

Sindh Resilience Project (SRP)
(Irrigation Component)

Terms of Reference

For

**Feasibility Study for Enhancing Irrigation through
Use of Solar Pumps and Command Area
Development in the Areas under Jurisdiction of
Small Dams in Kohistan (Dadu and Jamshoro)**

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Feasibility Study for Enhancing Irrigation through Use of Solar Pumps and
Command Area Development in the Areas under Jurisdiction of Small Dams in
Kohistan (Dadu and Jamshoro)

1. INTRODUCTION

The province of Sindh has always been under vulnerable natural disaster i.e. floods, droughts, cyclones, heat waves, etc. because of its geographical location and climatic cycles. In recent past province has faced heavy losses to public and private infrastructures, livestock, livelihood etc, worth billions of rupees. Sindh Irrigation Department also feels responsibility to fulfill agricultural and domestic water needs by managing floods and droughts through improved infrastructure in the water scarce areas. In flood irrigation, farmers are at the mercy of extreme events of floods and droughts. To maintain the agricultural profession as a secured source of livelihood, an improved and sustainable system was required.

The Government of Sindh has put great emphasis on the supply of irrigation and potable water to the population in urban, suburban and remote rural areas since 2007. The Irrigation Department Government of Sindh launched its long-term plan for constructing small/ storage dams, detention weirs, & I.S.S.O (impermeable sub surface overflow) barriers along Nais in Kohistan Range (upper, central & lower khirthar hills), Nagarparkar (Karooonjhar Hills) & Sukkur & Khairpur (Ubhan Shah Hills). After survey the consultants identified 122 potential sites for construction of various types of dams under Small Dams Organization Sindh Hyderabad. Out of these the Department has constructed 60 Nos. small dams, recharge dams & delay action dams under PSDP/ ADP in Kohistan-I, Koshistan-II and Nagarparkar. Further 23 Nos. are on-going. These structures would store/ retain rain water from the hills torrents to cultivate about 128,917 acres of land of Sindh province and provide water for drinking and for livestock.

SMALL DAMS STATUS

Sr. No.	Division	Completed Dams		Under Construction Dams		In Process
		ADP	PSDP	ADP	PSDP	
1	Small Dams Division Kohistan-I Dadu	12	06	05	05	04
2	Small Dams Division Kohistan-II Jamshoro	12	12	02	02	03
3	Small Dams Division Nagarparkar at Mithi	10	08	07	02	04
	Sub Total	34	26	14	09	
	Grant Total	60		23		11

Under the Sindh Resilience Project (SRP), further 30 Nos. small recharge/ storage dams have been identified in water scarce areas of Kohistan, Achhro Thar and Tharparkar regions of Sindh.

OBJECTIVE

Many small dams have been constructed to recharge fresh water aquifers or store fresh water for domestic, agriculture and livestock purposes to improve the livelihood of poor people, as well as minimize runoff into rivers and bodies

The small dams so constructed have raised the agricultural potential of the area which at present has subsistence level cropping solely dependent on rainfall and floods. In cases where substantial water storage has been created by dams full irrigation potential remains to be utilized. With fertile soil and abundant and easy to access groundwater resources, it has tremendous potential to contribute in expanding year-round irrigation in project area with groundwater in conjunction with or without surface

water. However, because of prohibitively high cost of fossil fuel, diesel pump sets are not economically viable for farmers to operate the tube wells. Electric pumps and electric energy is much cheaper to own and operate tube wells and hence the Shallow Tube Wells (STW) farmers have replaced their diesel pumps wherever electricity accessibility has become available STW are defined as those wells which are less than 50 m in depth). Deep Tube Wells (DTWs) are mostly filled with electric pumps. But, power generation and supply has remained an important constraint in ground water irrigation development due to inadequate and unreliable supply of electricity because of huge gaps between power generation and demand. As a result, tube well infrastructures are under-utilized in most cases, and the full potential of the benefit due from investment in tube well irrigation infrastructures could not be harnessed, either at government or the private level.

Irrigation Department Government of Sindh intends to hire the services of Consultants to undertake feasibility study for Enhancing Irrigation through solar pumps in the areas under jurisdiction of Small Dams in Kohistan (Dadu and Jamshoro).

SCOPE OF WORK

In the context of the present study, water stored in the dams would be led through channels on to the fields for surface irrigation. Availability of irrigation supply over the year or over a cropping season would result in increased cropping intensity. The feasibility study for enhancing irrigation through command area development and use of solar pumps may require;

- Topographic survey of the area and field channels layout.
- Construction of main channel from the dam.
- Construction of field channels and field drains.
- Land shaping wherever necessary.
- Introduction of rotational supply to ensure equitable and assured distribution to individual farm holding.
- Determine feasibility of deploying solar pumps for tubewells.

For the feasibility study of this project, the Consultants shall select a representative medium size storage dam and make a detailed study to arrive at the full feasibility of the project encompassing all the remaining dams. For the selected dam, the Consultants shall undertake the following activities: -

1. Determine Water Storage of the Dam

Consultants shall collect available gauge data and records of past years to estimate past period average storage of the dam. In the absence of record, the storage would be determined from rainfall/runoff data.

2. Estimate Groundwater Recharge

From storage of dam, substantial water percolates through the bed to recharge the aquifer. Consultants would estimate the groundwater recharge for which the following activities will be undertaken:

- 1) Observation of ground water table level in monitoring wells for estimation of water head difference.
- 2) Estimation of ground water extraction for various purposes.
- 3) Develop ground water model for selected area.

Groundwater Recharge – Number of methods are available for the estimation of natural and artificial recharge to the aquifer, selection of which depends on available data, local geographic and topographic conditions, spatial and temporal scale required, and reliability of results obtained by different methods.

The water-table fluctuation (WTF) method provides an estimate of groundwater recharge by analysis of water-level fluctuations in observation wells. The method is based on the assumption that a rise in water-table elevation measured in shallow wells is caused by the addition of recharge across the water table

3. Estimate Water Availability for Surface Irrigation

The water availability for irrigation of the command area will be the balance live storage after deducting groundwater recharge and water lost to evaporation.

4. Topographic Survey

From the availability of irrigation supplies the extent of area benefitting will be determined. Consultants shall carry out contour survey of area to enable layout of irrigation channels and blocks. The route of the main channel will also be surveyed to design the channel. The contour survey of area would be required at scale to estimate cutting and filling in land shaping.

5. Command Area Development Design

Consultants shall prepare complete irrigation network to irrigate the command area. The channels and drains as proposed will be designed, including all needed regulating and outlet structures. The area would be provided with access road if needed together with bridges and culverts.

The land shaping and leveling if required, will be proposed to include in the development design.

6. Soil Survey of Command Area

Consultants shall carryout soil sampling from at least 5 pits to a depth of 2 meters to determine the soil structure and properties best suited to cropping under irrigation.

7. Carry out Agricultural Studies

Consultants would undertake agricultural studies of the project area. The studies would include present cropping intensity, farm inputs and yields, farmers holding and cropping preference, marketing and agricultural constraints.

With the availability of irrigation supplies from the dam, the Consultants would propose increased cropping intensity or improved cropping. The extent of area benefitting through irrigation by water stored in the dam would be determined.

8. Design of Solar Pumps

Consultants shall plan and develop concept design of Solar Pumps including design drawings, cost-estimates, BOQ, and bidding documents etc.

9. Enable Women Emancipation

This is to be achieved by including a share of women's holdings in the development block, especially poor women of the area as per directive of the Honorable President of Pakistan.

10. Preparation of Cost Estimates

All works proposed will be costed using the approved schedule of rates.

11. Determine Project Benefits

Consultants shall determine project benefits. These will be direct and indirect. The measurable direct benefits of the project are represented by the increase in agricultural production resulting from the implementation of project works/ command area development.

The indirect benefits include availability of drinking water for cattle, creation of better health conditions and prosperity.

12. Carry out Economic Analysis

The economic analysis shall involve: -

- a) Determination of economic parameters for expressing project benefits and costs in terms of economic prices.
- b) Quantification of project economic benefit.
- c) Translation of project costs from financial prices to economic prices, determining B/C Ratio, NPV, EIRR and
- d) Undertaking sensitivity analysis by changing various assumptions used in the base case analysis.

13. Feasibility Report

Consultants shall prepare draft feasibility report for presentation to the Client. The final report will incorporate suggestions and outcomes from the presentation.

14. PC-I

After the finalization of the feasibility report, the Consultants shall prepare draft PC-I and subsequently final PC-I at the end of the study period.

Deliverables

Consultants shall submit the following deliverables

1. Inception Report
2. Topographical Survey Report
3. Command Area Development Report
4. Ground water Recharge Report
5. Agriculture Study Report
6. Solar Pump Design report
7. Draft Feasibility Report
8. Final Feasibility Report
9. PC-I

Time Frame

The assignment will be completed within Nine (9) months after signing the contract between Client and the Consulting Firm.

Coordination

The consulting firm will report to the Project Director, Sindh Resilience Project (Irrigation Component) or any other staff designated. All work must be approved by the Project Director or the designated staff.

Key Staffing

The number of key staff with the estimated time input of each will be as below: -

Sr. No.	Position	No.
1.	Water Resources Expert/ Team Leader	1
2.	Hydrologeologist	1
3.	Hydraulic Engineer	1
4.	Agriculturist	1
5.	Solar Pump Specialist	1
6.	Economist	1
7.	Survey Engineer	1
8.	CAD Expert	1

Selection Process:

Procurement will be completed following the Selection Based on Consultants Qualification (CQS) method in accordance with paragraph 3.7 of World Bank's Guidelines: Selection and Employment of Consultants [under IBRD Loans and IDA Credits & Grants] by World Bank Borrowers, January 2011 (revised July 2014).