2016 by WWF
12. Misc. Monitoring Reports by WWF (Birds, Fish, Mammals, Vegetation & Tree Plantation)
13. Jinnah Barrage: Draft Project Completion Report by PIC, 2016
14. Various Operation & Maintenance Manuals, 2016

MAP



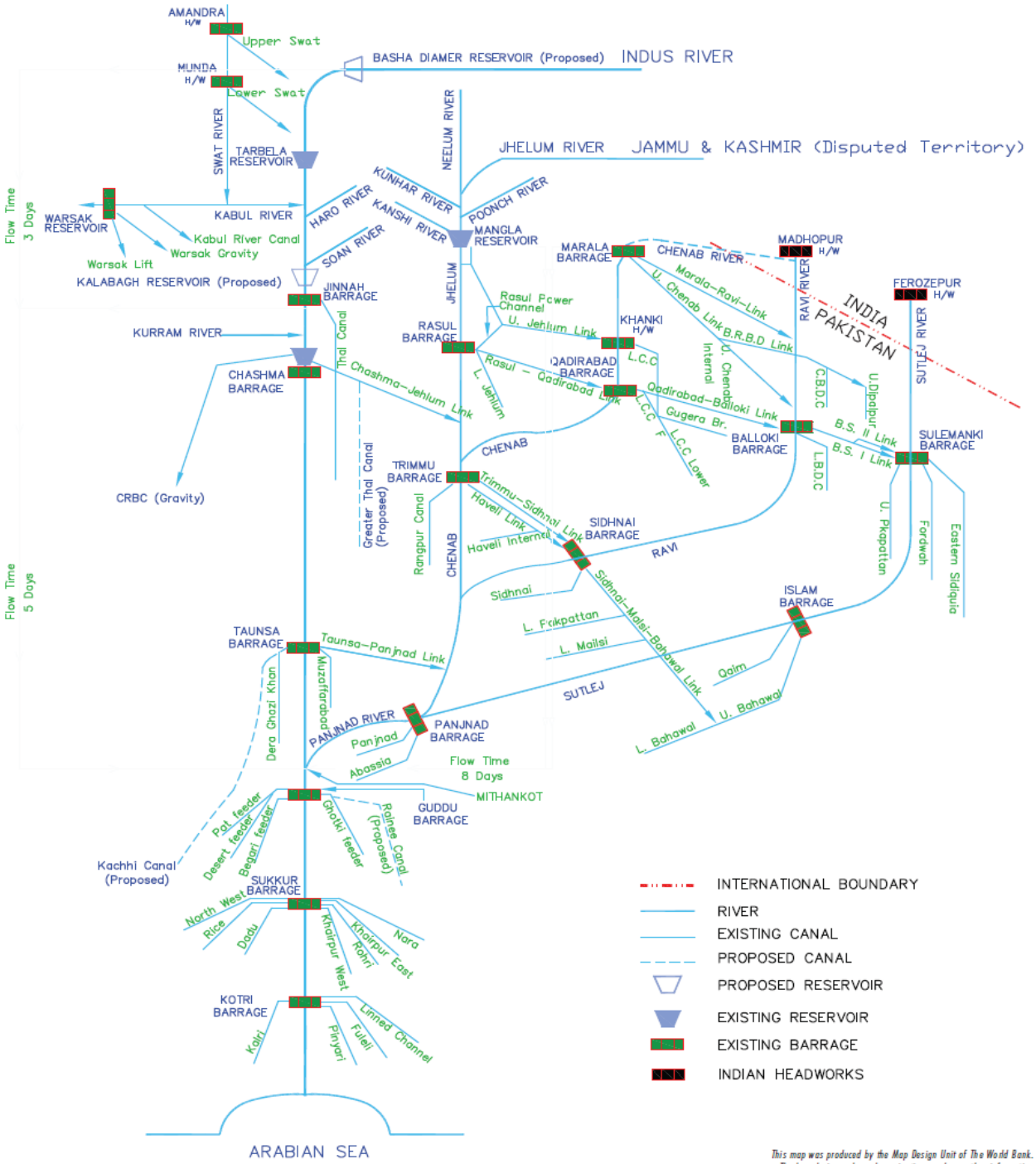
PAKISTAN

WATER SECTOR INVESTMENT PLANNING STUDY

IBRD 37352

PAKISTAN

SCHEMATIC DIAGRAM OF PAKISTAN INDUS BASIN WATER SYSTEM



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NOVEMBER 2009