Terms of Reference (TOR)
For
Impact Assessment of Small Dams Constructed under the Sindh Resilience Project (SRP) in the Sindh Province

Activity Reference No: PK-SID-383319-CS-CQS

1. INTRODUCTION

Water is essential for life and for most human activities. Both economic and social development, as well as human health are completely dependent upon availability of adequate water supplies. All societies require water, both for basic survival and for economic development. The demand for water is increasing in all sectors due to a number of factors, including increasing population, economic and technological growth, and climate change. The increasing population demands more food, including animal products, whose feed also requires more land and water resources.

Pakistan is the fifth most populous country in the world having total population of 241.49 million as per the 2023 census by the Government of Pakistan.. About 60% of the population of the country is dependent on agriculture for their livelihoods, either directly or indirectly. Further, Pakistan is a water-stressed country and has very little water storage capacity. Water availability is a serious problem, especially in arid and semi-arid regions of Pakistan. The major part of the population is settled in rural areas of Pakistan, which are fully dependent on the irrigated agriculture for their livelihood. Agriculture constitutes the major sector the country's economy and contributes about 24% of GDP, making Pakistan highly dependent on agriculture for economic growth.

In flood irrigation, farmers are vulnerable to extreme events such as floods and droughts. To ensure a secured source of livelihood, an improved and sustainable water availability system is required. The Government of Sindh has placed great emphasis on providing irrigation and potable water to its population in urban, suburban, and remote rural areas. The Irrigation Department, Government of Sindh established the Sindh Small Dams Organization (SDO), in Hyderabad, Sindh in 2006 to conduct studies and construct small dams at feasible locations across the province. For this purpose, the SDO Sindh has already carried out studies in the Kohistan region, and successfully constructed more than 32 small recharge and storage dams, which are now yielding benefits.

2. PROJECT BACKGROUND

Pakistan is exposed to a number of adverse natural events and has experienced a wide range of natural disasters over the past 40 years, including floods, earthquakes, droughts, cyclones and tsunamis. Exposure and vulnerability to hazards is further exacerbated by rapid population growth, growing urbanization, environmental degradation, and shifting climatic patterns that can result in the occurrence of increasingly severe natural disasters. Over the past decade, damages and losses resulting from natural disasters in Pakistan have exceeded USD 18 billion; as the population and asset base of Pakistan increases, so does its economic exposure to natural disasters. The geographic location and climatic conditions of the Province of Sindh, being the lowest riparian in the Indus basin, render it vulnerable to various natural disaster events.

Sindh experienced major floods in 1973, 1976, 1992, 1994, 1995, 2003, 2005, 2007, 2010, 2011, 2012, 2013 and 2022. These floods have displaced millions of people and caused widespread damage to property and infrastructure. Besides riverine floods, primarily involving the River Indus, torrential flash floods have also severely impacted parts of Sindh.

Floods in 2010 and 2011 were amongst the most devastating in the history of the region. The 2010 flood displaced 7.2 million people and affected 11,992 villages. The impact on the economy of Sindh was estimated at PKR 372 billion (USD 4.4 billion), with agriculture, livestock and housing contributing to major losses. The 2011 flood inundated 38,347 villages, displacing 9.3 million people and human loss stood at 497 lives. The 2011 flood-affected districts constitute 86 percent of geographical area and 54% of the total population of the province. In the flood of 2022 over 12 Million population affected, around 2.0 Million houses were damaged, and crops on 3.7 Million acres was adversely affected.

Besides floods, Sindh also faces recurring droughts in its northern and southeastern regions on a recurring basis. The drought from 1998 to 2002 affected 1.4 million people, 5.6 million cattle head and 12.5 million acres cropped area. It triggered the spread of malnutrition-based diseases in the population and food scarcity in the province due to poor crop yield, as well as challenges in availability of safe drinking water.

3. THE SINDH RESILIENCE PROJECT

On the request of the Government of Sindh, the World Bank approved a US$170 million Sindh Resilience Project (SRP) designed to mitigate flood and drought risks in selected areas and strengthen Sindh’s capacity to manage natural disasters and public health emergencies. In 2021, additional financing of US$130 million was approved to undertake further interventions. Combined with savings from Phase-I of SRP, the project in particular supported the construction of small recharge dams to address drought risks and strengthen flood embankments along the Indus River. The project is designated as the Sindh Resilience Project Additional Financing.

3.1. Project Components

The project includes the following components:

Component 1: Strengthening Disaster and Public Health Emergency Management

The component focuses on two key institutions to strengthen their operational systems and capacities viz, the Provincial Disaster Management Agency (PDMA) Sindh and the Sindh Irrigation Department.

<u>Component 2: Improving Infrastructure and Systems for Resilience</u>

This component of the project is covering structural investments through construction of small dams to address the drought risk.

These Terms of Reference pertain to Component 2.

3.2. Project Location

The project area is scattered inKhairpur Mirs', Malir, Hyderabad, Matiari, Suwajal, Tharparkar, Thatta, Dadu and Jamshoro Districts of the Sindh province of Pakistan. The project area and locations are shown in Figure 1 below.

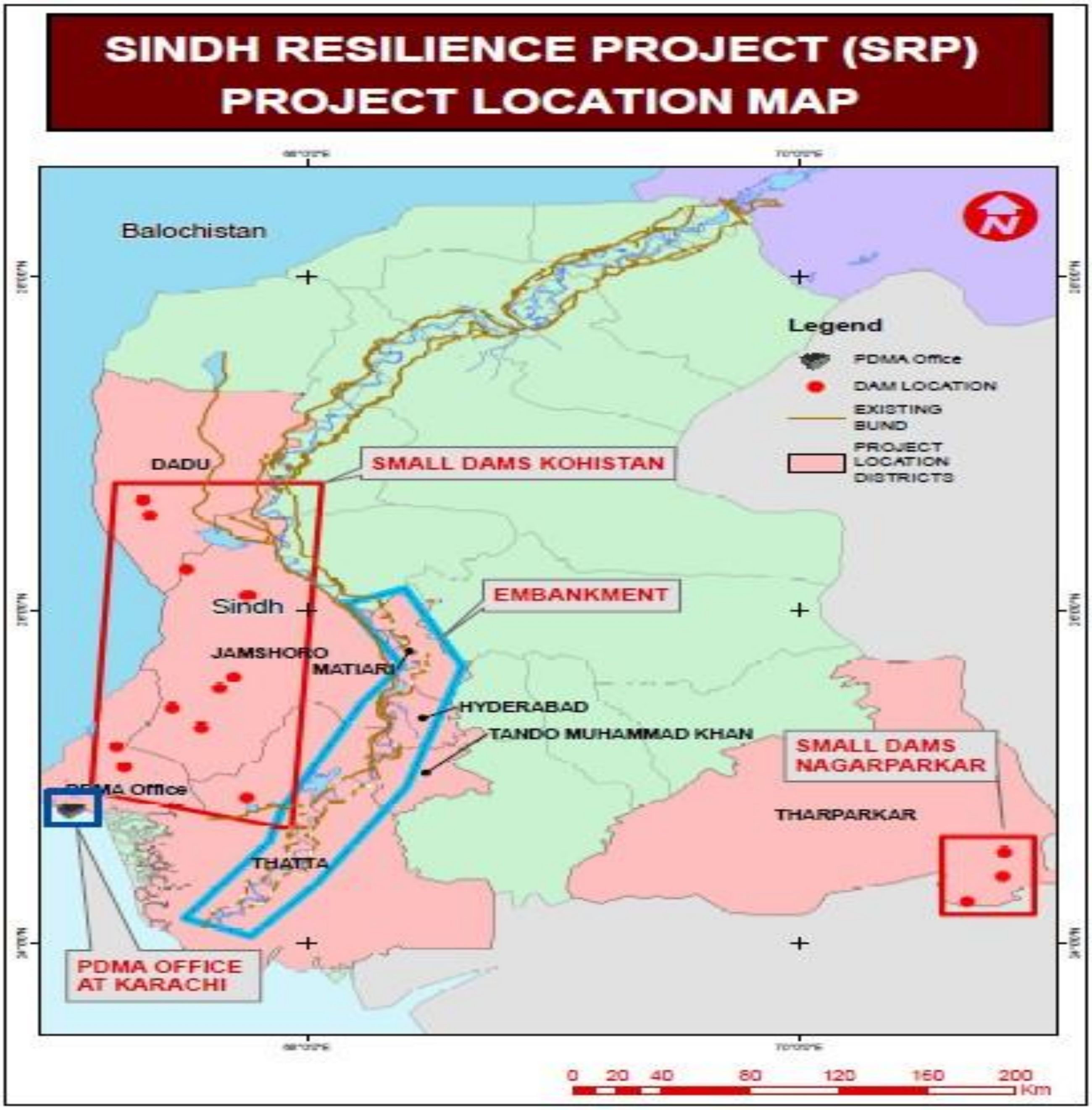


Figure 1: Location Map

3.3. Construction of Small Dams

The project is supporting physical investments for rainwater harvesting through the construction of (but not limited to) 53 small dams in the Kohistan and Nagarparkar regions that will contribute significantly to the provision of water to communities during dry periods and recharging of underground aquifers in adjacent drought prone areas. A list of small dams to be evaluated and their related details are placed at Annexure-A.

Table 1: Scope of Works / Schemes under SRP (Irrigation Component)

SMALL DAMS REGIONS
Kohistan-I Dadu
Kohistan-II Jamshoro
Nagarparkar at Mithi
Sukkur / Khairpur

4. OBJECTIVES OF THE STUDY

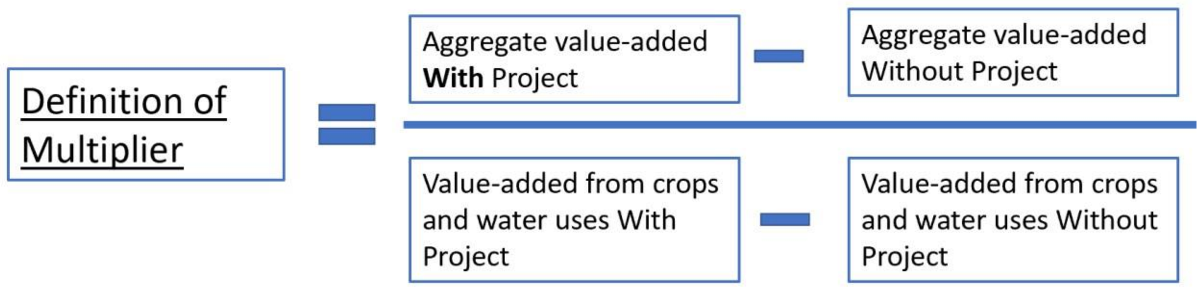
The overall objective of the study is to undertake a technical and economic analysis of small dams interventions, and assess their social impact, effects on livelihoods, contribution to agriculture enhancement, groundwater recharge, water quality, as well as their impact on the community and beneficiaries.

4.1. Direct and Indirect Economic Impact

Direct impacts of a project are measured in terms of the added value of agricultural commodities, water supply, energy savings, etc. The changes brought about by direct impacts generally alter the nature and pace of the prevailing state of affairs within the project area and its surrounding region, and through a "ripple" effect provides an impetus to the economy, resulting in increased overall economic activity in the region.

Indirect and induced economic impacts are those that stem from the linkages between the economic and other direct consequences of a project and the broader economy. Indirect economic impacts include: (i) inter-industry linkages, backward and forward, resulting in an increased demand for outputs of other sectors, and (ii) consumption-induced impacts arising from additional incomes generated by the project.

Economic multipliers represent a summary measure of the relative importance of direct versus indirect economic effects, expressed as a ratio of total to direct impacts.



While it is appreciated that the ongoing Sindh Resilience Project (SRP) is still in its early stages to allow for a meaningful quantification of its economic impacts, the focus of this analysis should not be solely on numeric multipliers. Instead, the emphasis should be on establishing an accounting system that looks at how the indirect effects are transmitted to the economy. This approach will enable the monitoring of the project during its implementation phase, allowing for necessary corrective actions could be taken to enhance growth linkages and ensure the benefits are spread to a wider section of the economy. These actions generally take the form of policies aimed at strengthening institutions, improving access to information, facilitating access to credit, and expanding access to market, etc.

5. SCOPE OF WORK

The firm shall be responsible for undertaking following tasks:

5.1. Task-1: Undertake an Economic Impact Assessment

a) Define the economic region of analysis, e.g. an area lying within a radius of 5-10 kilometers of the village within which the village has strong economic ties in terms of the sale of commodities, purchase of inputs and consumption goods and for earning wage employment.

b) Identify the key sectors of the rural economy, e.g. agriculture, animal husbandry, biomass and fish, etc.

c) Assess the baseline economic situation before the start of the SRP, i.e. subsistence economy with minimal interactions amongst production units themselves or between the villages and the rest of Sindh.

d) Carry out the economic assessment of the "no-project" option (status quo) and comment on implications.

e) Estimate the aggregate value-added under the “With Project” and the “Without Project” situations by the use of a Social Accounting Matrix (SAM) for the “economic region” defined to include the village and its neighboring areas.

f) The village-level SAM should be able to capture the interlinkages among village production activities, village institutions and the outside “world” (Taylor and Adelman, 1996).

g) The SAM should illustrate the flow of inputs, outputs and income levels between different production activities, the channeling of these incomes into consumptions and investments and the exchange of goods and factors between the village and the rest of the “world”.

h) Evaluate economic values-added and calculate “ex-ante” multipliers.

i) Complete a cost-benefit analysis to compare the costs associated with dam construction and maintenance, and its economic benefits such as increased agricultural productivity, income generation, and water availability.

j) Determine distribution of income by category of household (e.g. marginal farmers, small farmers, medium farmers, large farmers, workers).

k) Recommend complementary resource management policies, and development of appropriate institutions for their management.

l) Recommend a plan for monitoring the economic outcomes of the investments.

m) Identify possible risks that could impact the economic viability of the intervention and propose risk mitigation strategies.

5.2 Taks-2: Undertake a Technical Impact Assessment

a) Undertake condition survey of all the small dams constructed by SRP in Sindh. Assess their current physical status and functional condition. Develop a checklist for the condition survey.
b) Conduct a physical survey of all the dams and assess the increase in agriculture area and production with the project scenario. Obtain satellite imaginaries of pre-project and post project scenarios and compare the physical changes.
c) Assess the extent of sedimentation deposit in the dams.
d) Estimate the increase in agriculture area and production after the construction of dams.
e) Assess the improvement in the social status of the community and improvement in the source of earnings/income levels of the local community.

5.3. Taks-3: Undertake an Environmental and Social Impact Assessment

a) Assess the environmental impacts of dams on the vicinity and the livelihoods of the area.

b) Visit all dam sites constructed by SRP and meet with the local communities for their feedback.
c) Consider past, present, and future environmental and social impacts and the potential range of environmental variables that may influence the conditions of Valued Ecosystem Components (VECs).
d) Support the co-management of environmental and social impacts (avoidance, minimization, compensation, etc.) resulting from multiple or successive developments in the catchment area.
e) Evaluate the impacts on downstream areas, including social benefits such as improved access to water for domestic use and livelihood enhancement. This could also include resultant community development such as improved infrastructure, education, and healthcare access.
f) Analyze how the dams are enhancing agricultural practices through availability of irrigated water and mitigation of droughts. Also assess the associated potential for increased income generation through improved agriculture and related activities.

5.4. Task-4: Estimate the Increase in Groundwater Recharge and Improvement in Groundwater Quality

a) Several methods are available for estimating natural and artificial recharge to the aquifer. The selection of method depends on available data, local geographic and topographic conditions, the required spatial and temporal scale, and the reliability of results obtained by different methods. The main activities for this task include:

   i. Observations of monitoring wells and groundwater table levels for the estimation of water head difference.
   ii. Estimation of groundwater extraction for various purposes.
   iii. Asses the impacts of over abstraction of groundwater through solar system
   iv. Groundwater modeling for all dam sites, including potential for ground water recharge through dam-induced infiltration and its impact on local aquifers.
   v. Estimation of the increase in groundwater levels after the construction of dams.

b) Groundwater is vulnerable to contamination from a range of activities, such as industrial and agricultural enterprises and changes in land use. Poor management of groundwater can cause significant water quality problems, rendering water unfit for human or animal consumption. Ensuring the proper quality of water for drinking and irrigation purposes is essential. The main activities for this task include:

   i. Water sampling at distinct locations to conduct different laboratory tests such as

Physical, Biological and Chemical parameters to check the suitability of water for drinking and irrigation purposes.

ii. Examination of the impact of dams on groundwater quality.

iii. Identification of potential water quality issues and proposed mitigation measures to address them.

5.5. Task-5: Problems and Issues

a) Conduct physical surveys of all the dam sites and social surveys with communities living around the dam sites to assess problems and issues which are restricting the benefits of the dams.
b) Perform physical surveys and modeling studies to estimate the amount of silt deposition in the dam reservoir.
c) Propose remedial measures for addressing the problems and issues.

6. QUALIFICATION

The interested firm must:

- Corporate capacity (Core business and at least 10 years of experience in the same field).
- The consultant should have significant experience with similar assignments in terms of nature, size, and complexity.
- The consultant shall provide evidence of having successfully executed at least 3 contracts of similar nature and complexity.
- Adequate logistical capacity, as evidenced by established offices.

- Technical and Managerial Capability of the Firm (Key personnel are not evaluated at this stage) but indicative outline is presented below:

i) Team Leader

The Expert will have a Master’s degree in Engineering/Agriculture Economics/Economics with preferably 15 years of experience in impact evaluation and economic analysis of dam and other irrigation projects, including experience of working on donor funded projects. S/he will have demonstrated ability to lead a multidisciplinary team.

ii) Dam Engineer

The expert will have a Master’s degree in Hydraulic/Geotechnical Engineering/ Structural Engineering with preferably 15 years of experience in design of dam and other irrigation structures; including dams cost estimation, preparation of BOQs, including experience working on donor funded projects. S/he will have demonstrated ability to work in a multidisciplinary team.

iii) Groundwater Expert

The expert will have a Master’s degree in Hydrology/Hydrogeology/Water Resources engineering with preferably 15 years of experience in groundwater studies, groundwater modeling and estimating flows. S/he will have demonstrated ability to work in a multidisciplinary team.

iv) Hydraulic Design Engineer

The expert will have a Master’s degree in Water Resources Engineering / Hydraulics Engineering with preferably 15 years of experience in design of hydraulic structures; including cost estimation, preparation of BOQs, including experience working on donor funded projects. S/he will have demonstrated ability to work in a multidisciplinary team.

v) Sociologist

The expert will have Master’s degree in social sciences with preferably 15 years of relevant work experience including experience of social surveys and monitoring, impact evaluations and implementation of social safeguards and resettlement plans.

He/she should be fully familiar with the relevant national and provincial legislation and international social safeguards policies and demonstrated ability to work in a multidisciplinary team.

vi) Environmental Specialist

The expert will have a Master’s degree in environmental sciences/engineering with 15 years or more professional experience in conducting environmental screening and assessment and monitoring and implementation of environment management plan of water resources projects. He/she should be fully familiar with the relevant national and provincial legislation and international environmental safeguards policies and demonstrated ability to work in a multidisciplinary team.

vii) Agriculture Economist

The Expert will have a Master’s degree in Agriculture Economics with preferably 15 years of experience in impact evaluation and agriculture studies of dam and other irrigation projects, including experience of working on donor funded projects. S/he will have demonstrated ability to lead a multidisciplinary team

viii) Economist

The Expert will have a Master’s degree in Economics/Agriculture Economics, preferably with 15 years of experience in financial and economic analysis and impact assessment of dams and other irrigation projects, including experience of working on donor funded projects. S/he will have demonstrated ability to work in a multidisciplinary team.

ix) SAM Experts

The Expert will have a Master's degree in Statistics with preferably 15 years of experience in working with the social accounting matrix (SAM), and on water resources projects, including experience of working on donor funded projects. S/he will have demonstrated ability to work in a multidisciplinary team.

x) Junior Engineers

They will have a bachelor's degree in Civil Engineering with preferably 05 years' experience of working on dam and other irrigation projects.

xi) Data Collection Staff 15 No.

They will have a bachelor's degree in Sociology/Environmental Sciences with preferably 05 years' experience of working on dam and other irrigation projects.

7. DELIVERABLES

1. Inception report confirming methodology and proposed timeline for deliverables.
2. Baseline economic assessment and economic impacts of the no-project option.
3. Data collection and SAM population.
4. Mid-term report.
5. Multipliers analysis and distribution of income by household category.
6. Technical Impact Assessment Reports.
7. Report of Environment and Social Impact Assessment.
8. Final report (Report should include development of info graphics, fact sheets and animations to showcase summary findings on dams.).

8. EXPECTED TIMEFRAME

The assignment will be completed within six (06) months after signing the contract between the Client and the Consulting Firm.

9. COORDINATION

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

10. SELECTION PROCESS:

A consulting firm will be selected in accordance with the Consultant Qualification Selection method as set out in the “World Bank Procurement Regulations for IPF Borrowers Goods, Works, Non-Consulting and Consulting Services Fourth Edition”, November 2020.

Annexure-A

S.No	Name of Contract
01	Construction of Jaganwari Small / Recharge Dam in Khairpur Mir's
02	Construction of Tungwari Small / Recharge Dam in Khairpur Mirs'
03	Construction of Darig Small/Recharge Dam in Khairpur Mirs
04	Construction of Samlee Small / Recharge Dam in Nagarparkar
05	Construction of Paro Jo Wandhio Small/Recharge Dam in Nagarparkar
06	Construction of Sehriyoon Small / Recharge Dam in Nagarparkar
07	Construction of Bhatta Siro Dam in Nagarparkar
08	Construction of Sohrio Wah Dam in Nagarparkar
09	Construction of Namaro Dam in Nagarparkar
10	Construction of Viakasar Dam in Nagarparkar
11	Construction of Gordhro-2 Dam in Nagarparkar
12	Construction of Sudran Dam in Nagarparkar
13	Construction of Adhigam-Syed Alam Dam in Nagarparkar
14	Construction of Layari-1 Dam in Nagarparkar
15	Construction of Jhanjhoo Dam in Nagarparkar
16	Construction of Pathar Dam in Nagarparkar
17	Construction of Targaam Budhesar Dam in Nagarparkar
18	Construction of Bandhaka Dam in Central Kohistan
19	Construction of Baaro Dam in Central Kohistan
20	Construction of Chakri Dam in Central Kohistan
21	Construction of Churlo Dam in Central Kohistan
22	Construction of Sunn-2 Dam in Central Kohistan
23	Construction of Gadap-2 Dam in Lower Kohistan
24	Construction of Lat-2 Dam in Lower Kohistan
25	Construction of Khuda Bux Dam in Lower Kohistan
26	Construction of Gurrand Small/Recharge Dam in Lower Kohistan
27	Construction of Sangchat Jo Taar Dam in Lower Kohistan
28	Construction of Jharando-1 Dam in Lower Kohistan

29	Construction of Jharando-II Dam in Lower Kohistan
30	Construction of Gorban Bhutti Dam in Lower Kohistan
31	Construction of Dahri Sharif Dam in Lower Kohistan
32	Construction of Gaib Janan Dam in Lower Kohistan
33	Construction of Narani Dam / Awais Gabol Dam in Central Kohistan
34	Construction of Buzeh / Sohring Dam in Central Kohistan
35	Construction of Khar Gani Dam / Uth Plann & Lal Bagh Dam in Central Kohistan
36	Construction of Toopi Dam / Garato and Panjtan Jo Bagh Dam in Central Kohistan
37	Construction of Khinji Dam / Munh Mukhri & Lundi Dam in Central Kohistan
38	Construction of Tunni Dam / Chaat Bagh Dam in Central Kohistan
39	Construction of Gaarelo / Surni Dam in Central Kohistan
40	Construction of Khurand Dam in Central Kohistan
41	Construction of Jaam Dataar Dan in Central Kohistan
42	Construction of HUB-I Dam in Lower Kohistan
43	Construction of HUB-II Dam in District Karachi
44	Construction of HUB-III Dam in District Karachi
45	Construction of Asabo Dam in District Karachi
46	Construction of Janai Dam in District Malir Karachi
47	Construction of Kund Nai Dam in District Malir Karachi
48	Construction of Moosa Khan Shoro Dam in Lower Kohistan
49	Construction of Purkhani Dam in Lower Kohistan
50	Construction of Ghulam Mustafa Dam in Lower Kohistan
51	Construction of Kamal Shodo Dam in District Jamshoro
52	Construction of Pipre Baricha Dam in District Jamshoro
53	Construction of Tikho-III Dam in District Jamshoro