



Asian Development Bank

Project Number: PAK 39590
December 2005

Small Scale Technical Assistance

Islamic Republic of Pakistan: Additional Works for Preparation of Hill Torrents Management Project

I. INTRODUCTION

1. The Government of Pakistan (the Government) has requested the Asian Development Bank (ADB) to finance the proposed hill torrents management project (the Project) from the savings of the ongoing loan for the Chashma Right Bank Irrigation Project, Stage III (CRBIP-III).¹ The need of the Project for the hill torrents that cross the Chashma Right Bank Canal (CRBC)² was earlier raised in the stakeholder workshop for CRBIP-III that was held in March 2002, and discussed between ADB and the Irrigation and Power Department (IPD) of the Government of Punjab (the Punjab). IPD carried out an updated feasibility study for the Project in 2004-05. ADB reviewed the proposed plan and design, and recommended that the design of structures be reviewed to reduce the technical risks involved with them. ADB proposed to provide a technical assistance (TA) grant to finance necessary revision works. ADB Management cleared a concept paper for the TA in September 2005. A TA fact-finding mission was fielded from 10 to 18 October 2005, and reached an agreement with the Government on the goals, impacts, outcomes, scope, implementation arrangements, cost, financing arrangements, and terms of reference of the TA.³ The TA design and monitoring framework is in Appendix 1.

II. ISSUES

2. The alluvial fan (*pachad*) area located to the west of CRBC has been left undeveloped, making agriculture dependent on highly unpredictable and often uncontrollable hill torrent floods. When hill torrent floods are large in scale, people in *pachad* and the riverine area of the Indus River both suffer from severe flood damage. Under the spate irrigation system, communities in *pachad* area construct earthen bunds in hill torrents every year to divert floodwater into their land, and then breach them after sufficient volume of water is down. However, intense floods

¹ Loan No. 1146-PAK (SF), approved on 17 December 1991 for 213.34 million, and to be closed on 30 June 2009. As of 25 October 2005, the uncommitted loan amount is \$38.16 million.

² CRBC is the canal system that was developed under the three stages of CRBIP. CRBC consists of 274 kilometer long main canal and 71 distributary canals with a total length of 863 kilometers. The system is to irrigate the total cultivable command area of about 252,000 hectares.

³ The TA first appeared in ADB Business Opportunities (internet edition) on 27 September 2005.

cannot be diverted, as earthen diversion weirs can easily be breached by floods. The Project has been proposed by the Punjab to construct permanent structures to disperse the torrential floods in *pachad* area, and thereby making it possible to utilize flood water for spate irrigation in a controlled manner, and reduce the flood risk in downstream area. Three major hill torrents in the west of the CRBC, Sanghar, Vehowa, and Kaura were proposed to be covered under the Project. The proposed Project is independent in nature and it is complementary to CRBIP-III, as it would also reduce the risk of floods from the three hill torrents in the area to the immediate west to the main canal, which has been identified as one of the adverse impacts of the CRBIP-III.

3. The proposed project is expected to save poorer people in the dry zone from flood damage and enhance their agricultural production by increasing usable flood water for farming. This will contribute to sustainable pro-poor growth, one of three pillars of ADB's Country Strategy and Program approved in May 2002. Both the Government and the Punjab are strongly committed to poverty reduction, providing the poor with increased economic opportunities and greater access to physical and social assets as expressed in their poverty reduction strategies,⁴ as well as in the partnership agreement with ADB.⁵ The proposed Project is, therefore, consistent with the development strategies of the Government, the Punjab, and ADB.

4. In March 2005, IPD completed with its own resources a feasibility study⁶ that updated an earlier study carried out in 1995-96.⁷ ADB and IPD reviewed the final report and noted that while the study in general provides an adequate basis for project approval, there remains technical uncertainty in the design of some structures that may lead to vulnerability to potential large floods. In August 2005, ADB's staff consultant and IPD agreed that additional work was needed to review the structural design. In view of the importance of a revision of the design that would improve technical soundness of the proposed Project, ADB proposed to finance the re-design work from its TA modality.

5. There have been several interventions made to hill torrents in Dera Ghazi Khan District that are located to the south of the CRBC area. Construction of diversion structures to Kaha hill torrent, being financed under ADB-financed Flood Protection Sector Project and completed in 1996, was the first major intervention made in the District. This was followed by a project for Vidore hill torrent, being financed as part of a World Bank loan and completed in 1996, and the Mithawan Hill Torrent Pilot Project in Punjab, financed by the Japan International Cooperation Agency and completed in 1999. As of August 2005, structures constructed in Kaha hill torrent have been severely damaged by a series of floods in recent years, and main parts of five out of 13 structures have collapsed completely, while the rest are functioning partially. Three cross structures were totally washed away by floods due to lack of river bed fixing and debris/sedimentation management structures in upstream, and inadequate design of structures.⁸ On the other hand those in Vidore and Mithawan hill torrents perform relatively better, though with some sedimentation and minor damages. The better performance is mainly

⁴ *Poverty Reduction Strategy Paper*, December 2003, http://www.adb.org/Documents/Poverty/pa_pak.pdf, and Punjab Poverty Reduction Strategy Paper (P-PRSP), October 2003.

⁵ *Poverty Reduction Partnership Agreement Between the Government of the Islamic Republic of Pakistan and the Asian Development Bank*, September 2002, <http://www.imf.org/external/pubs/ft/scr/2004/cr0424.pdf>

⁶ National Engineering Services Pakistan (pvt) Limited. March 2005. *Updating Feasibility Study on Hill Torrents Management Plan in CRBC Area in Dera Ghazi Khan District*. Lahore.

⁷ National Engineering Services Pakistan (pvt) Limited. February 1997. *Master Feasibility Studies for Flood Management of Hill Torrents of Pakistan, Flood Management of D.G. Khan Hill Torrents*. Lahore.

⁸ ADB's staff consultant pointed out several shortcomings of the design of main structures under Kaha project, such as embankment without proper compaction, filter layer not conformed with required particle distribution, and shortage of cutoff wall penetration into the foundation and abutments in both sides.

due to the effect of reduced large debris by bed fixing structures and better design of the weirs based on the experience of Kaha structures. The performance of existing diversion structures demonstrates the strong need for a prudential approach in designing the structures to make them tolerant of large floods.

III. THE TECHNICAL ASSISTANCE

A. Impact and Outcome

6. The TA will help the Punjab complete the design of the proposed hill torrent management project for the three hill torrents located in the CRBC area, namely, Sanghar, Vehowa, and Kaura hill torrents. The proposed Project intends to (i) reduce flood incidents in the alluvial fan areas and Indus riverine area located in the upper and lower slope of the command area of the Chashma Right Bank Irrigation Project, and (ii) increase agricultural production in the alluvial fan area.

B. Methodology and Key Activities

7. The TA will be implemented on the basis of the extensive studies on hill torrents that have been carried out by the Irrigation and Power Department (IPD) in the past. The TA will be guided by the following principles: (i) hill torrent structures should be designed based on the field observation of the topographic, geotechnical, and hydrological conditions of the specific locations, rather than a desk study, as well as considering the lessons learned from the experiences of existing structures in other hill torrents; (ii) given the unpredictability of the torrential floods, design of structures and their safety level must be determined with due consideration of possible errors in hydrological projection, and the best possible alternative options found to cope with erratic floods; and (iii) design of structures should be determined at the point where the marginal cost of enhancing the specification becomes equal to the marginal benefit from it.

8. The proposed Project is to construct flood dispersion and diversion structures in three hill torrents that cross the Chashma Right Bank Canal in its Stage III section, namely, Sanghar, Vehowa, and Kaura. Social mobilization and training to strengthen water user groups will also be provided. The proposed Project would consist of (i) flood dispersion and diversion structures, (ii) strengthening water user groups, and (iii) detailed design and project management. The structures to be constructed will disperse torrential floods to the branch channels in a controlled manner, and thereby decrease the flood discharge to downstream of the torrents, and increase the volume of usable flood water for spate irrigation in the alluvial fan area. Appendix 2 provides an initial poverty and social analysis of the proposed Project.

9. It is envisaged that the outputs of the TA would form the basis for IPD to prepare a project document that is needed for obtaining government's approval, and provide necessary information for obtaining ADB's approval to finance the proposed Project from the savings of the loan for CRBIP-III. The TA will also support IPD in establishing a panel of experts to review and supervise the technical aspects in design and construction works under the proposed Project.

C. Cost and Financing

10. The total cost of the TA is estimated at \$165,000 equivalent. ADB will finance a total of \$150,000 equivalent. The TA will be financed on a grant basis by ADB's TA funding program. The Government will provide the remaining local currency cost of \$15,000 equivalent. Detailed

cost estimates are given in Appendix 3. The Government has been informed that approval of the TA does not commit ADB to finance any ensuing project.

D. Implementation Arrangements

11. The TA will be implemented over 15 months, commencing in January 2006 and ending in April 2007. Of the period, main work for the design review will be carried out in the initial three months, followed by 12 months to support the panel of experts intermittently. Individual consultants will be engaged by ADB in accordance with its *Guidelines for the Use of Consultants* and other arrangements satisfactory to ADB for the selection and engagement of domestic consultants. All procurement under the TA will follow ADB's *Guidelines for Procurement*. The TA will require a total of 14 person-months of consulting services, comprising 3 person-months of international and 11 person-months of domestic consultants' inputs. The TA's initial three-month work will be led by a domestic river structure engineer with experience in working on design and construction supervision of hill torrent intervention structures. Other domestic consultants' expertise is required for the initial three-month work in design and hydrology. An international hill torrent specialist will provide guidance to the design work at commencement of the services and review the outputs in the end of the three-month period with his/her 1.5 person-months services. Another 1.5 person-months of the international consultant's services and 2 person-months of a domestic Senior Engineer will be allocated for them to serve as two non-government members of the five-member panel of experts that will be formed to provide advisory services in formulating a hill torrent management strategy, and supervising the detailed design and initial implementation of the proposed Project. The outline terms of reference for consulting services are in Appendix 4.

12. The executing agency for the TA will be IPD. IPD will provide necessary support to the TA consultants in performing their terms of reference, including access to information and projects sites and facilities. The Chief Engineer, Dera Ghazi Khan Zone will serve as a TA Manager, concurrently with his ordinary duties as a head of the zonal office, and responsible for assigning counterpart staff who will work together with the consultants to implement the TA. The Chief Engineer, Dera Ghazi Khan Zone will subsequently serve as a Project Director during project implementation. The Government has agreed to (i) appoint one qualified staff as a full-time TA coordinator, and supporting staff as required; (ii) provide office space within the Dera Ghazi Khan Zone Office of IPD, utilities, furnishings, and communication facilities for the consultants; (iii) provide assistance to the consultant in collecting data and information needed for carrying out their assignments, and in conducting consultation meetings and workshops; (v) obtain permission from the Government for the international consultant to enter Dera Ghazi Khan subdistrict, as needed; and (vi) prepare a simple and easy-to-understand brochure of the proposed Project in local language, and distribute it to the people in the project area for public awareness purposes. Equipment procured under the TA will be turned over to the executing agency.

13. The consultants will deliver (i) a revised design report for the Project including a revised cost estimate, and (ii) a revised Project document for Government approval. These reports will be submitted to ADB and IPD in forms of hard copy and soft copy. Following ADB's Public Communication Policy, all reports that will be delivered under the TA will be disclosed to the public upon finalization. A tripartite meeting between the Government, ADB, and the consultants will be held in Lahore following the submission of the revised design report.

14. An advanced payment facility amounting to \$7,000 will be established for IPD in accordance with the ADB's *Guidelines for Disbursement of Technical Assistance* for the expenses of workshops and equipment.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
<p>Impact</p> <ol style="list-style-type: none"> 1. Reduce flood incidents in the alluvial fan areas and Indus riverine area located in the upper and lower slope of the command area of the Chashma Right Bank Irrigation Project. 2. Increase agricultural production in the alluvial fan (<i>pachad</i>) area. 	<p>Frequency of flood damage becomes less, from almost every year to once in more than two years.</p> <p>Crop production in 116,000 acres <i>pachad</i> area increases from 3,000 tons to 18,600 tons (with once-in-5 year probability floods) and from 1,200 tons to 24,200 tons (with 25 year floods).</p>	<p>Records and reports by the Water and Power Development Authority and IPD</p> <p>Revenue Office and Agriculture Department, Dera Ghazi Khan District Field Investigations.</p>	<p>Assumptions</p> <ul style="list-style-type: none"> • Hydrological assumptions are robust. • Diverted water is efficiently drawn to fields and efficiently used by farmers. <p>Risk</p> <ul style="list-style-type: none"> • Hill torrent floods exceed the statistically estimated peak discharge.
<p>Outcome</p> <ol style="list-style-type: none"> 1. Disperse flood water in the alluvial fan in a controlled manner. 2. Increase utilization of flood water for spate irrigation. 	<p>Designed flood discharge is diverted to torrent branches.</p> <p>Cropping intensity in the alluvial fan area increases from current average of 12% to 70%.</p>	<p>Flood discharge records to be monitored by Dera Ghazi Khan Zone Office of IPD</p> <p>Revenue Office and Agriculture Department, Dera Ghazi Khan District Field Investigations.</p>	<p>Assumptions</p> <ul style="list-style-type: none"> • Diversion structures function as designed. • Diversion channels have adequate capacity. • Bunds to store flood water in the farm land have sufficient capacity. <p>Risk</p> <ul style="list-style-type: none"> • Structures are damaged by floods.
<p>Outputs</p> <ol style="list-style-type: none"> 1. Revised design of the proposed structures. 2. Adequate level of consultation with the people in the project area. 3. Documents needed for government's approval of the Project. 	<p>Revised design report.</p> <p>Records of information dissemination and consultations.</p> <p>Project proforma document (PC-1).</p>	<p>Clearance of the report by the panel of experts.</p> <p>Feedback from the people.</p> <p>Approval of the proposed project by the Government.</p>	<p>Assumptions</p> <ul style="list-style-type: none"> • The panel of experts functions as expected. • Revised design based on earlier consultations with the people will satisfy the people. <p>Risk</p> <ul style="list-style-type: none"> • Consultants fail to deliver quality outputs.

Activities with Milestones	Inputs
<ol style="list-style-type: none"> 1. Hydrological analysis in the earlier feasibility report will be reviewed to re-estimate the peak flood discharge of the three hill torrents. 2. Based on the field investigation, needs for revision of the structural designs will be re-assessed, and design will be revised to assure the sustainability of the structures. 3. The panel of experts will be established to provide technical guidance to the consultants and IPD in designing and implementing the hill torrents management project. 	<ul style="list-style-type: none"> • ADB will finance \$150,000 to recruit 3 person-months of international consultants and 11 person-months of domestic consultants. • Government will provide support for the consultants in value of about \$15,000.

ADB = Asian Development Bank, IPD = Irrigation and Power Department.

Frederick C. Roche
Director, SAAE

Kunio Senga
Director General, SARD

INITIAL POVERTY AND SOCIAL ANALYSIS

A. Linkages to the Country Poverty Analysis

Is the sector identified as a national priority in country poverty analysis?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Is the sector identified as a national priority in country poverty partnership agreement?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<p>Contribution of the sector or subsector to reduce poverty in Pakistan:</p> <p>The Asian Development Bank's (ADB) poverty partnership document for Pakistan recognizes that rural economy is built around the sustainable use of natural resources particularly irrigation water and cultivable land.¹ Based on an analysis of poverty determinants, the government's poverty reduction strategy paper² places emphasis on the emerging correlation that the rural poor are highly vulnerable to droughts, as a significant finding to help frame a poverty reduction strategy. Thus one of the goals explicitly elaborated in this strategy is to address water scarcity and the flow of floodwater that remains unutilized. Rapid growth in agriculture is attributed to a strong labor bias and associated self employment opportunity. Access to cultivable land assets is recognized to have a positive impact on the food and nutritional requirements of poor households. Improved natural resource management and irrigation increase productivity in agriculture and livestock, income generation opportunities, and the reliability of livelihood for small farmers, women and the landless.</p>			

B. Poverty Analysis

Targeting Classification: Targeted Intervention

<p>What type of poverty analysis is needed?</p> <p>Poverty analysis has been made and summarized as follows:</p> <p>The number of poor³ in Pakistan has more than doubled in the nineties as the number of poor increased to 45 million in 1999, of which 33 million or 73% (4.7 million households) are estimated to live in rural areas. Moreover, Pakistan ranks poorly in major social indicators: infant mortality in rural areas is 106 per 1000 live births; malnutrition of children under 5 is 39%. An important feature of poverty in Pakistan is the clustering of incomes around the poverty line, as 40.5% of the nation's population falls in a narrow income range around this line. Approximately 12.2% of the total population may be classed as chronically or extremely poor. According to the Social Policy and Development Center's assessment in the nineties over a ten-year period the disposable income of the top income quintile grew in real terms by 23%, while that of the lowest quintile grew by 3%, increasing the gap between the rich and the poor.⁴</p> <p>In Punjab, 36.3 % of the rural population lives below the poverty line. These high levels of poverty in rural areas tie in closely with particularly low growth rates in the agriculture sector over the past decade. Growth in agricultural GDP has been below 5% for most of the 1990s and due to a prolonged and serious drought dropped into negative figures in 2001 and 2002. The unirrigated areas suffered much more severely as a result of the drought than the canal irrigated areas. Poor yields or complete crop failures forced many farmers into debt and to abandon their lands during this period.</p> <p>In a self assessment by communities during a participatory rural assessment in the Project area, the communities in the Sanghar area classified 25% households amongst themselves as living below the poverty line and 15% as poor. In Vehowa and Kaura, the averages of the self assessments worked out at 30 % below the poverty line, and 30% as poor. The very poor were described to include the destitute and the landless with no access to land, no assets and negligible livestock; and those who have no stable source of labor, are sole wage earners in the family, barely manage 20 days of work in a month, and usually have several small children. They are not in a position to have access to credit services. Both man and wife work during the wheat harvest when labor is paid in kind to increase their family's food security. Their annual income, when monetized, does not exceed PRs3,500 per month. Poor usually include landless who have access to regular labor opportunity or who sharecrop relatively small holdings. They tend to have</p>
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¹ *Poverty Reduction Partnership Agreement Between the Government of the Islamic Republic of Pakistan and the Asian Development Bank*, September 2002, <http://www.imf.org/external/pubs/ft/scr/2004/cr0424.pdf>

² *Poverty Reduction Strategy Paper (PRSP)*, December 2003, http://www.adb.org/Documents/Poverty/pa_pak.pdf.

³ The official poverty line is estimated at 2,350 calories/day/adult, equivalent to PRs750 per month in 2002-PRSP. This was calculated at prices of 2000-01. Estimated inflationary changes at prices of 2004 raise it to PRs850 per adult equivalent per month (Economic Survey of Pakistan 2004).

⁴ Social Policy and Development Center, Annual Report 2001.

fewer children or grown-up boys who also supplement the family income through labor or in tending a small flock of 10 to 15 goats. Just a few amongst them will have any milk animals. They can usually afford to purchase grocery on credit and informal loans. They labor on other peoples' fields every year during the wheat harvest to create or supplement their own stock of grain. The annual income for this category of households would range between PRs3,500 and PRs5,000.

Sharecroppers are either small land owners who take on additional land to make their operations viable or landless cultivators, generally households that have been categorized as poor above. The direct impact that Project structures will have on spate irrigation sharecroppers is that it will relieve them of their obligation for the labor and time intensive collective labor that they had to perform for raising diversions in the main torrent several times a year, which translates as a direct benefit of project intervention for the poor. This raises a valid concern. With the elimination of the most labor and time intensive activity in spate irrigation agriculture, land owners are likely to dispense with sharecropping arrangements and evict their tenants increasing the vulnerability of the landless. On closer examination there is not much likelihood for this to happen. While the intensity of labor for irrigation preparation has reduced due to mechanization, specifically due to the tractor, the preparation for irrigation and the irrigation process itself in spate irrigation agriculture requires motivated and committed labor driven by an interest in increased productivity and consequently an increased share and not merely the wage at the end of a particular day. Sharecropping as a preferred mode of organization of spate irrigation agriculture will continue after the Project. The increase in cultivated land due to the Project is also expected to increase the demand for new sharecropping arrangements increasing income opportunities for the landless and small landholding poor.

The Project will contribute to poverty reduction in the west of the Chashma Right Bank Canal through improved natural resource management, increased productivity in agriculture and livestock, and increased income generation opportunities for small farmers, women, and the landless.

C. Participation Process

Is there a stakeholder analysis? Yes No

Is there a participation strategy? Yes No

Spate irrigation system is a community-operated and managed system with a long history. The Project is intervening with concrete and gabion structures that will eliminate the need for construction (raising and re-raising) of the earthen diversion structures several times a year. The community will continue to manage and operate the system but the nature of this *kamara* i.e., participation in collective work, will change from participation in construction to participation in maintenance.

During Planning: Recognizing that spate irrigation has old and established upper riparian rights and sensitive lower riparian concerns, and that there is cogent local knowledge that only communities have about spate irrigation which cannot be ignored, participation, consultation, and information dissemination have been diligently incorporated during planning. The feasibility study consultants proposed structures in consultation with farmer water users. A special stakeholder consultation with the beneficiaries by the Irrigation Department was facilitated to explain the proposed intervention. Particularly because of the potentially cataclysmic nature of the hill torrents and of flood irrigation it was a major concern of both the Government of Punjab and ADB that the beneficiaries of the Project understand clearly what was being finally proposed. Spate irrigation systems is the farmers' own system and from experience of the past several hundred years they know best the behavior of their respective hill torrent flows, their own irrigation requirements, their established water rights, the methods of diversion and use of varying flows, and the rules of distribution. The farmers were facilitated to focus on the proposed improvement by reiterating the working of the system and the changes it has undergone over time. The feedback has been carefully incorporated in subsequent revisions of the plan.

During Implementation: Social mobilization on the Project will precede detailed design, land acquisition, and construction. The approach to realize participation during implementation and post project operations will be to organize the existing community of interest at each diversion into a committee representing all the subgroups that have a stake at that level. Building on the extensive participation that has characterized the planning process, social mobilization during the implementation of the Project will facilitate each community through consultations to (i) form committees for each distributary channel and the collective structures such as closure embankments, (ii) ensure meaningful participation of communities in the detailed design of their respective structures, and (iii) form Project Liaison Committees on each channel and collective structure to include representation from channel committees, field staff of the Punjab Irrigation and Power Department, and the contractor responsible for the construction. These

committees will oversee quality, timeliness, and mitigation measures of adverse impact including land acquisition.

D. Gender Development

Strategy to maximize impacts on women:

Women are as familiar with their natural environment and the behavior of hill torrents as men are and participate during flood irrigation events in the immediate neighborhood of their embanked fields, physically applying water while men concern themselves with the diversion weirs. Although women work in agriculture and livestock, contributing to household income and quality of life, there is segregation between men and women in the public domain.

The Project will organize the management, primarily maintenance, of improved spate irrigation water tanks for domestic use under the leadership and participation of women.

Has an output been prepared? Yes No

E. Social Safeguards and Other Social Risks

Item	Significant/ Not Significant/ None	Strategy to Address Issues	Plan Required
Resettlement	<input type="checkbox"/> Significant <input checked="" type="checkbox"/> Not significant <input type="checkbox"/> None	The Irrigation and Power Department will formulate appropriate resettlement plan(s), after detailed design based on the approved Resettlement Framework developed in accordance with Pakistan Law and ADB policy to address any resettlement impacts in consultation with all affected persons, which will be submitted to ADB for review and approval prior to construction. Any land required will be acquired under the Land Acquisition Act 1894 and compensated at market rates plus 15% compulsory acquisition charges. Land will only be acquired, and construction initiated after full compensation has been paid.	<input type="checkbox"/> Full <input checked="" type="checkbox"/> Short <input type="checkbox"/> None
Affordability	<input type="checkbox"/> Significant <input type="checkbox"/> Not significant <input checked="" type="checkbox"/> None		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Labor	<input type="checkbox"/> Significant <input type="checkbox"/> Not significant <input checked="" type="checkbox"/> None		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Indigenous Peoples	<input type="checkbox"/> Significant <input type="checkbox"/> Not significant <input checked="" type="checkbox"/> None	There are no indigenous people in the project area according to the definition of indigenous people for purposes of ADB operations. Most of communities belong to Baloch tribes.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

<p>Other Risks and/or Vulnerabilities</p>	<p><input checked="" type="checkbox"/> Significant <input type="checkbox"/> Not significant <input type="checkbox"/> None</p>	<p>The hill torrent irrigation systems have historically been farmer-operated and maintained systems. The construction of gabion and concrete structures in the place of the earthen embankments will eliminate the need for collective effort. This may erode community initiative totally, especially if the responsibility of maintenance will pass on to the Punjab Irrigation Department. To prevent this, the Project includes a social mobilization component organizing the existing community of interest at each diversion into a committee to take responsibility for maintenance of these structures.</p>	<p><input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p>
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COST ESTIMATES AND FINANCING PLAN
(\$'000)

Item	Total Cost
A. Asian Development Bank Financing ^a	
1. Consultants	
a. Remuneration and Per Diem	
i. International Consultants	42.00
ii. Domestic Consultants	56.00
b. International and Local Travel	13.00
c. Reports and Communications	3.00
d. Vehicle Rental ^b	10.00
2. Equipment ^c	8.00
3. Workshops	3.00
4. Contingencies	15.00
Subtotal (A)	150.00
B. Government Financing	
1. Office Accommodation and Transport	5.00
2. Remuneration and Per Diem of Counterpart Staff	8.00
3. Others	2.00
Subtotal (B)	15.00
Total	165.00

^a Financed by the Asian Development Bank's technical assistance funding program.

^b Two 4 wheel drive vehicles for three months, including fuels and drivers.

^c Two sets of computers, necessary software, and one printer.

Source: Asian Development Bank estimates.

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

A. River Structure Engineer/Team Leader (domestic, 3 person-months)

- (i) Review the Final Feasibility Report (FR) prepared by National Engineering Services Pakistan (NESPAK) in March 2005,¹ particularly Chapter 4: Hydrological Evaluation and Chapter 5: Management of Hill Torrents, a report on Performance Evaluation of Kaha Hill Torrent, April 2004 also prepared by NESPAK,² a desk review report made by Mr. Terry Heiler on these documents in July 2005,³ Social and Poverty Assessment by Mr. Jamshed Tirmizi in June 2005,⁴ and a report produced by Mr. Yoichi Kishi in August 2005;⁵
- (ii) Conduct field trips to the proposed project sites to assess the geographic conditions of the proposed locations of structures in FR;
- (iii) Visit the existing structures in Kaha and Vidore hill torrents to assess the behavior of the existing structures;
- (iv) Review the proposed design in FR considering (a) site specific condition, (b) characteristics of hill torrent flood flow and debris flow, (c) experiences in construction and operation and maintenance, (d) selection of type of the structures; flexible or rigid, (e) width of weirs and share of flood distribution, (f) relative elevation of top of weirs of distributor, top of weirs of off-takes, and intake level of fields in the upper reaches of each wah, (g) structural details of bank protection, (h) cutoff wall material and its depth and penetration length, (i) structure of energy dissipater, etc., and (j) flow capacity of each wah and design discharge at the off-take;
- (v) Review the proposed implementation plan, taking into consideration the recommendation of Mr. Yoichi Kishi to construct structures one after another starting from the most upper reaches to avoid flood damage during construction, based on the experience of the Kaha project;
- (vi) Review and revise the design criteria that are provided in FR, and determine the new criteria in consultation with the Irrigation and Power Department (IPD) and the panel of experts, based on which review of the design will be carried out;
- (vii) Provide guidance to the design engineers to re-design the structures, as needed, following the revised design criteria;
- (viii) Review the terms of reference for the consultants for detailed design and construction supervision of the Hill Torrent Management Project (the Project). The terms of reference was prepared by IPD in June 2005 and comments on them were provided by Mr. Yoichi Kishi;
- (ix) Based on the revised design of structures and the terms of reference for consulting services, re-estimate the project cost in consultation with IPD;
- (x) Prepare a draft revised design report for the Project including a revised cost estimate and implementation plan, and submit a copy (hard copy and soft copy) to IPD and the Asian Development Bank (ADB);
- (xi) Finalize the revised design report for the Project, incorporating the comments received from IPD, the panel of experts, and ADB; and

¹ NESPAK. March 2005. *Updating Feasibility Study on Hill Torrents Management Plan in CRBC Area in Dera Ghazi Khan District*. Lahore.

² NESPAK. April 2004. *Kachi Canal Project, Performance Evaluation of Kaha Hill Torrent*. Lahore

³ T. Heiler. July 2005. *Review Report of Hill Torrent Management Plan in Chashma Right Bank Canal Area*. New Zealand.

⁴ J. Tirmizi. June 2005. *Hill Torrent Management Project, Social & Poverty Assessment and Consultations with Flood Irrigation Communities on Proposed Engineering Interventions*. Lahore.

⁵ Y. Kishi. August 2005. *Consultant's report on Loan 1146-PAK (SF): Chashma Right Bank Irrigation Project (Stage III), Hill Torrent Management Plan in the Chashma Right Bank Canal Area*. Lahore.

- (xii) Prepare a revised draft PC-1 for the Hill Torrent Management Project and submit a copy (hard copy and soft copy) to IPD and ADB.

B. Design Engineers (domestic, two experts, 2 and 3 person-months each)

- (i) Review the FR prepared by NESPAK in March 2005, particularly Chapter 4: Hydrological Evaluation and Chapter 5: Management of Hill Torrents, a report on Performance Evaluation of Kaha Hill Torrent, April 2004 also prepared by NESPAK, a desk review report made by Mr. Terry Heiler on these documents in July 2005, Social and Poverty Assessment by Mr. Jamshed Tirmizi in June 2005, and a report produced by Mr. Yoichi Kishi in August 2005;
- (ii) Conduct field trips to the proposed project sites to assess the geographic conditions of the proposed locations of structures in FR;
- (iii) Visit the existing structures in Kaha and Vidore hill torrents to assess the behavior of the existing structures;
- (iv) Review the proposed design in FR considering (a) site specific condition, (b) characteristics of hill torrent flood flow and debris flow, (c) experiences in construction, and operation and maintenance, (d) selection of type of the structures; flexible or rigid, (e) width of weirs and share of flood distribution, (f) relative elevation of top of weirs of distributor, top of weirs of off-takes, and intake level of fields in the upper reaches of each wah, (g) structural details of bank protection, (h) cutoff wall material and its depth and penetration length, (i) structure of energy dissipater, etc., and (j) flow capacity of each wah and design discharge at the off-take;
- (v) Carry out detailed survey for Sad Loharan closure dike site in Kaura (from about 2 kilometers upstream of the dike to about 500 meters downstream of the first distributor), as well as other structures for which designs need to be reviewed;
- (vi) Confirm relative elevation of each structure in each hill torrent system, and prepare longitudinal section of each hill torrent from the gorge (*darrah*) to the Chashma Right Bank Canal;
- (vii) Following the design criteria and other guidance given by the team leader, and as agreed to by IPD and the panel of experts, revise the design of structures and produce drawings as needed;
- (viii) Re-estimate the cost of each structure based on the revised designs;
- (ix) Together with the team leader, prepare a draft revised design report for the Project; and
- (x) Together with the team leader, prepare the final revised design report for the Project.

C. Hydrologist (Domestic, 1 person months)

- (i) Review the FR prepared by NESPAK in March 2005, particularly Chapter 4: Hydrological Evaluation and Chapter 5: Management of Hill Torrents, a report on Performance Evaluation of Kaha Hill Torrent, April 2004 also prepared by NESPAK, a desk review report made by Mr. Terry Heiler on these documents in July 2005, Social and Poverty Assessment by Mr. Jamshed Tirmizi in June 2005, and a report produced by Mr. Yoichi Kishi in August 2005;
- (ii) Collect other relevant information on hydrological analyses of the hill torrents in and around the project area;
- (iii) Critically review the hydrological analysis and estimation of the peak flood discharge in FR, taking lack of reliable flood discharge data and rainfall data into account;
- (iv) Collect information from the residents in the project area to supplement the hydrological analysis; and

- (v) Prepare a hydrological reassessment report, which will be a chapter of the revised design report for the Project.

D. Hill Torrent Specialist (international, 3 person-months, intermittent)

- (i) Participate in the inception meeting between the domestic consultants and IPD, discuss the direction in addressing the issues raised by Mr. Yoichi Kishi in the course of the re-design work with them, and provide necessary instruction and guidance to the domestic consultants for their work;
- (ii) During the TA implementation, provide necessary advice to the domestic consultants from time to time;
- (iii) Review the draft of the revised design report for the Project, and provide comments on it. Participate in the meeting to discuss the draft report between IPD and the consultants, as well as a tripartite meeting including ADB;
- (iv) Serve as a member of the panel of experts to provide overall guidance to the hill torrent management works undertaken by IPD, and to review the design and implementation of the Project;
- (v) Participate in meetings of the panel of experts and provide technical views and comments; and
- (vi) As requested by ADB, provide necessary information and advice related to status of the technical assistance and the Project.

E. Senior Engineer (domestic, 2 person-months, intermittent)

- (i) Serve as a member of the panel of experts to provide overall guidance to the hill torrent management works undertaken by IPD, and review the design and implementation of the Project; and
- (ii) Participate in meetings of the panel of experts and provide technical views and comments.