GOVERNMENT OF SINDH

Irrigation Department

ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN (ESMP) FOR – 11 SMALL DAMS IN NAGARPARKAR REGION

Bhata Siro, Sohrio Wah, Namaro, Viakasor, Gordhoro-2, Sudran, Adhigam - Syed Alam Shah, Layari-1, Jhanjhoo, Pathar and Targam Bhodesar




ADDITIONAL FINANCING OF SINDH RESILIENCE PROJECT – SRP (IRRIGATION COMPONENT) (P173087)

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PROJECT MANAGEMENT TEAM
SINDH RESILIENCE PROJECT
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LIST OF ABBREVIATION

ACE	Associated Consulting Engineers Ltd
AF	Additional Financing
BP	Bank Policy
BOQ	Bill of Quantity
CoI	Corridor of Impacts
DC	Deputy Commissioner
EC	Electrical Conductivity
ECA	Employment of Child Act
EIA	Environmental Impacts Assessment
EMU	Environment Management Unit
EPA	Environmental Protection Agency
ESA	Environmental and Social Assessment
ESIA	Environmental and Social Impacts Assessment
ESMEC	Environmental/Social Monitoring and Evaluation Consultants
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESMU	Environmental and Social Management Unit
ESU	Environmental and Social Unit
FGDs	Focus Group Discussions
GFP	Grievance Focal Point
GoS	Government of Sindh
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
IBIS	Indus Basin Irrigation System
IEE	Initial Environmental Examination
ISDS	Integrated Safeguards Data Sheet
IUCN	International Union for Conservation of Nature
LAA	Land Acquisition Act
MEAs	Multilateral Environmental Agreements
NCS	National Conservation Strategy
NEP	National Environmental Policy
NEQS	National Environmental Quality Standards
NGO	Non-Governmental Organization
OP	Operational Policy
P&DD	Planning and Development Department
PAP	Project Affected Person
PCC	Public Complaint Centre
PC-I	Pakistan Planning Commission Form – 1 Appraisal of Development Project
PD	Project Director
PDMA	Provincial Disaster Management Authority

PEPC	Pakistan Environmental Protection Council
pH	Power of Hydrogen
PID	Project Information Document
PISSC	Project Implementation, Support and Supervision Consultant
PIU	Project Implementation Unit
PKR P	Pakistani Rupee
PMT	Project Management Team
POPs	Persistent Organic Pollutants
PSC	Project Steering Committee
RAP	Resettlement Action Plan
RoW	Right of Way
SEPA	Sindh Environmental Protection Agency
SEPC	Sindh Environmental Protection Council
SID	Sindh Irrigation Department
SRP	Sindh Resilience Project
VECs	Valued Ecosystem Components
WB	World Bank
WHO	World Health Organization

1. EXECUTIVE SUMMARY

The Government of Sindh (GoS) has undertaken a World Bank-financed Project - the Sindh Resilience Project (SRP) through the Sindh Irrigation Department (SID) and Provincial Disaster Management Authority (PDMA) in various parts of Sindh Province. Physical interventions under SRP Irrigation component include rehabilitation/ improvement of existing earthen embankments along River Indus and construction of small rainwater recharge dams in the water-scarce areas of the province. During the last two years of the SRP implementation, fifteen dams were constructed which are at completion stage. Now, through Additional Financing (AF) from the World Bank, the Government of Sindh under SRP (Irrigation component) is planning to construct the eleven small rainwater recharge dams (namely Bhata Siro, Sohrio Wah, Namaro, Viakasor, Gordhoro-2, Sudran, Adhigam - Syed Alam Shah, Layari-1, Jhanjhoo, Pathar and Targam Bhodesar) in Nagarparkar Tehsil, Tharparkar districts of Sindh.

In compliance with the national/ provincial regulatory requirements and World Bank safeguard policies an environmental and social assessment was carried out to address the potentially negative impacts of the proposed interventions under SRP-AF. Environmental categorization of the subprojects was done using the environmental and social assessment checklist. These subprojects are likely to cause low to moderate levels of environmental and/or social impacts, therefore, fall under category “B” under environmental categorization criteria as specified in the Environmental & Social Management Framework (ESMF) document prepared for the project and approved by World Bank. This Environmental & Social Management Plan (ESMP) has been prepared accordingly to meet the World Bank Category “B” project requirements for the subject works.

This ESMP covers information on the prevailing physical, biological, socio-economic, and environmental aspects of the sub-project areas. It provides a set of mitigation measures during the project implementation and operation to eliminate environmental and social negative impacts, up to an acceptable level. The sub-project areas are located in Nagarparkar region, District Tharpakar of Sindh. The local settlements in sub-project areas are also using subsurface and groundwater for drinking and irrigation. The groundwater depth varies from 40 to 180 ft. in different parts of the region. If the rains are absent for more than 2 years, the subsurface water gets dried making the local population get zero water abstraction both for drinking and harvests.

The proposed initiative by building groundwater recharge dams in the region would sustain the groundwater availability for a longer time. Water collected in the proposed dams would also serve the local livestock drinking water facility closer to the rangeland. The constructed structures would reduce the flood velocity, and there will be fewer losses of the fertile soil erosion, public amenities like link roads, electricity polls, and local human settlements. Due to

the absence of water, agriculture in the area is affected. As a result, rain-fed crops areas have been reduced with productivity going down due to moisture stress.

Millet, sorghum and castor beans are the main traditional summer rain-fed crops, while barely and mustard are grown during the winter. In addition to producing grains for human consumption, these crops are the primary sources of stalk/crop residue for livestock feeding. Livestock has been a major asset base of the local population. Lack of drinking water and vegetation in the areas has badly affected the health of livestock. Milk production of livestock has declined, which has serious implications for the nutritional status and income level of the households. Due to fodder unavailability, people are compelled to move their livestock to irrigated areas, which are also facing water shortages.

The recharge dams in Nagarparkar region in Tharparkar district will augment the groundwater aquifers through percolation. The groundwater will be utilized through dug or tube wells for drinking. In addition to recharging of fresh groundwater aquifers, these investments will provide safe drinking water to local communities and livestock. Sub-projects are not financing the construction of any water supply channels / and tube wells.

The main objective of the construction of small dams is to recharge groundwater and is not deliberately designated to promote agriculture activities. While, the water from proposed dams may be taken directly from the reservoir for drinking and domestic use and drinking of livestock and wild animals. The treatment and supply system for villages may be constructed by local government at a later stage.

The Nagarparkar region lies in the desert arid zone. The availability of water in the region is scarce and the land surface consists of stunted scrub and bushes. The main natural groundcover is provided by grasses, which are nutritive and palatable fodder for the livestock. Babul, Neem, Jar, and Kikar are some of the other trees and bushes found in the area. The major water resource in the area is seasonal precipitation that enables the groundwater recharge and increases the vegetation covers on the top surface and produces wild grass for animal feed. In some parts of the area direct rainfall moisture is utilized for local crop production. The rainfall water drains in different Nais (streams) that ultimately end up Runn of Kutch area.

The major sources of drinking water are the dug wells, and its depth ranges vary from 40 to 180 ft. in different parts of the Nagarparkar region. The other seasonal source of water is traditional manmade earthen ponds that are made by digging the ground and filled up by the surface runoff. These ponds get filled during the rainy season mainly in summer months upon the occurrence of rains and provide water for 2-6 six months for human use and livestock. They also help in recharging of groundwater aquifer. The women folks use to fetch water from an average distance ranging from 2-10 km from their villages from the existing earthen ponds. In the Nagarparkar region small dams are proposed under SRP-AF.

The proposed structures will resolve the drinking water scarcity and comparatively sweet water will be available to the local population for longer time through the year. Due to construction of these proposed dams total number of about 25 villages having 6,105 households with 48,840 male and female population (upstream and especially downstream of about 5 km radius) will be benefited with project intervention. The absence of significant rainfall in the last three to four seasons has triggered drought emergency in the Tharparkar and other arid parts of Sindh Province.

An analysis of alternatives has been performed to review and assess different ways of meeting the project objectives that might have fewer environmental or socio-economic impacts. The dams shall be constructed as earth fill embankments using local materials of earth fill, fine and coarse filters and stone protection. Where large size stones are not available for riprap for upstream slope protection, it can be obtained from limestone quarries. A concrete spillway will be provided in the central part of the dam to allow safe passage of high river flow. This type of small dams are very useful, use local materials and construction industry, store more water for long duration of time in form of groundwater recharge, are thus recommend as most suitable option to achieve the project objectives.

No acquisition of any private land is required for these subprojects because nais and nalas (Rainwater Rivers) are the state-owned properties. Also, no demolition of structures will be involved and no one will be required to be resettled; as subproject areas are lying in the less populated areas and the population is scattered. However social and environmental impacts may arise only due to temporary use of privately owned or government owned uncultivated. Land for camps construction/ excavation of borrow material, and due to influx of external workforce, loss of vegetation, unattended residual wastes, and occupational health and safety issues for labors and community, therefore, ESMP has been prepared. The small dam sub-projects involve the construction of 15 to 19 ft high earthen embankments and concrete structures of spillways.

During the construction of the dams cumulatively, about 250 to 350 worker will be hired by the contractors, thus their livelihood will be secured till the construction period. The contractor will restrict his outsider staff to mix with the locals to avoid any social problems. Local vendors will be provided regular business by purchasing campsite goods and services from them. The contractor shall include information about COVID-19 and the spread of sexually transmitted diseases (HIV/AIDS) within the worker's code of conduct. During operation phase of proposed dams (under SRP & SRP-AF) in addition to the already constructed dams may create positive impact on ecology in terms of habitat restoration and vegetation cover enhancement. The operation phase of proposed dams in addition to the other already constructed dams will create positive impact on ecology in terms of habitat restoration and vegetation cover enhancement due to availability of water. The proposed dams will have synergistic impact on over all water conservation and rain harvesting during operation phase. The

biodiversity/habitat (trees and vegetation) will be increased due to the availability of groundwater for a sustainable manner. An emergency response plan will be prepared for the all dam site which will be triggered in case of dam break.

The construction-related impacts such as air pollution, noise and use of community resources can be well mitigated through the proper implementation of the mitigation measures. Moreover, the construction of proposed dams will improve ecological conditions of the sub project area by the availability of water in dry season comparatively without the proposed dam. The proposed small dams will enhance the ecological worth of the area, which usually face acute drought. These dams will provide drinking water for wildlife as well as residents of this area. However, mitigation measures recommended in the report would need to be strictly ensured by the Contractor during the construction period. Anticipated negative impacts can be mitigated through proper inspection and maintenance of vehicles and machinery to reduce exhaust emissions, using noise suppressors or mufflers for heavy equipment, watering of unpaved roads, and control of adverse impacts from construction debris/ residual wastes by proper handling and immediate removal, control of water pollution through proper storage and handling of oil wastes and treatment of wastewater at the site, control of solid waste through sanitary storage and frequent collection for sanitary disposal.

The occupational health and safety will be ensured through continuous inspection to prevent disease and accidents, awareness-raising among labor and community, sanitation measures, COVID-19 management &monitoring and emergency response and rescue procedures, provision of adequate sanitary facilities, potable water, and garbage bins for workers. The sub-projects, after implementing the mitigation measures as detailed in this ESMP, will not have any significant and lasting negative impact on the physical, biological or socioeconomic environment of the area, rather it will have significant positive impacts that will ultimately result in sustainable development in the area. Besides, it outlines a specific description of institutional arrangements for carrying out the mitigation measures and their monitoring; capacity building and training of field staff; implementation and cost estimates; and Grievance Redressal Mechanism (GRM). As a part of the ESMP, consultations with the stakeholders particularly the local communities were carried out. Environmental & Social Safeguard monitoring will be carried out to ensure that the mitigation plans are regularly and effectively implemented. It will be carried out at three levels.

At the Project Management Team (PTM) level, the environment and social specialists will carry out safeguard monitoring to ensure that the mitigation plans are being effectively implemented, and will conduct field visits regularly. At the field level, more frequent safeguard monitoring will be carried out by the relevant staff of Project Implementation Consultants (PISSC). At third level, PISSC and ESMU of PMT will produce monthly, quarterly and annual reports for ESMP implementation. The overall responsibility for implementing the SRP project as well as the present ESMP rests with the Project Management Team (PMT), Sindh Irrigation Department, headed by the Project Director. The PMT is supported by the Environmental and Social

Management Unit (ESMU) established within the team. PMT has also engaged Project Implementation, Support, and Supervision Consultants (PISSC), responsible for construction supervision. PISSC also have environmental and social safeguard specialists to supervise and monitor ESMP implementation. Finally, the construction contractor will also have environmental, social and health safety inspectors/officers to implement mitigation measures and other requirements defined in the present EMP. Appropriate clauses will be included in the construction contracts for this purpose. PMT has also engaged Environmental/Social Monitoring and Evaluation Consultants (ESMEC) to carry out external monitoring or third party validation of the sub-project activities.

It has been concluded from the dam break study, the reservoir area of all eleven (11) dams is small, and not exceeding 0.27 sq. Kilometers. Thus the area inundated in worst case scenario (Combined dam breach + 100 year flood) 40.35 sq.km (15.58 sq. Miles), and number of person affected in the worst case scenario is 3,382 person. Overall the areas inundated by breach of dams are small and consequently the population affected, in case of dam breach, is small.

The primary corridor of impact area was surveyed physically and scanned through the HECRAS and google map software to estimate expected loss during the construction and in case of dam break, 100 years flood and combined impact of dam break + 100 years flood, in terms of tree cut, disturbance to track routes, agriculture land, archeological sites, and hand pumps. Since all the proposed dams are recharge dams, in which the estimated loss or disruption will be for few days and temporary as the water will percolate to aquifer. There are 6 kacha tracks and 86 trees will be impacted due the construction of proposed dams. Financial assistance in term of community support have been proposed in the ESMP budget to compensate these and any other unforeseen impacts.

It is estimated that 86 trees will be felled for the construction of the above mentioned 11 dams. The replanting of 5 times trees against the number of cuts down trees would cost Rs. 430,000 considering the rate of Rs 1,000/- per tree. A total budget of Rs. 216,132,190. /- has been proposed for the implementation of the ESMP including the management of COVID-19. For general community support an amount of Rs. 10,000,000/ has been also allocated for each dam site. This has been incorporated as provisional sum item in ESMP bill of each dam and BOQ item.

2. INTRODUCTION

The province of Sindh has always been under vulnerable natural disasters i.e. floods, droughts, cyclones, heat waves, etc. because of its geo-graphical location and climatic cycles. In recent past the province has faced heavy losses to public and private infrastructures, livestock, livelihood etc. worth billions of rupees. Besides floods, Sindh province faces droughts in north-western and southern regions on recurring basis. Sindh province is prone to multiple hazards: floods and drought. Although, Sindh has not experienced a major flood since 2015, but drought/drought like conditions have been prevailing since 2013 which have impacted on livelihood and food security in parts of the province. Particularly, drought has been a recurring phenomenon in the South-East and Western districts of the province. The Sindh Drought Needs Assessment (SDNA) conducted by the Food Security Working Group (FSWG) revealed that the arid zones in the West (Jamshoro and Dadu) and South-East (Tharparkar, Umerkot and Sanghar) were the most drought affected areas. These areas experienced moderate to severe drought during 2013-15 and reported livestock and crop losses. (Source: Sindh Drought Needs Assessment (SDNA) Report, January 2019).

The Government of Sindh through World Bank financing successfully implemented the Sindh Resilience Project (SRP) with its focus on improving system at the provincial Government and key agencies for managing disaster risk. Moreover, World Bank on successful implementation of Phase – I has committed to providing additional financing for the construction of more small dams to improve resilience against drought. Total 53 dams will be constructed (eight Dams from saving amount and 45 dams from Additional financing). In Nagarparkar area 17 small dams either constructed or proposed under SRP project (06 Dams) or SRP-AF (11 Dams) project as depicted in Annexure – I.

In light of the above fact, the Government of Sindh launched the small dam projects in 2007. The main objectives of the small dams' project were to provide water in the arid areas to meet the demand of irrigation, domestic, livestock, potable water and serves for soil and water conservation measure to the remote areas in Sindh. The main water scares areas of Sindh are Kohistan region, Nagarparkar and Ubhan Shah Hills Nara region in which the project was launched, and some small dams have been completed, and some are underway.

2.1 Project Background

The Government of Sindh has undertaken a project to enhance disaster and climate resilience; increase the technical capacity of Government entities to manage natural disasters and climate variability; construction of small dams and support restoration of flood protection infrastructure on Indus River. The project designated as Sindh Resilience Project - Additional Financing (SRP - AF) is financed by World Bank and will be completed in five year period 2021-2025.

The subprojects planned in this regard may potentially cause environmental and social impacts in the existing condition of the area. The environmental and social safeguards rapid screening depict that the subprojects (i) will not require land acquisition; (ii) will not involve any involuntary resettlement. However, there may be low to moderate adverse environmental and social impacts due to excavation of borrow areas, operation of machinery and vehicles, haulage routes and temporary damage to property due to establishment of Contractor's camp. This ESMP has been prepared through identification of a set of responses to potentially adverse impacts; determining requirements for ensuring that those responses are made effectively and in a timely manner; and describing the means for meeting those requirements.

2.1.1 An Overview of the Sub Project

Eleven dams have been proposed in the Tharparkar (Nagarparkar) Region. Tharparkar is the District and Nagarparkar is its Tehsil (Taluka). All proposed dams are in the Nagarparkar.

The height of all proposed dams ranges from 15 to 19 ft. The water from these proposed dams will be taken directly for human and livestock consumption (mainly drinking). These will also act as recharge dams and augment the groundwater aquifers through percolation. The groundwater will be utilized through dug or tube wells for drinking, livestock and agriculture purpose as it is presently in practice at the sub-project areas. These dams are not deliberately designated to promote agriculture needs. There will be no temporary or permanent road construction during the project activities to access the site.

2.2 Objective of ESMP

The primary objectives of the ESMP are as follows:

- Identify social and environmental impacts of the subproject and related activities.
- Suggest suitable mitigation measures for identified impacts at planning, designing and implementation stage of the subprojects and to eliminate or reduce their adverse impacts if any.

- Propose environmental monitoring program to ensure that mitigation measures are implemented during the subprojects execution and timely corrective actions are taken where required and

- Propose the institutional arrangements required to implement and monitor the ESMP.

2.3 Sub-Project Justification

Sindh province faces drought in the northern and eastern region on a recurring basis. The drought from 1998 – 2002 affected 1.4 million people, 5.6 million heads of cattle and 12.5

million acres of cropped area, triggering the spread of malnutrition-based diseases in the population and food scarcity in the province due to poor overall crop output. Similarly, the ongoing drought situation in the province since 2013 has affected 4.9 million heads of cattle and 0.5 million people, resulting in the death of 750 persons. [1]These drought events have also generally coincided with the El Niño phenomena. The strongest El Niño event in recorded history was 1998 which triggered a three-year long drought in Pakistan. Another El Niño emerged in 2015 causing weaker monsoons over parts of Pakistan, including most of Sindh and a strong heat wave in June-July 2015 which caused more than 1200 fatalities from heatstroke and dehydration, mostly in Karachi (the provincial capital).

The national average for rainfall has been -24.4% below average with the Sindh region suffering most, receiving rainfall -69.5% below average. This situation is leading to adverse effects on the agricultural and domestic needs of the local communities in the area, further exacerbating the prevalent problems of poverty and child malnutrition. In the district of Tharparkar alone, nine infants have been reported dead during the month of August 2018, while 375 children have died due to malnutrition in 2018. Due to protracted low crop production, the food insecurity and malnutrition issue has further worsened as families are forced to sell the goods that they otherwise would have consumed themselves. Access to clean water has also severely been limited causing water-borne diseases and compromising the health of the residents. The Pakistan Met Department has predicted no adequate rainfall soon meaning that the situation will only worsen with diminishing resources. Crop production will continue to drop while the death of livestock will rise. The health of the community will continue to suffer more as the water and food supplies decline.

For the last ten years, 50 percent of the overall population of reported sub-project areas have migrated to barrage areas to find food, because during droughts it becomes hard for them to even find water to drink, leave alone for growing crops[2].

A large number of sheep, camels, cows and goats had died in the reported sub-project areas during previous droughts. The loss of livestock has added to the severity of the situation as many people in these areas are farmers that depend on their animals for revenue.

There are number of positive effects of the proposed sub-project which in general will improve the Socio-economic and environment conditions of the sub-project areas, including:

- The project will help in recharging the ground water in the areas where it is crucial for the drinking agriculture and livestock.

[1] Source: PMDA Situation Report 28/08/2010) UNOCHA (Situation Overview - Situation Report 30/08/2010

[2] https://dailytimes.com.pk/105392/drought-and-migration-a-brief-story-of-tharparkar/

- The project will help in improvement of domestic water supply.
- Due to the project, intervention water will be available for a longer period which will augment to uplift socio-economic activities.

Nagarparkar regions is the main potential site in Sindh Province, to construct, Small Dams, Delay Action Dams, and Weirs to retain the run off generated from precipitation and continuous storm rainfall.

2.4 Sub-Project Categorization

The ESMF of World Bank defines that:

i. a full ESIA and ARAP/RAP will be carried out for subprojects requiring new construction or having significantly irreversible and widespread impacts or involving significant degradation of forests of sensitive areas, requiring land acquisition or dam height more than 15meter;

ii. an ESMP (and a ARAP/RAP if needed) will be prepared for medium sized sub-projects involving the rehabilitation of existing structures, potentially causing low to moderate level of negative but reversible and localized impacts; and

iii. Environmental and Social Checklists will be filled for smaller sub-projects resulting in low/negligible impacts.

According to Sindh – EPA: For sub project have storage volume less than 25 million cubic meters and surface area less than 4 sq.km. Therefore, this sub-project falls under category schedule I – G (1) “Dams and Reservoirs with Storage volume less than 25 million cubic meters of surface area less than 4 sq.-km”.

According to Donor Agency (World Bank): The sub-project is relatively small size and it will have some minor adverse environmental impact, with reversible nature and site–specific as well. Therefore, this sub-project falls under category B under characterization criteria described above. The present ESMP has been prepared accordingly to meet the Category B subproject requirements.

2.5 Subproject Screening Procedure

The sub-projects screening was performed through the checklist covering major environmental and social issues including storage volume and surface area of the reservoir, loss of community assets, basic facilities and services, livelihoods and income, possible affected ethnic minorities, archaeological sites and gender. Surveys were conducted to fill individual checklists and a summary of environmental and social concerns noted during surveys is given below. Checklists of eleven proposed dams are attached as Annexure – II.

- Total 86 number of out of 289 trees would be felled due to the construction of eleven dams.
- None of the dam is to be constructed in protected area.
- No archaeological site observed near the dam and no physical cultural resources at or near the proposed dam sites is observed which may likely to be affected by construction activities.
- No settlement observed near the all proposed dam sites. The nearest settlement is a minimum of 2 km away from the proposed dam site
- During the construction of dams, some natural habitats might be disturbed, with negligible impact.
- No protected forests observed near proposed dam sites. Revenue department owned the land of the proposed dam sites.
- Ambient air quality, ambient noise level is within acceptable limits of Sindh Environmental Quality Standards (SEQS).

2.6 Sub-Project Duration

The execution works of the sub-project are proposed to be completed in 12 months after the approval of PC-1 and bidding process according to the procurement plan approved by the World Bank.

2.7 Policy, Legal and Administrative Framework

This section presents an overview of the policy and legal framework relevant to the environmental and social aspects of the subproject. More details have already been provided in the ESMF prepared for SRP.

2.7.1 National/ Provincial Legislation

Sindh Environmental Protection Act, 2014

The categories are defined in the Sindh Environmental Protection Agency (SEPA) Review of IEE and EIA Regulations, 2014. The sub-projects are categorized based on a storage volume and surface area of the reservoir mentioned in Schedule-I, section - G, subsection-I “Dams and Reservoirs with Storage volume less than 25 million cubic meters of surface area less than 4 sq.-km”. Therefore, all sub-project dams are within limits given in Schedule-I of IEE and EIA Regulations, 2014, so this sub-projects fall under Schedule “I” so it will require an IEE. However, an ESMP has been prepared to satisfy the requirements of the World Bank for such type of projects. Moreover, No Objection Certificate (NOC) will be obtained from Sindh EPA to fulfill legal compliance.

Other Applicable Cross Sectoral Laws in Sindh

Laws that may have relevance to the environment with brief scope of the law and their applicability are listed in Table – 1.

Table 1: Key Applicable Cross Sectoral Legislation in Sindh

Legal Instrument	Scope and Applicability	Relevance
Land Acquisition Act 1894	Empowers the government to acquire private land for projects of national importance and lays down the acquisition procedure.	If the land for the project is acquired through the government, the acquisition process shall comply with this law.
The Sindh Forest (Amendment) Act, 2012	Regulates forest resources. Empowers the government to declare any forest area reserved or protected.	Not relevance as there is no reserve or protected forest in the sub -project area.
The Sindh Wildlife Protection Ordinance 1972 (Amendment 2001, 2010) Act, 2007, 2020	This ordinance provides for the preservation, protection, and conservation of wildlife by the formation and management of protected areas and prohibition of hunting of wildlife species declared protected under the ordinance.	Some interventions are likely to be carried out near important habitats.
Employment of Child Act, 1991	The Employment of Child Act (ECA) 1991 disallows the child labour in the country. The ECA states that no child shall be employed or permitted to work in any of the occupation set forth in the ECA (such as transport sector, railways, construction, and ports) or in any workshop wherein any of the processes defined in the Act is carried out.	The contractor will be bound by this Act to disallow any child labour at the project sites or campsites.
The Sindh Occupational Safety and Health Act, 2017	The clauses relevant to the project are those which concern health, safety and welfare of workers, disposal of solid wastes and effluents, and damage to private and public property. The Act also provides regulations for Compulsory vaccination and inoculation and Precautions against contagious or infectious disease at workplaces.	All these regulations will be applicable to the project construction's contractor.
The Antiquities Act 1975	Preservation and protection of antiquities (any object more than 75 years old). Empowers the government to declare any antiquity as protected.	There is no protected antiquity within the Study Area. Will apply to any chance find.
Sindh Cultural Heritage (Preservation) Act - 1994	The Act 1994 provides rule and regulations to preserve and protect ancient places and objects of agricultural, historical, archaeological, artistic, ethnological, anthropological and national interest in the province of Sindh.	This act may be applicable in specific situation. Like any chance find.

2.7.2 Operational Policies (OPs) of the World Bank

Developers seeking financing from the World Bank are required to comply with the applicable environmental and social safeguards, OPs and Bank Procedures (BPs). A summary of the

key objectives of the relevant safeguards policies considered for the sub-project is provided in Table – 2.

Table 2: Summary of the World Bank Policies and Their Triggering

Directive	Policy	Description	Triggered = ✓, Not Triggered= x	Comments
Environmental Assessment	OP 4.01	This OP requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable. This OP also categorizes the projects on the basis of the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.	✓	As the subproject falls into Category B ESMP has been carried out instead of a full assessment (ESIA)
Natural Habitats	OP 4.04	The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long term sustainable development. Through this OP, the WB therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions.	✓	Although the sub project will not adversely impact natural habitats due to its small size and localized, site specific impact of short duration and reversible nature anyhow special provisions for management of natural habitat have been adhered in ESMP.
Forestry	OP 4.36	The objective of this Policy is to assist the WB's borrowers to exploit the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests.	x	There will be no disruption to forests associated with the sub project works.
Pest Management	OP 4.09	Through this OP, the WB supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides.	x	Not triggered as the Project will not use or promote the use of pesticides.
Indigenous Peoples	OP 4.20/OP 4.10	The policy requires projects to identify whether indigenous peoples are affected by the	x	Not triggered as no Indigenous People or ethnic minorities will

Directive	Policy	Description	Triggered = ✓, Not Triggered= x	Comments
		project and, if so, to undertake specific consultation activities and to avoid or mitigate impacts on this potentially vulnerable group.		be affected by the sub -project.
Physical Cultural Resources	OP 4.11	The World Bank's general policy regarding cultural properties is to assist in their preservation, and to seek to avoid their elimination.	x	No known areas of cultural heritage will be impacted by the sub project. Procedures will be in place to deal appropriately with any chance finds.
Involuntary Resettlement	OP/BP 4.12	The World Bank aims to avoid involuntary resettlement where possible. Where necessary or acquisition of land or other assets is necessary, the policy sets out requirements for participation in resettlement planning, mandates compensation for assets at replacement cost, and expects the borrower to see that incomes and standards of living of affected persons are improved or at least restored to what they were prior to displacement. The document also identifies the need for a Resettlement Plan, an abbreviated Resettlement Plan or otherwise.	✓	it is not relevant since there is no resettlement
Safety of Dams	OP/BP 4.37	The Policy seeks to ensure that appropriate measures are taken and sufficient resources provided for the safety of dams the WB finances.	✓	The selected sub-projects are falling under the definition of Small Dams as specified in OP 4.37. As part of due diligence and considering that Bank's OP 4.37 is applicable.
Public Disclosure of Information	BP 17.50	This BP deals with the World Bank policy on disclosure of information. It is a mandatory procedure to be followed by the borrower and Bank and supports public access to information on environmental and social aspects of projects.	✓	ESMP summary would be available in Sindhi to public, and would be available on SRP website.

2.8 Compliance with ESMP

This ESMP forms part of the Bid Documents and its compliance is mandatory. The contractor may request amendments in ESMP for aligning it with ground realities and requirements for each subproject/sites mentioned in this ESMP. If there is any change required, the contractor shall make such request to Project Implementation Support and Supervision Consultants (PISSC). The E&SS team of PISSC shall validate the amendments and consult with E&SS team of PMT. If acceptable, the amendments would be communicated to the contractor by PISSC. These site-specific ESMPs will then be embedded into the civil works contracts and therefore will be legally binding on the contractor. The amended Site Specific ESMP would be approved by PMT and PISSC.

The contractor will be required to prepare other site plans as mentioned in Section 7 including a traffic management plan, HSE plan, waste management plan, COVID-19 management plan, etc. The site-specific plans must be submitted to the PIU/Supervising Engineer for review and clearance within 30 days of the signing of the contract or before mobilization on-site, whichever date is earlier.

2.9 Study Team

The following members conduct the study. A list of team members is given in Table – 3.

Table 3: Study Team

Sr. No.	Name	Designation	Organization
1.	Dr. Abbas Ali	Team Leader	Consultant – ACE
2.	Mr. Sameen Khokhar	Environmental Specialist	Consultant – ACE
3.	Mr. Ghulam Haider Bhirahmani	Social Safeguard Specialist	Consultant – ACE
4.	Mr. Attaullaha Pandrani	Ecological/Wildlife Specialist	Consultant – ACE
5.	Mr. Sayed Ahmad Hussain	GiS Expert	Consultant – ACE
5.	Ms. Nazira	Sociologist – Gender Survey	Consultant – ACE
6.	Ms. Kamala Devi	Sociologist – Gender Survey	Consultant – ACE

2.10 Data Collection

This report has utilized primary and secondary data, collected through field surveys, field tests and observations, laboratory testing, environment monitoring in the field (refer Annexure – III), data acquisition from concerned departments, through consultations meetings, interviews and filling of questionnaires and sifting through published material to establish a baseline profile of physical, biological and socio-economic environmental conditions.

3. DESCRIPTION OF SUB-PROJECTS

3.1 Background

Eleven small dams are proposed which are scattered in the Nagarparkar, the tehsil of Tharparkar District (Figure – 1). Hence, Tharparkar region (Nagarparkar) is the sub project of the 45 Dam project (total number of dams proposed under SRP-AF).

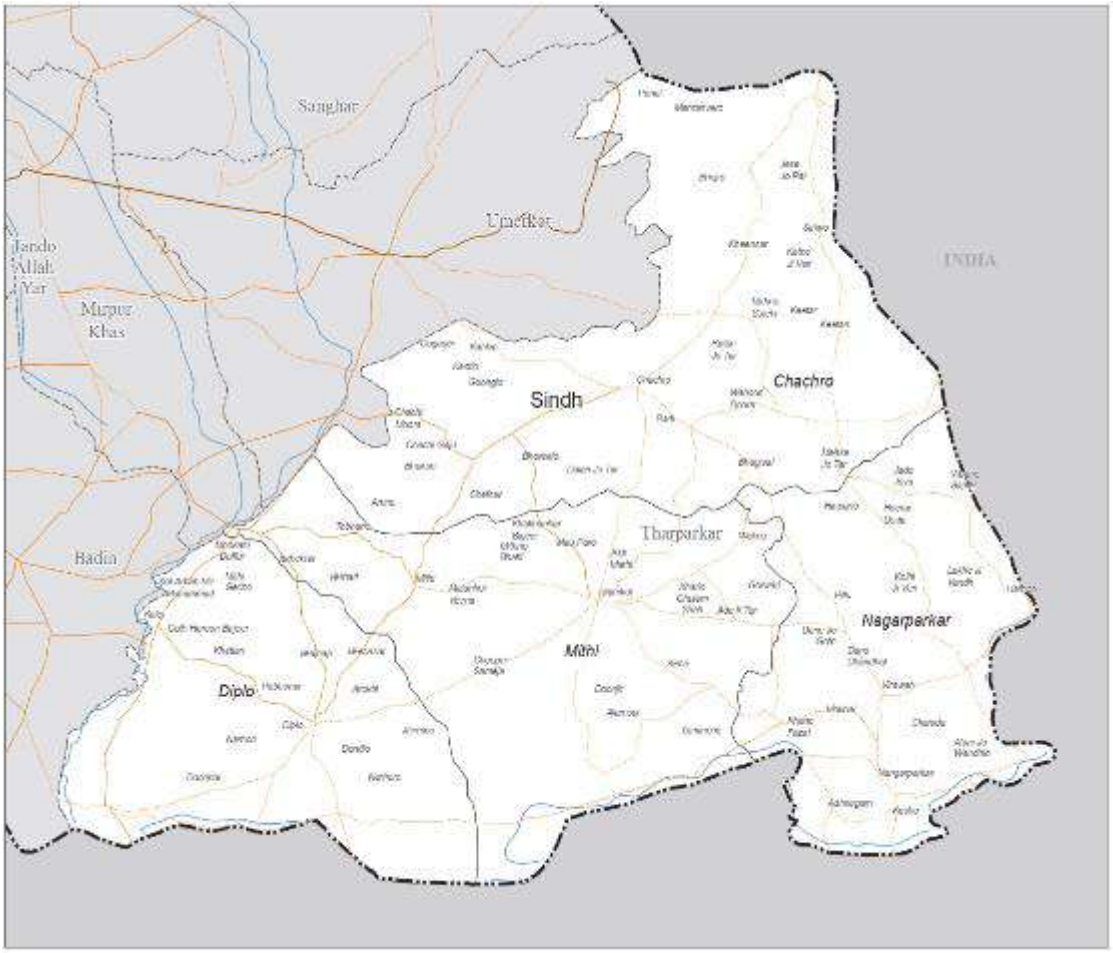


Figure 1: Location Map of Tharparkar District

Nagarparkar is located in Tharparkar District, Sindh, Pakistan. It is located129 km from Mithi. Nagarparkar is located between latitudes 240 14' N to 240 33' N and longitudes 700 36' E to 710 03'E, and it covers an area of approximately 1,560 km^2. Nagarparkar area is connected by road with Karachi, Hyderabad, and Badin via Mithi and Islamkot. It is situated in the south-east corner of Sindh Province and is shown in Figure – 1.

Nagarparkar region is divided into two categories based on geomorphology. Area one is the Thar Desert, and an area two is the hilly Thar (Nagarparkar) region. The Thar Desert consists of an area of high sand dunes, composed of fine, coarse sand with silt. The hilly Thar region also consists of mountains in which some granite matter is present. The Granite Mountains

covers the central part of the hilly Nagarparkar (Karunjhor Mountains), and they extend for approximately 80 square kilometers. The elevated peaks vary from 114 to 360 meters above sea level. Location of SRP – AF sub-project area is shown as Figure – 2.

3.2 Locations of Sub Project

The proposed sites are ideally situated in and around the Hilly Nagarparkar as shown in Figure – 3. Detail of each proposed dam is given below.

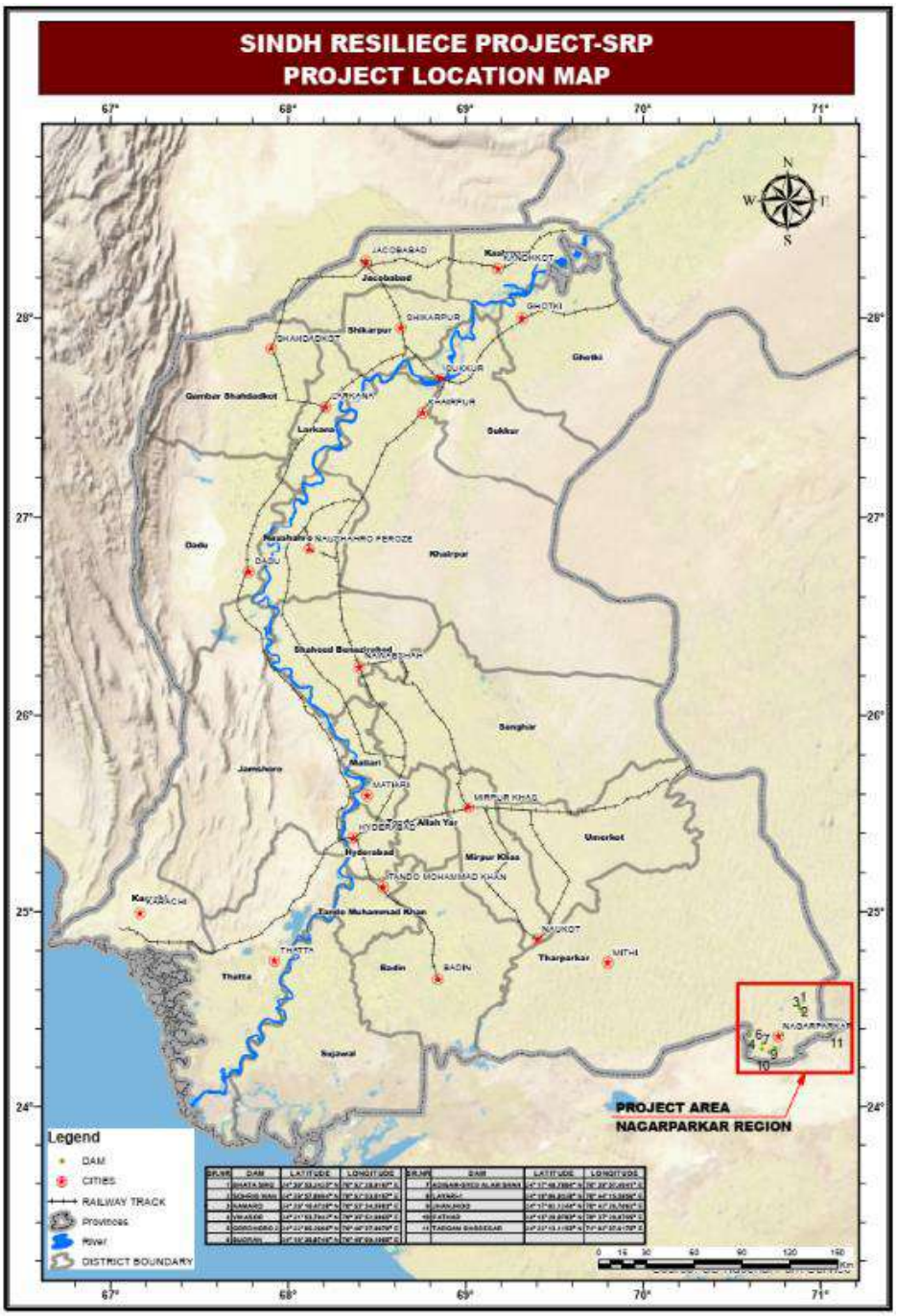


Figure 2: Location of the SRP-AF Sub-Project Area

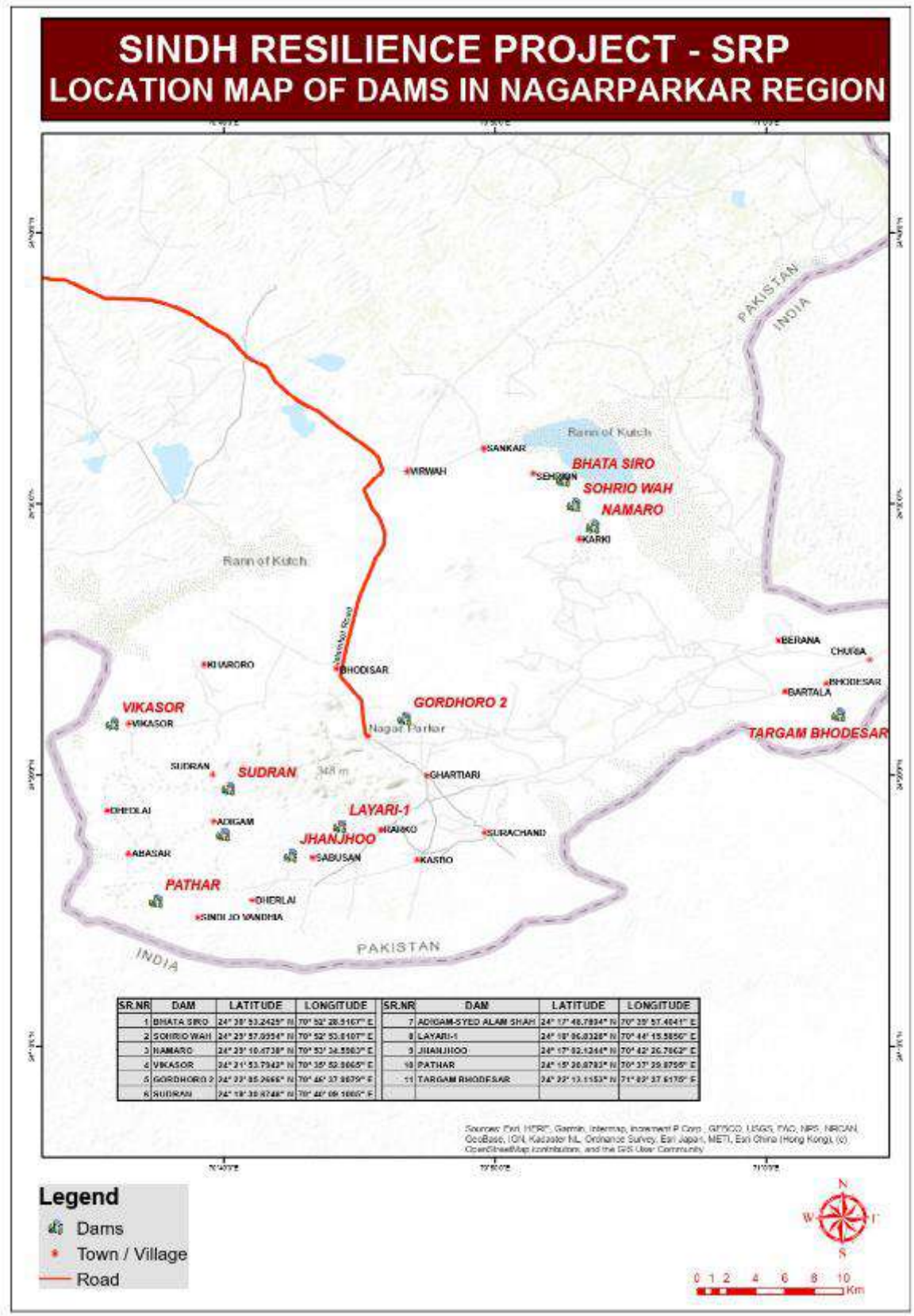


Figure 3: Location Plan of Dams in Nagarparkar Region

i. Bhata Siro Dam

Bhata Siro is a narrow but deep stream collecting rain water from elevated and uneven land on upstream and further Wari Bhatasari nadi, Khanani nadi, and Sankar sar nadi pouring flashflood in to Bhuttasro nadi. The area is almost uncultivated.

Proposed Dam Name	Nadi /Channel Name	UC Name	Near By Village	Coordinates	Distance from Nagarparkar	Upstream Features	Down-stream Features
1. Bhata Siro	Bhatta-Siro nadi	Veera Wah	Sehrion	24° 30' 35.0" N 70° 52' 34.2" E	25 km S side	Barren Land, village about 2 km away NW side, Pond – NW side about 500m	Runn of Kutch about 1020 m

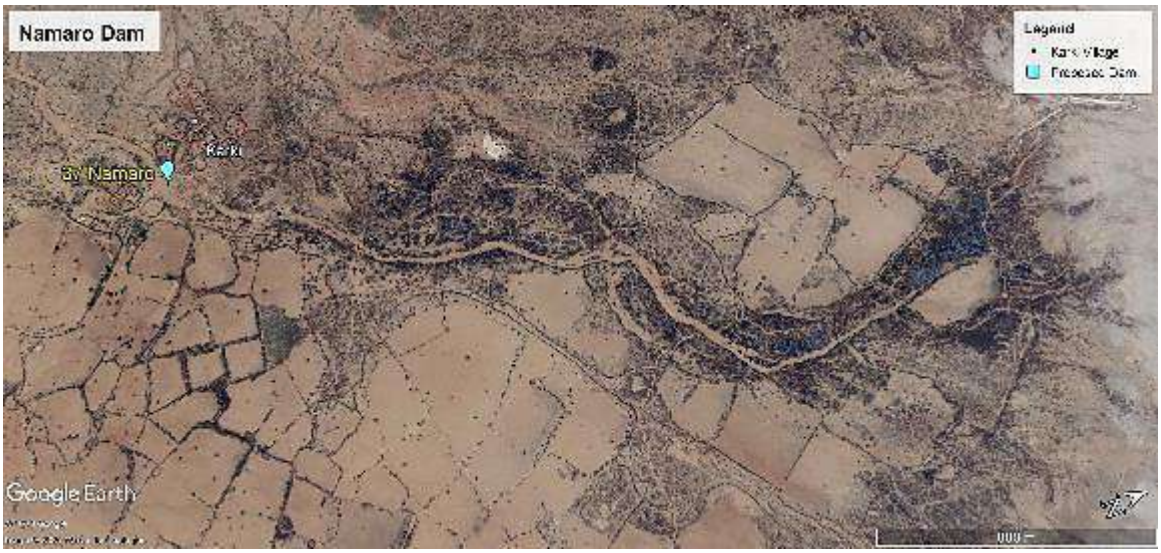
ii. Sohrio Wah Dam

Sohrio-wah is a narrow stream collecting rain water from Sohrio jabal/hill and Sadoras hilly area. Ram jo wandio, Sohrio nadi and other small and medium level streams contributing rainwater into Sohrio wah Stream. .

Proposed Dam Name	Nadi /Channel Name	UC Name	Near By Village	Coordinates	Distance from Nagarparkar	Upstream Features	Down-stream Features
2. Sohrio Wah	Sankar sar	Veeran Wah	Sohrion Wango	24° 30' 01.2" N 70° 52' 55.7" E	22 km S side	Barren Land, village about 3 km away S side	Runn of Kutch about 1230 m

iii. Namaro Dam

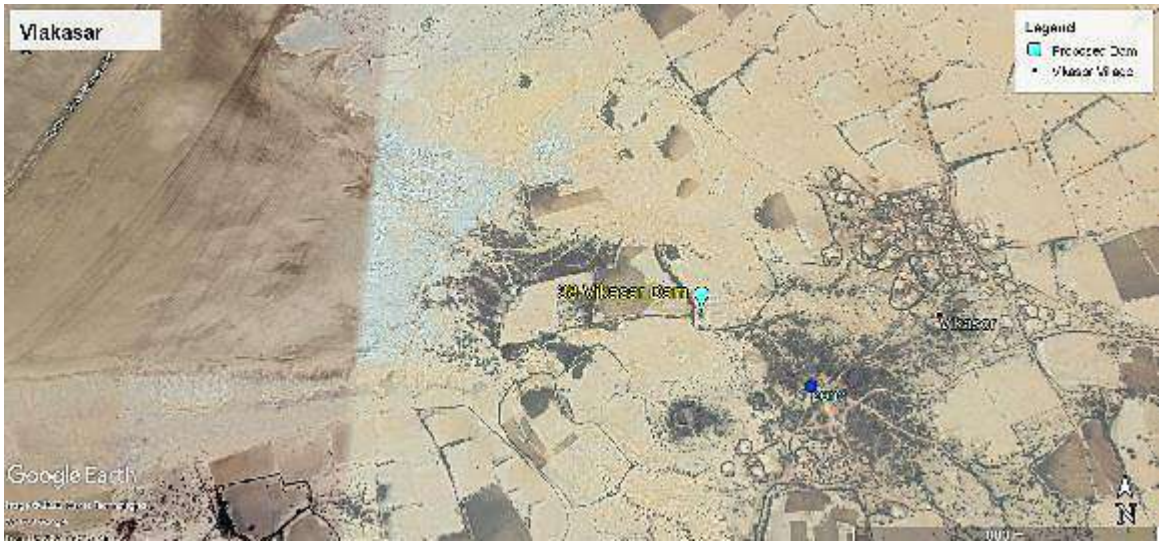
Namaro is a non-perennial stream collecting rain water from Sadoras hilly area. Namaro is junction of small and medium level streams including Namaro, Karaki, Sadoras, Nagar and Khanari jo wandio flowing into Namaro stream.



Proposed Dam Name	Nadi /Channel Name	UC Name	Near By Village	Coordinates	Distance from Nagarparkar	Upstream Features	Down-stream Features
3. Namaro	Namaro	Behrano	Karki	24° 28' 36.5" N 70° 53' 08.3" E	22 km SW side	Barren Land, nearest village is about 2 km far	Runn of Kutch about 3510 m N side

iv. Vikasor Dam

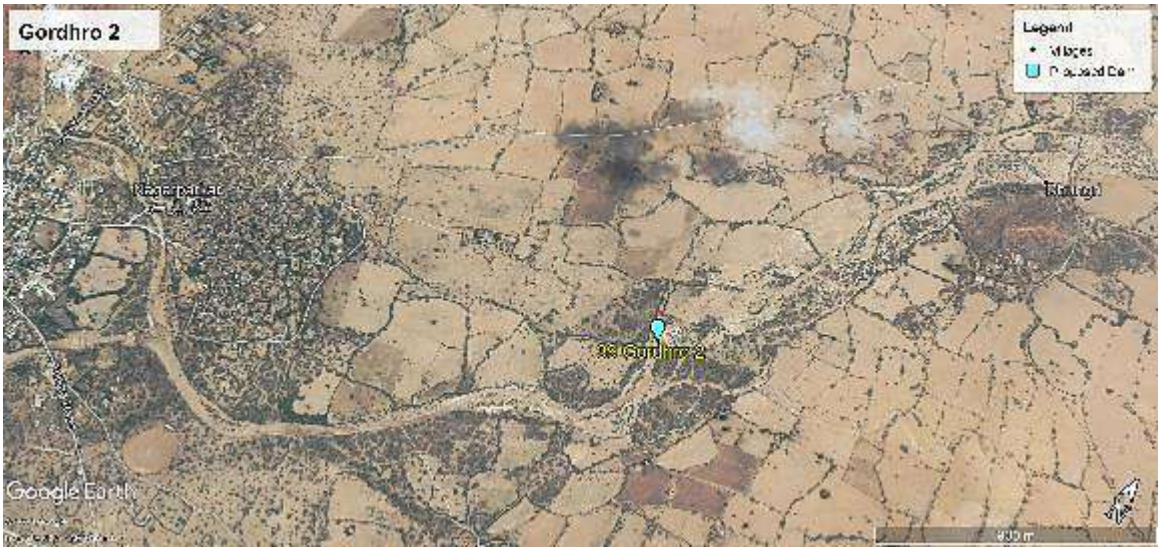
Vikasor dam site is South of Nagar town and close to Indian Territory, catchment area of proposed dam is on barren land containing sandy loam soil, while down-flow is hard and rocky and consist of un-cultivable land mass. Vikasor stream discharging its rainwater in to Runn of Kutch plain.



Proposed Dam Name	Nadi /Channel Name	UC Name	Near By Village	Coordinates	Distance from Nagar	Upstream Features	Down-stream Features
4. Vikasor	Vikasor	Nagarparkar	Vikasor	24° 21' 54.27" N 70° 36' 09.65" E	15 Km from E side	Agricultural Land, Pond about 1Km – E side	Runn of Kutch and Border about 2800 m NW side

v. Gordhro-2

Gordhro dam site is located close to Nagarparkar town and Karoonjhar hills. Gordhro nadi is emerging from Bhatiani nadi further Sardro nadi and Gordhro nadi joining on upstream of dam site near Khosa village. Upstream at Bhatiani nadi point is hard and rocky, downward to Kasbo bridge rest of the study site consist of unstable sandy and fewer field crops existed.



Proposed Dam Name	Nadi /Channel Name	UC Name	Near By Village	Coordinates	Nearby bench Mark	Upstream Features	Downstream Features
5. Gordhro-2	Bhatiani nadi	Nagarparkar	Fakir Darya Khan	24° 21' 54.23" N 70° 46' 27.00" E	about 4Km – w side	Barren and Agricultural Land,	Barren and Agricultural Land,

vi. Sudran Dam

Sudran dam site is located at foothill of Karoonjhar, proposed dam site is consisting of sandy and pours soil.

Proposed Dam Name	Nadi /Channel Name	UC Name	Near By Village	Coordinates	Distance from Nagarparkar	Upstream Features	Down-stream Features
6. Surdan	Surdan Nadi	Adhigham	Surdan	24° 19' 30.6" N 70° 40' 10.7" E	Nagarparkar is about 12 Km – E side	Barren and Agricultural Land,	Barren and Agricultural Land,

vii. Adhigam - Syed Alam Shah

Adhigam site is locatedin the vicinity of Sudran nadi and habitats area sharing. Catchment area of Adhigam is located foothill of Karoonjhar kill, there ShaheedAlam channel, Gatro nadi, Haryandi and Adhigam collecting flashflood to main Adhigam stream. Habitat of the site is almost sandy.

Proposed Dam Name	Nadi /Channel Name	UC Name	Near By Village	Coordinates	Distance from Nagarparkar	Upstream Features	Down-stream Features
7. Adhigam - Syed Alam Shah	Adhigam	Adhigam	Adhigam	24° 17' 57.6" N 70° 40' 06.1" E	about 13 Km – E side	Barren and Pond about 2 km W side	Barren and Agricultural Land,

viii. Layari – 1

Layari - 1 dam site'shabitat is same as Sudran and Adhigam. Upstream is connected to Karoonjhar hilly area, with gravel cum sandy loam soil and downstream consist of loos sandy. Agriculture fields are the dominant habitat, constituting major habitats of the area.

Proposed Dam Name	Nadi /Channel Name	UC Name	Near By Village	Coordinates	Distance from Nagarparkar	Upstream Features	Down-stream Features
8. Layari - 1	Lyari	Nagarparkar	Kharirioon	24° 18' 08.0" N 70° 44' 16.4" E	about 8 Km – N side	Barren land and Mountain	Barren and Agricultural Land,

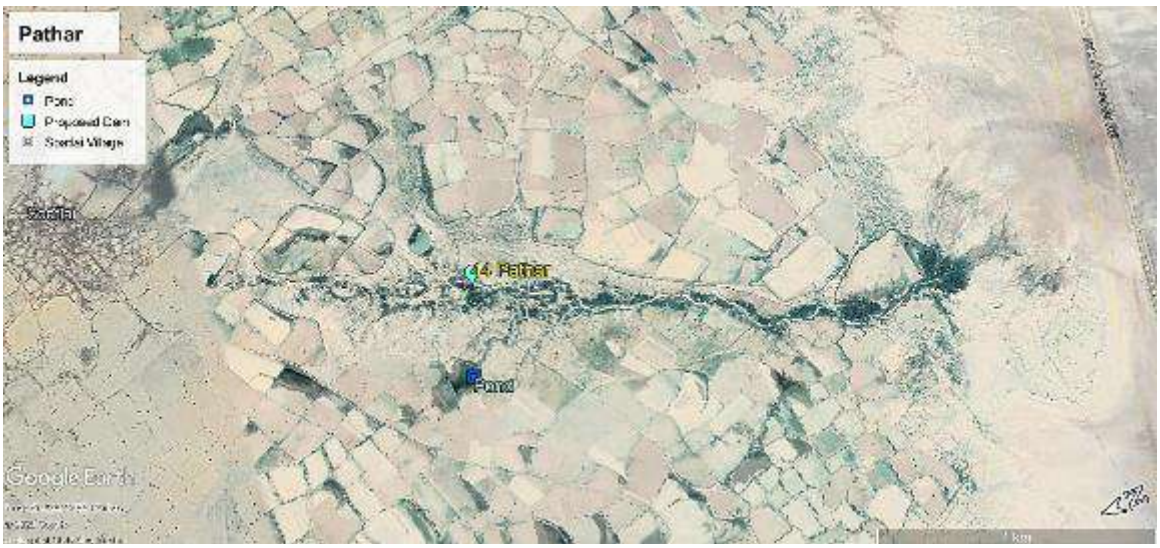
ix. Jhanjhoo

Habitat of this site is (throughout upstream and downstream) is sandy, rain-fid agriculture land found near the site. Soil is sand to gravel well drain for surface water. Seepage water found in stream bed, which providing temporary habitat for aquatic fauna like frogs, toads and insects, which are food source for secondary consumers. Agriculture fields are the dominant habitat, constituting major habitats of the area.

Proposed Dam Name	Nadi /Channel Name	UC Name	Near By Village	Coordinates	Distance from Nagarparkar	Upstream Features	Downstream Features
9. Jhanjhoo	Jhanjhoo	Adhigham	Kharario	24° 17' 22.3" N 70° 42' 24.8" E	about 12 Km – SN side	Barren land and Mountain	Barren and and Pond about 1.5 km S side

x. Pathar

Pathar dam site is located at South of Nagar town and close to Indian Territory, upstream is sandy and cover with agriculture fields, whereas downstream consist of hard and unfertile soil, further downward of site is salt marsh and barren land.



Proposed Dam Name	Nadi /Channel Name	UC Name	Near By Village	Coordinates	Distance from Nagarparkar	Upstream Features	Downstream Features
10. Pathar	Pathar nadi	Adhigham	Kharario – 1.5 Km	24° 15' 24.3" N 70° 37' 30.0" E	about 25 Km – E side	Barren and Agriculture land and Pond about 500 m W side	Barren Land, and Runn of Kutch about 3000 m, S side

xi. Targam Bhodesar

This site is located at North East of Nagar town near to Indian Territory and it is closed to salt marsh of Kutch. Namaro is a non-perennial stream collecting rain water from Churia hilly area. Targam is junction of small and medium level streams including Bhodesar, Bartla and Wandiasar. Soil of area is sandy loam, some sites are gravel on top, Churia jabal is locate vicinity of the dam site. A small dam near Bartala, also existed upstream of the proposed dam site.

Proposed Dam Name	Nadi /Channel Name	UC Name	Near By Village	Coordinates	Distance from Nagarparkar	Upstream Features	Down-stream Features
11. Targam Bhodesar	Namaro	Behrano	Bhodesar	24° 22' 23.77"N 71° 32' 34.2" E	about 36 Km – W side	Barren land and pond about 2km N side	Barren Land, and Runn of Kutch about 2400 m S

3.3 Salient Features of Sub-Project

The main components of the sub-project are the construction of small rain water-fed dams, less than 10 meters in height, in Nagarparkar region. The main objective of the construction of small dams and weirs is to recharge groundwater water may be used for domestic and livestock purposes. Salient features of sub-projects are given in Table – 4 below.

Table 4: Salient Features of the Sub-Project

Description	Nagarparkar Region, Tharparkar District										
	Bhata Siro Dam	Sohrio Wah Dam	Namaro Dam	Vikasor Dam	Gordhoro-2 Dam	Sudran Dam	Adigam- Syed Alam Shah Dam	Layari-1 Dam	Jhanjhoo Dam	Pathar Dam	Targam Bhodesar Dam
Catchment Area (sq.mile)	1.8	1.3	3.5	3.3	8.9	2.2	2.7	0.8	3.2	3.5	0.9
El.of River Bed (ft)	35	46	55	45	181	260	152	256	161	52	51
El.of Spillway Crest (ft)	45	58	68	56	191	272	165	269	174	64	61
Head Over Crest (ft)	2	3	3	3	4	3	3	3	3	3	2
Highest Flood Level (ft)	47	61	71	58	195	275	168	271	177	66	63
El.of Dam Crest (ft)	51	64	74	62	198	279	171	275	180	70	66
Dam Height above Riverbed (ft)	16	18	19	17	17	19	19	19	19	18	15
Weir height above river bed ft)	10	12	13	11	10	13	13	13	13	12	10
Reservoir area at normal pool level (Acre)	53.0	20.0	72.0	56.0	79.2	27.0	14.0	16.0	9.0	39.0	46.0
Reservoir Area (Sq.-Km)	0.21	0.08	0.29	0.23	0.32	0.11	0.06	0.06	0.04	0.16	0.19
Reservoir Capacity (Acre-ft)	173.0	69.0	289.0	245.0	278.5	130.0	55.0	83.0	40.0	151.0	171.0
Storage Volume (million cubic meter)	0.21	0.09	0.36	0.30	0.34	0.16	0.07	0.10	0.05	0.19	0.21

The proposed dams will augment the groundwater aquifers through percolation. The groundwater will be utilized through dug or tube wells for drinking and livestock purposes as it is presently in practice at the sub-project areas.

3.4 Construction Activities

The Construction activities for various sub-project dams will span 12 months. The execution works of the sub-project are proposed to be completed in 12 months after the approval of PC -1 and bidding process according to the procurement plan approved by the World Bank. The related activities are the establishment of contractor's camp and stockyards for cement, steel, and aggregate, shifting of necessary machinery and equipment to site and exploitation of borrow areas, construction of concrete spillways, earth fill embankments and one-room building for dam O&M staff. The major activities are briefed below:

i. Contractor's mobilization: After awarding the contract the selected Contractor shall be mobilized in the field and arrange the camp for their staff and labor. The machinery and other necessary equipment shall be shifted.
ii. The concrete structures will be constructed with contraction joints. PVC water stopper shall be provided at these joints.
iii. The borrow areas will be excavated as per specifications. The borrow material will be loaded and transported by tractor trolleys through the approved traffic management plan.

iv. Formation of embankments/ bunds for the reservoir with the soil obtained from borrow areas. Activities involve unloading the soil on embankment, leveling, and compaction of soil in layers.

v. The stone shall be loaded and transported from nearby quarries or by approved material quarries to the site through trucks and unloaded/stacked at designated places.

vi. Stone pitching works shall be carried out as per specification.

vii. Restoration of campsite and Contractor's demobilization.

3.5 Construction Material

The following construction materials are foreseen to be used in the construction of concrete spillways and earthen bunds:

a) Embankment fill
b) Fine and coarse filters
c) Toe drain stones
d) Gravel bedding
e) Riprap stones
f) Cement
g) Fine and coarse aggregates
h) Reinforcement
i) Water
j) PVC water stops

Estimated quantities of construction material required are given in Table – 5. The materials used for the construction of the sub-project proposed dams includes coarse aggregates, fine aggregates (sand), rock for stone pitching and riprap, earth, water, cement and steel.

Table 5: Estimated Quantities of Construction Materials

Sr. No	Dams	Earthwork (Cft)		Cement Concrete		Reinforcement	Protection Stones	Filter Media	
		Excavation	Fill	Mass (Cft)	RCC (Cft)	(Cwt)	(Cft)	Fine (Cft)	Coarse (Cft)
1	Bhatta Siro 2	1,078,573	1,624,069	76,436	84,685	134,482	570,905	294,494	361,804
2	Sohrio Wah	792,123	895,535	68,653	89,517	142,155	376,588	159,374	176,831
3	Namaro	1,347,485	1,940,065	166,569	129,992	206,430	660,285	341,975	413,847
4	Viakasar	1,333,038	1,907,204	200,286	145,705	231,383	583,390	315,948	399,263
5	Gordhro-2	1,801,122	2,296,561	300,973	193,885	307,894	714,079	390,913	496,580
6	Sudran Nadi	791,214	949,459	176,945	139,277	221,175	301,096	154,684	195,687
7	Adhigam - Syed Alam	726,489	360,978	197,934	142,035	225,554	167,424	80,176	90,222
8	Nagar - 2 (Layari)	448,088	536,767	100,506	106,288	168,788	160,518	86,492	117,465
9	Jhanjhoo Nadi	921,827	339,934	197,850	142,520	226,325	111,473	60,426	82,789
10	Pathar	894,667	838,171	144,693	115,903	184,056	338,782	146,773	173,492
11	Targaam Budhesar	751,694	1,259,662	56,213	73,339	116,465	421,231	223,514	283,752
	Total	**10,886,321**	**12,948,406**	**1,687,058**	**1,363,147**	**2,164,708**	**4,405,770**	**2,254,768**	**2,791,732**

The natural materials such as coarse aggregate, toe drain stones, riprap stones, and coarse filters can be obtained from crush plants of local suppliers which are abundant near all sub-project dam sites. The fine aggregate and fine filters will be obtained and transported from approved query areas.

The water would be obtained from tube wells installed by the Contractors. The contractor shall strictly bound not to use community tube well as this may compete for the local water resource in the dry season when water table decline. The contractor will conduct an Electrical resistivity surveying test along with a pump-out test to assessing the groundwater potential required for the construction activities before the tube wellbore. This condition will be included in the bid document as contractual binding.

Cement will be procured from Mirpur Khas, Khairpur, Sukkur, and Islamkot cities. Most of the other construction supplies such as fuel, steel, and lubricants can also be arranged from big cities like Mirpur Khas and Hyderabad. Some other construction materials such as rolled steel bars, PVC water stops, and steel plates for formwork, pump installation material may be brought from Hyderabad and Karachi.

3.6 Construction Camp and Workforce

For the construction of dams and appurtenant works, camps will be established on the government near the dam sites minimum 1000 m away from settlements Contractor’s camps will be on government land. As construction works are confined only to the dam’s site, therefore, camps will be placed as per designated sites. The contractor will give preference to local people for unskilled labor from the communities with the consultation of elders of different communities in an equitable manner and there would be no need of setting up large scale camp.

Only 15 to 20 workers will be accommodated in each camp. Most of the laborers will go back to their nearby homes after completion of the daily work these will includes the drivers/operators (tractor trolley, loader. etc.) and some semi-skilled labour. The contractor will be bound to provide facilities like kitchen/washing/bathing/ latrine with septic tanks and medical checkups (including COVID related) to laborers. The health screening of laborers and workers will be conducted at the start of the project. The contractor will prepare workers' code of conduct plans and Camp layout plan and get it approved by the Resident Engineer and PMT for implementation at site. The camp will be established after the approval of the layout plan. Al these interventions have been discussed and consensus was built from the community during the public consultations. Details are given in below Table – 6.

Table 6: Details of the Camps Site for Each Sub-Project

Sr. No.	Sub project Name	Coordinates		Away from the Dam site (Km)	Distance from closest settlement (Km)	Land Required
		Northing	Easting			
1	Bhata Siro Dam	24°30'58.44"N	70°52'19.76"E	0.4	2.4	4 Acers
2	Sohrio Wah Dam	24°29'48.69"N	70°53'1.55"E	0.4	4.4	4 Acers
3	Namaro Dam	24°29'16.74"N	70°53'14.62"E	0.4	2.4	4 Acers
4	Vikasor Dam	24°22'6.96"N	70°36'0.41"E	0.5	2.5	4 Acers
5	Gordhoro-2 Dam	24°22'10.30"N	70°46'33.66"E	0.4	1.4	4 Acers
6	Sudran Dam	24°19'19.73"N	70°39'59.43"E	1.1	3.4	4 Acers
7	Adigam- Syed Alam Shah Dam	24°17'42.41"N	70°39'55.88"E	0.55	1.6	4 Acers
8	Layari-1 Dam	24°18'13.48"N	70°44'11.52"E	0.4	2.8	4 Acers
9	Jhanjhoo Dam	24°17'6.45"N	70°42'23.47"E	0.4	1.0	4 Acers
10	Pathar Dam	24°15'38.36"N	70°37'24.12"E	0.8	2.7	4 Acers
11	Targam Bhodesar Dam	24°22'28.40"N	71° 2'43.49"E	0.4	2.6	4 Acers

Prospective campsites location map are shown as Annexure – III.

3.7 Borrow Material

The fill for the earthwork/embankment can be obtained from borrow areas near dam sites where suitable soil is available. The Contractors will be allowed to choose their own borrow areas as per their arrangement. The contractor will be bound to procure the material from authorized quarries. Before start of the work contractor will get approval. Quantities of fill material are given in Table – 5.

3.8 Machinery & Equipment

The construction work includes earthwork and concrete work. These works will require earthmoving machinery such as excavators, dumpers, graders and rollers, transit mixtures, etc. the concrete works will involve medium-size batching plant and concrete placing equipment. All these equipment will be directly managed by the contractors. The estimated machinery and equipment required are given in Table – 7.

However, the actual number of equipment required on the site will be determined by the contractor to carry out the strengthening work.

Table 7: List of Machinery and Equipment to be used on all Sub-Projects

Machinery/ Equipment	Sub-project Names											Total
	Bhata Siro Dam	Sohrio Wah Dam	Namaro Dam	Vikasor Dam	Gordhoro-2 Dam	Sudran Dam	Adigam- Syed Alam Shah Dam	Layari-1 Dam	Jhanjhoo Dam	Pathar Dam	Targam Bhodesar Dam	
Loader	3	3	3	3	3	4	4	3	3	4	3	**36**
Tractor Trolley dumper	10	8	10	12	8	10	10	12	8	10	8	**106**
Earth leveler machine	2	2	2	2	2	2	2	2	2	2	2	**22**
Excavator	4	4	4	4	4	4	4	3	3	4	3	**41**
Transit Mixtures	5	4	3	4	5	4	5	5	5	4	5	**49**
Batch Plant	1	1	1	1	1	1	1	1	1	1	1	**11**
Total	**25**	**22**	**23**	**26**	**23**	**25**	**26**	**26**	**22**	**25**	**22**	**265**

3.9 Manpower Requirement

The manpower required by the contractor during the execution of the sub-projects is given in Table – 8. For unskilled laborers, local people will be preferred. Machinery Loader/Dumper/Trucks/ Tractor Trolley will be used for bringing earth material from the designated sites. Local operators/drivers will be preferred with valid driving licenses having experience of driving vehicles like (Truck, dumpers, and Dozers etc.). This does not include the drivers which will carry the stone from the quarry and other items like cement and steel from the local market.

Table 8: Estimation of Required Manpower

Type of Manpower	Sub-project Names											Total
	Bhata Siro Dam	Sohrio Wah Dam	Namaro Dam	Vikasor Dam	Gordhoro-2 Dam	Sudran Dam	Adigam-Syed Alam Shah Dam	Layari-1 Dam	Jhanjhoo Dam	Pathar Dam	Targam Bhodesar Dam	
Construction Supervisor	1	1	1	1	1	1	1	1	1	1	1	**11**
Environment and Social Safeguard Staff	3	3	3	3	3	3	3	3	3	3	3	**33**
Surveyor	3	3	3	3	3	3	3	3	3	3	3	**33**
Skilled laborer	4	5	4	5	4	4	5	4	5	4	4	**48**
Semi-skilled laborer	5	6	5	6	5	5	5	6	5	5	6	**59**
Unskilled laborer	15	15	15	15	15	15	15	15	15	15	15	**165**
Drivers/operators	25	25	30	25	30	25	30	30	30	30	30	**310**
Total	**56**	**58**	**61**	**58**	**61**	**56**	**62**	**62**	**62**	**61**	**62**	**659**

Manpower requirement is based on best estimates and subject to revision. The final requirement would be determined after the finalization of bid documents by the contractor(s).

3.10 Delineation of the Area of Project Influence

The Corridor of Impact (CoI) for the sub-projects has been considered carefully keeping in view the proposed interventions and associated impacts during construction, operation, and maintenance phases. The CoI would cover the footprint of the temporary and permanent works or the working area required to complete the works, the anticipated impacts during construction and operation phases. The spatial extent of the subproject area when preparing the ESMP has been focused on keeping in view the proposed interventions and broad impacts of the sub-project after completion. The CoI is classified as described below.

3.10.1 Primary Impact Zone

The primary corridor of impact area was surveyed physically and scanned through the HECRAS and google map software to estimate expected loss during the construction and in case of dam break, 100 years flood and combined impact of dam break + 100 years flood. The below Table – 9, shows the expected loss in terms of Tree cut, disturbance to track routes, agriculture land, archeological sites, and hand pumps. Since the all proposed dams are recharge dams, in which the estimated loss or disruption will be for few days and temporary as the water will percolate to aquifer. There are 6 kacha tracks and 86 trees will be impacted due the construction of proposed dams. Financial assistance have been proposed in the ESMP budget to compensate these impacts. For each site land use maps have been developed which are attached as Annexure – IV.

Table 9: Primary Impact Zone

Sr. No	Name of Project	Dam Type	Road Type	Trees	Agriculture Land Area (Acres)	Archeological Site (if any)	Hand pump/ Well
1	Bhata Siro	Recharge	Kacha Track (1)	15	0	0	0
2	Sohrio Wah		0	10	5	0	0
3	Namaro		0	6	0	0	0
4	Viakasor		0	12	10	0	0
5	Gordhro-2		0	6	5	0	0
6	Sudran		Kacha Track (1)	4	10	0	0
7	Adhigam - Syed Alam Shah		Kacha Track (1)	5	0	0	0
8	Layari-1		Kacha Track (2)	11	25	0	0
9	Jhanjhoo		0	11	0	0	0
10	Pathar		Kacha Track (1)	2	0	0	0
11	Targam Bhodesar		0	4	0	0	0
Total			**6**	**86**	**55**	**0**	**0**

3.10.2 Secondary Impact Zone

The secondary impact zone, which consists mainly of the settlements benefitting from the enhanced water availability in the wells. Maps regarding the Land use, camp location, and secondary impact zone have been depicted in Annexure – IV. These areas are mostly expected to be impacted positively in the medium and long term through availability of the water / groundwater for domestic use as well as for livestock consumption. In addition, the project is also expected to enhance the groundwater table in the long run. This will be elaborated in subsequent chapters.

4. ANALYSIS OF ALTERNATIVES

4.1 Selection of Dam Site Location

The Consultants have undertaken reconnaissance survey of the Nagarparkar Region for selection of dam sites. In addition, Consultants have reviewed three feasibility studies carried out by different Consultants i.e. M/S Associated Consulting Engineers ACE Limited for dams in Nagarparkar and Kotdiji Hills and by M/S Mott-MacDonald Pakistan (MMP) for dams in Kohistan Region. In these studies about 120 dam sites were investigated and 70 dam sites were recommended for construction. The present 11 dam sites have been selected considering findings of the reconnaissance survey & recommendations of the previous studies by following criteria as given in below.

Selection Criteria	Status
(i) Dam is located in water scarce area which solely depends for water on ground water and rain runoff for drinking and agriculture purposes.	(i) All eleven proposed dams are located in highly water scarce areas of Sindh Province.
(ii) Dam is able to either: a) Effectively recharge groundwater or b) Create a storage pond which will supply water for a longer period of time	(ii) All of the proposed dams are recharge dams
(iii) The topographical and geotechnical conditions at dam site provide suitable condition for safe and economical structure.	(iii) The topographical and geological conditions at all 11 dams are such that they provide most economic and safe dams.
(iv) The negative effect of dam on lower riparian's is negligible.	(iv) 25.1% of the available water will be retained for groundwater recharge for all proposed small dams, the rest will flow naturally and benefited the lower riparian Table 30 shows the total estimated inflow and proposed retention volume for each site. On the other hand in recharge dams the maximum benefit will reach the downstream communities.
(v) There should be minimum negative social or environmental impact of dam or on the other hand there must be a positive long term positive impact on environmental and social conditions.	(v) This is true for all sub-projects.
(vi) No or small land acquisition or resettlement is involved due to construction of dam.	(vi) In all 11 dams no land is to be acquired and no resettlement is

Selection Criteria	Status
	involved as all sub-projects will be built on lands owned by Revenue Department, Government of Sindh and there are no settlements, which need to be displaced nor even any farm or agricultural land will be impacted.
(vii) The project must be economic viability.	(vii) The economic analysis has shown that the sub-projects are economically viable with a tentative benefit cost ratio of 3.01.

An analysis of alternatives has been performed to review and assess different ways of meeting the project objectives that might have fewer environmental or socio-economic impacts.

This section presents an overview assessment of the impacts of each option under the following categories:

- Economic;
- Environmental; and
- Social

For the alternatives considered in this chapter, each category is assigned an impact significance according to the criteria given in Table – 10.

Table 10: Determination of Impact Significance

Impact Magnitude	Impact Significance	
	Short-term Duration	Long-term Duration
Major Positive	Moderate Positive	Major High positive
Moderate Positive	Minor Positive	Moderate Positive
Minor Positive	Negligible	Minor Positive
Neutral	Negligible	Negligible
Minor Negative	Negligible	Minor Negative
Moderate Negative	Minor Negative	Moderate Negative
Major Negative	Moderate Negative	Major Negative

4.2 The Available Alternatives for Sub-projects

The subject small dams are planned to be constructed in arid zones of Nagarparkar region in Tharparkar District of Sindh. The geographical location of these regions is such that the source of water is rain water which normally falls for few days of a year and the ground water. The

proposed small dams will primarily contribute to provision of water to communities during dry period by recharging of underground aquifers and formation of storage ponds.

To develop resilience against draughts the following alternative may be considered:

Option 0: Do nothing
Option 1: Construction of Gabion Dams
Option 2: Construction of Diversion Dams
Option 3: Construction of Small Earthen Dams with proper overflow Spillways

The scope of SRP-AF is only small dams are to be considered and as per World Bank and ICOLD criteria the small dams shall not be higher than 10 m and reservoirs not larger than of 2400Acft (3 million cubic meter) capacity. Thus large dams are not considered as an Option of this study

4.2.1 Option 0: No Project Alternative

In the No Project Scenario, the following issues are expected to continue:

- Communities will suffer hardships of dry seasons, particularly during long periods of draughts.
- People may increase the extraction of groundwater resulting its depletion and deterioration of groundwater quality and quantity.
- Due to shortage of water local people may resort to migrations which may increase social problems and economic burdens.
- Due reduction in crop production and livestock people may develop social vices such as armed robbery and terrorism.

4.2.2 Option 1: Construction of Gabion Dam

The gabion dams are the structures constructed across rivers / nallas / nais by placing stones in boxes / crates of steel wire mesh is an option to obstruct flows of water and recharge groundwater. This option is considered not suitable for the purpose for following reasons.

- Gabion dams do not have long life. The steel meshes get rusted and enclosed stones get washed away during nalla / river flows.
- Gabion dams are vulnerable to vandalism. People cut the mesh wires and steal them for their own uses. A broken gabion gets easily damaged and washed away by subsequent flows.
- The heights of gabions are not kept more than 6 to 10 feet. The required heights of subproject dams vary from 15 to 19 feet.

- The gabion dams can be used as recharge delay action dams only. Due to their porous body the gabion dams cannot be used as storage dams.

In view of above reasons, the gabion dams are not considered technically feasible for the subprojects.

Figure 4: Gabion Dam/Weir

4.2.3 Option 2: Construction of Diversion Dams

The small diversion dams can be constructed access rivers / nallas to divert river flows to adjoining lands for spate irrigation. There are following observations on this option:

- This option is suitable in cases where river / nallas flow for a long duration of time. Whereas in arid zones of Sindh the rains are very scanty and are of short duration. Though discharges in Nais / Nallas are very high but occur for a period of 7 to 15 days in a year. So this type of dam will not be beneficial.
- There are chances that diversion of flow may become uncontrolled which may badly inundate the adjoining crops and villages and may create shortage of water in the downstream area.

Due to above reasons, the diversion dam option is not adopted for the sub-projects.

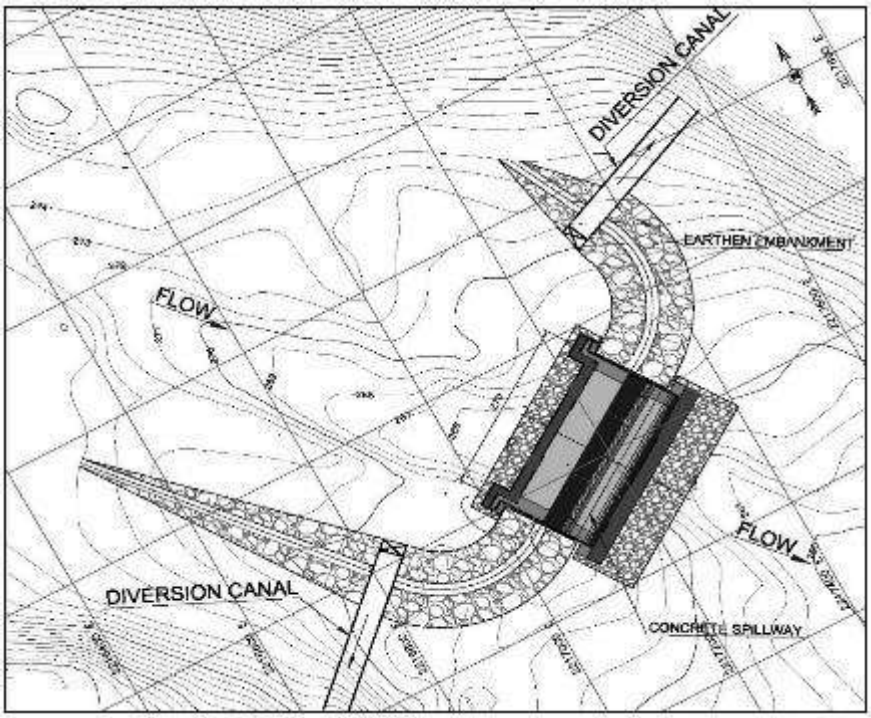


Figure 5: Diversion Dam

4.2.4 Option 3: Construction of Recharge / Storage Dams (Earthen embankments with Concrete Spillways)

The best options for Nagarparkar Hills are construction of recharge dam on Nais, where the dam will cause recharge of groundwater through entry of nai / nalla flow through river alluvium and underlying jointed rocks by delay action / storage and high head caused by the dams. These dams can be constructed to 15 to 19 ft height. Normally water remains in these reservoir for a period of 2 to 3 weeks. The recharged groundwater is also safe from the loss by evaporation and impurities.

In streams the recharge dam are proposed. In these dams, though there will be some loss in evaporation, still surface water will be available for a period of 5 - 6 months. Communities and their livestock can utilize water directly from these reservoirs.

The dams shall be constructed as earth fill embankments using local materials of earth fill, fine and coarse filters and stone protection. Where large size stones are not available for riprap for upstream slope protection, it can be obtained from limestone quarries. A concrete spillway will be provided in the central part of the dam to allow safe passage of high river flow. This type of small dams are very useful, use local materials and construction industry, store more water for long duration of time in form of groundwater recharge, are thus recommend as most suitable option to achieve the project objectives.

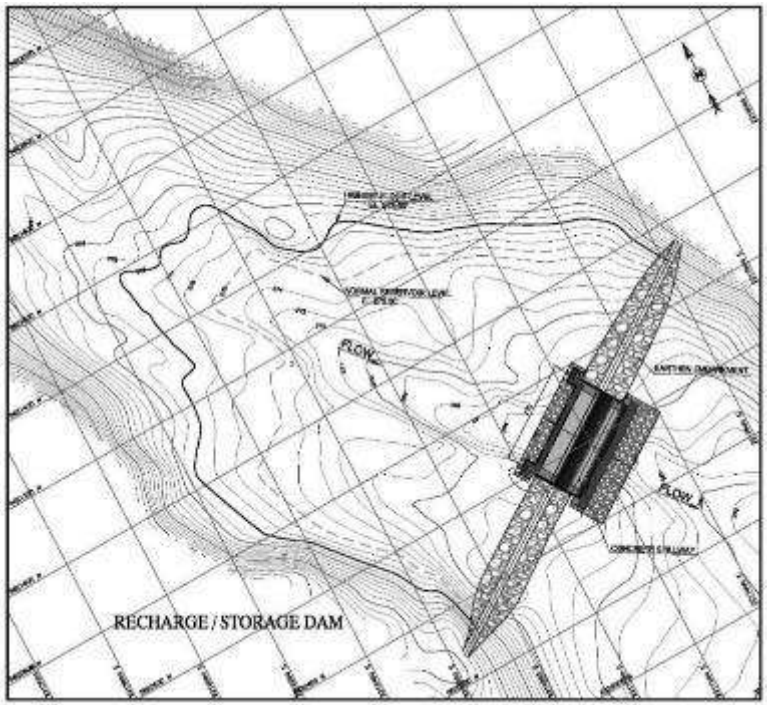


Figure 6: Recharge/Storage Dam with Earth Embankment and Concrete Spillway

This type of small dams are very useful, use local materials and construction industry, store more water for long duration of time in form of groundwater recharge, are thus recommend as most suitable option to achieve the project objectives.

Table – 11 reviews the alternative inventions considered to improve resilience against droughts in the sub - project area.

Table 11: Analysis of Alternatives: Construction of Small Dams

Option No.	Action	Economic Impacts		Environmental Impacts		Social Impacts	
Positive	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**
0	Without project	None	• Cost of relief to be provided during draughts (major, long term) • Loss of agriculture production and livestock (major, long term)	• No disturbance to environment (neutral)	• Loss of trees, crops and livestock (major, long term)	None	• Hardships to people and livestock during draughts (major, long term) • Migration of population from draught affected areas, increase in hardships especially in female population (major, long term). • Increase in social vices such as armed robbery and terrorism (major long term).
1	Construction of Gabion Weir for groundwater recharge	• Employment during construction (Moderate, short term) • Increase in crop production and livestock (Moderate, short term as compared to Options 2 and 3)	• Moderate capital cost to implement (Moderate short term); • Due to short life not more than 5-7 years the benefit will be short lived • Due to short heights, the economic benefits will be low (moderate long term) • Storage of water not possible (major, long term) • Short lived benefit	• Improvement in water availability (Moderate, short term as compared to Options 2 and 3) • Improvement in crop production Moderate, short term as compared to Options 2 and 3) • Improvement in ecology, and green cover (Moderate, short term as compared to Options 2 and 3)	• Felling trees in construction area (Moderate short term); • Quarrying of stone (Minor long term) • Greenhouse gas emissions from machinery during construction (Minor short term)	• Resilience against draught (Moderate, short term as compared to Options 2 and 3) • Improvement in standard of life (Moderate, short term as compared to Options 2 and 3) • Reduction in migration of communities (Moderate, short term as compared to Options 2 and 3)	• Minor loss of displacement of people due to stone pitching and widening of bunds (Minor long term) • Construction stage disturbance (Moderate short term)

2	Construction of diversion dam	As for Option No. 1	• Moderate capital cost to implement – higher than alternative #3(Moderate short term); • Moderate on-going maintenance costs(Moderate, long term) • Due to reduction floods in downstream reduction in crop production and livestock in downstream area	As for Option No. 1	• Felling trees on new alignment (Moderate short term); • Quarrying of stone (Minor long term) • Transport of earth material(Minor short term); • Air emissions from heavy machinery during construction Negative Positive Negative (Minor short term) • Serious decrease in water flows on the downstream affection of human life and ecology	As for Option No. 1	• Borrow areas and construction of structures (Major, long term); • Construction stage disturbance (Moderate, short term) • Downstream populations may face series shortage of water supply resources of their livelihood
3	Construction of Recharge / Storage Dam of Earthen Dam with Concrete Spillway	• Increased economic activities • Prolonged availability of water	Same as Option 2 • High capital cost to implement – higher than alternative #2 (Major, long term); • Moderate on-going maintenance costs(Moderate, long term)	• Increase in greenery and plantation (after implementation) • Due to ground water recharging water will be available for longer time. • Improvement in water availability(major, long term) • Improvement in crop production (major, long term). • Only some amount of water of Nai will be stored / recharged, remaining water will overspill. No or negligible impact on lower riparian.	• Felling trees on new alignment (Moderate short term); • Quarrying of stone (Minor long term) • Transport of earth material (Minor short term); • Air emissions from heavy machinery during construction(Minor short term)	• As for Option No. 2 but more than Option 2 and 3.	• Moderate loss of land to be acquired due to establishment of borrow areas and embankments (Major long term); • Construction stage disturbance(Moderate short term)

5. DESCRIPTION OF ENVIRONMENT

5.1 Introduction

This section describes the existing environmental and socio-economic conditions of the SRP – AF project area. The environmental and social baseline aims to provide a generic baseline against which the project impacts can be measured. This Section also identifies archaeological sites, protected areas, sensitive flora and fauna receptors in the project area. The potential impacts of the project and associated mitigation measures to address these impacts have also been discussed in this Section.

5.2 Physical Environment

5.2.1 Geography

All proposed dams are located in Nagarparkar region, district Tharparkar, of south east of Thar Desert. Nagarparkar region is divided into two categories based on geomorphology. Area one is the Thar Desert, and an area two is the hilly Thar (Nagarparkar) region.

The Thar Desert consists of an area of high sand dunes, composed of fine, coarse sand with silt. The drainage system of the Thar rainwater that comes from the sand dunes and accumulates into the low- lying areas.

The hilly Thar (Nagarparkar) is mostly flat land. The drainage system of the hilly Thar area consists of fifteen streams and rivers, locally called Nai/Nadi. These seasonal Nai drain the rainwater from the plain and Karunjhoor hills to Runn of Kutch. All proposed dams are around hilly Thar. In that region, there is no functional irrigation system; the only available source of water is underground sources.

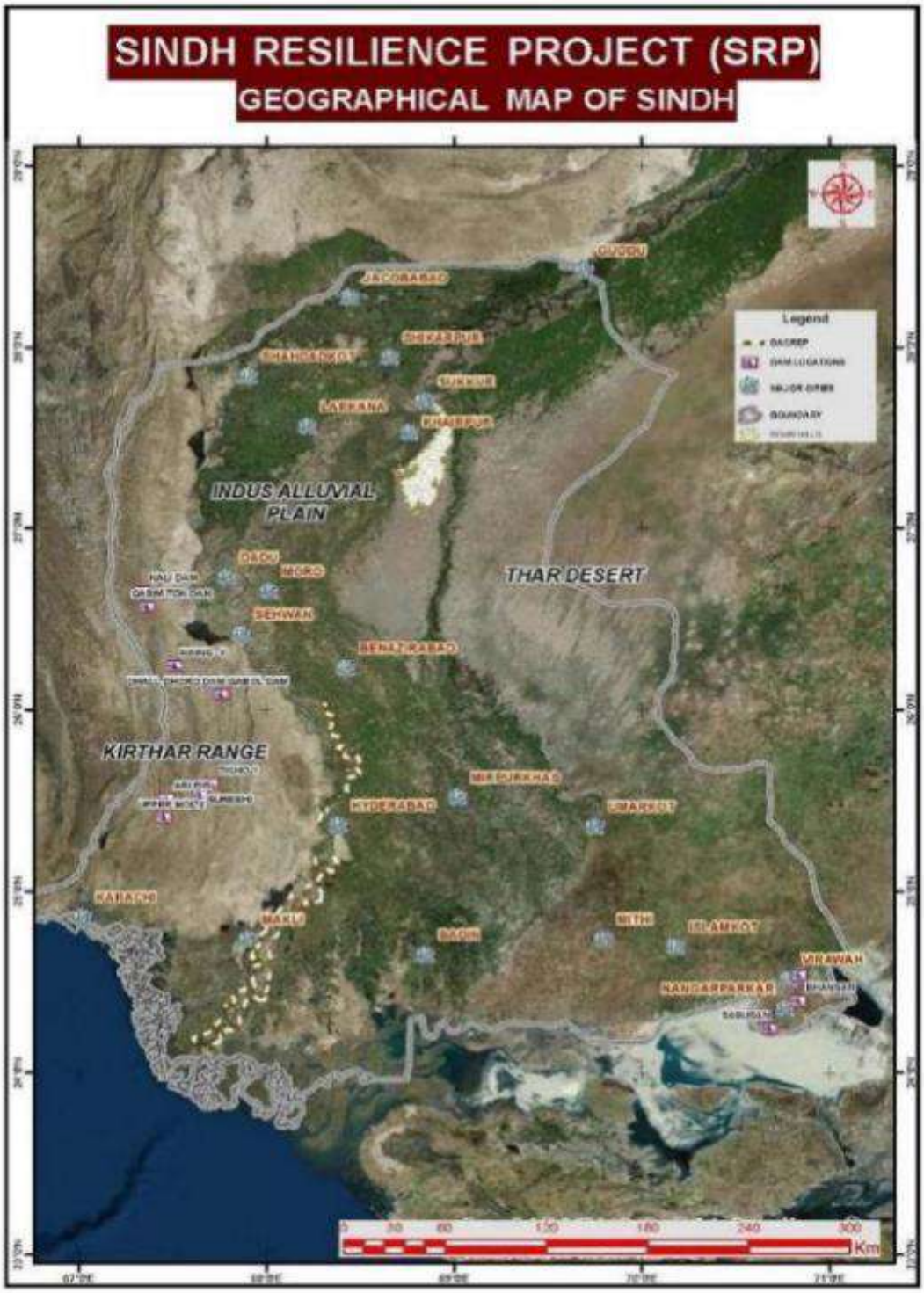


Figure 7: Topographic Map of Nagarparkar

5.2.2 Geology

The geology of Nagarparkar sub project area have remarkable features as it exhibits a variety of rocks from Pre-Cambrian basement rock to Tertiary sandstone and clays depicting a long tectonic history of the region. The desert to the south of Nagarparkar is believed to have grown over last 3,000 to 4,000 years, before that the region had more humid and tropical climate which favoured growth of thick vegetation and habitation of wild animals such as peacock and deer. The presence of lignite coal of Thar Coal Field showed that a humid climate existed at the time. The eastward extension of desert condition was prevented by Aravalli Mountain range about 250km from Nagarparkar where moisture-bearing clouds of southwest monsoon precipitates. Since there are no hills across the direction of winds the southwest monsoon just passes over the Thar Desert.

Project specific geological map is shown as Figure – 8. Sub-project area is surrounded on three sides by Runn of Kutch shelf which was a shallow arm of the sea during Pleistocene (1.6 million years) which extended and locally submerged the sloping land. The Indus once flowed into it and is now silted up and forms an extensive and desolate salt marsh during dry period and tidal flat covered with little seawater during monsoon period

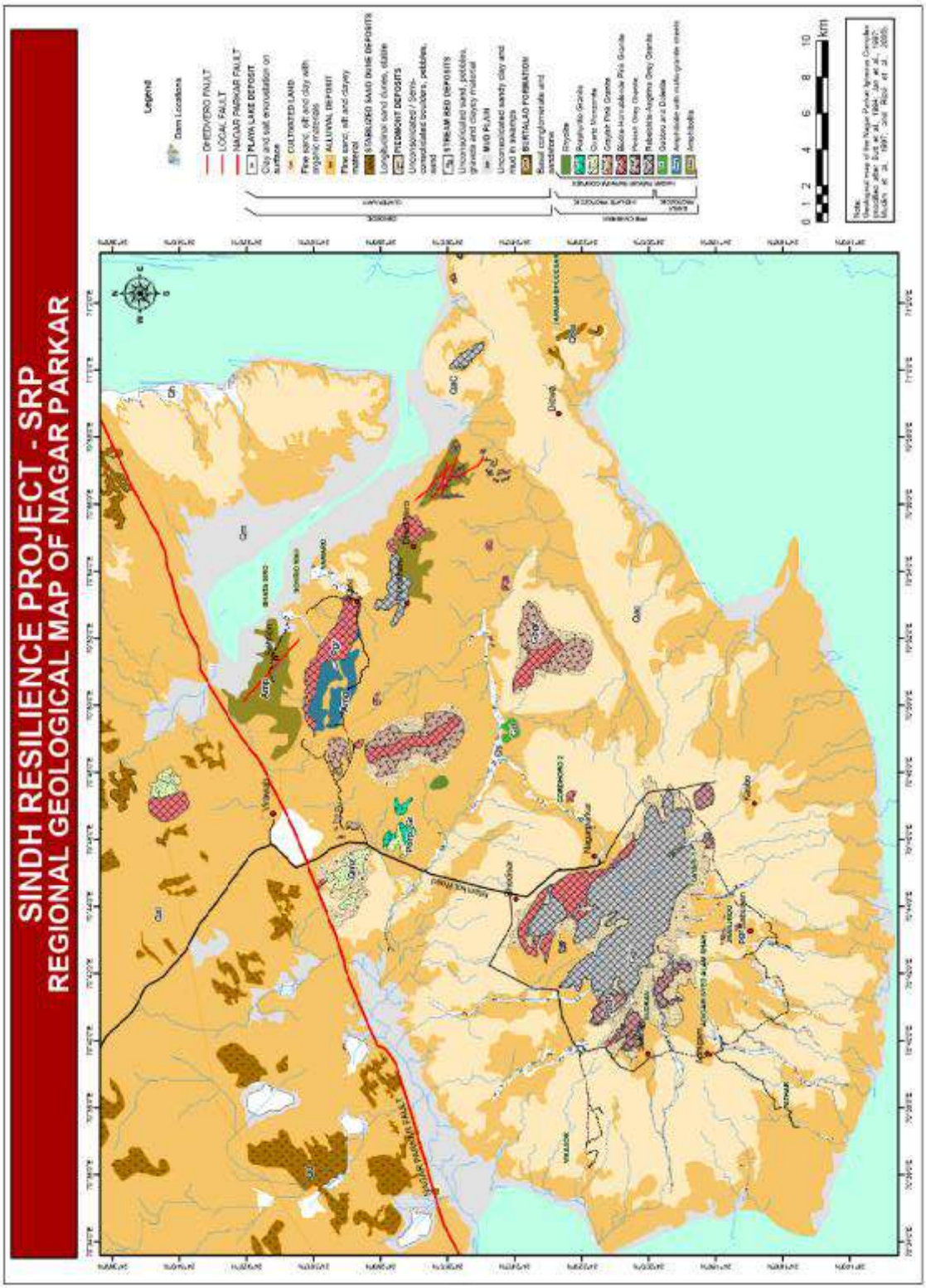


Figure 8: Project specific Geological Map of Nagarparkar

5.2.3 Soils

According to reconnaissance soil survey carried out by Soil Survey of Pakistan, generally, the area likely to be occupied by the proposed sub project comprises hilly sandy soil of Aeolian desert. Specifically at places Rock outcrop are covered with gravely and rock land and valley soil is mainly loamy soil. While, with the availability of water, the land in the sub project area having medium level of agricultural potential.

5.2.4 Seismicity

The map shown as Figure – 9 indicates that all of the sub-projects area is falling in Zone 2B, with peak ground acceleration (PGA) varying from 0.16 to 0.24g (Pakistan Building Code of Pakistan, 2007). While no any site is falling in Zone 4 which is called the High Damage Risk Zone and covers areas liable to MSKVIII. Moreover, all structure designs will be reviewed by the World Bank dam expert.

5.3 Climate & Rainfall

In an average year, sub-project sites receive a maximum rainfall of 5.3 to 9.0 inches or 135-230 mm (Figure – 10).

Most of the rains occur during July-August monsoon from southwest direction, whereas the prevailing winds are from the northeast during the rest of the year. During a good rainy-season, the area becomes "Green Hilly" The winter rains are insignificant. Dust storms are common, with winds of 140 to 150 km/hr from April to June in the desert. The maximum temperature rises to over 45^0C during the hot months of April, May and June.

Nagarparkar metrological station represents the climatological conditions in sub-project area. The mean monthly temperatures is min 17.8 ^{0}C & max 34.0 ^{o}C (Figure- 10), minimum rainfall is 0.04 inches to 5.63 inches maximum (Figure – 11) and evaporation rate is 2.48 inches to 11.83 inches (Figure – 12) at sub-project area

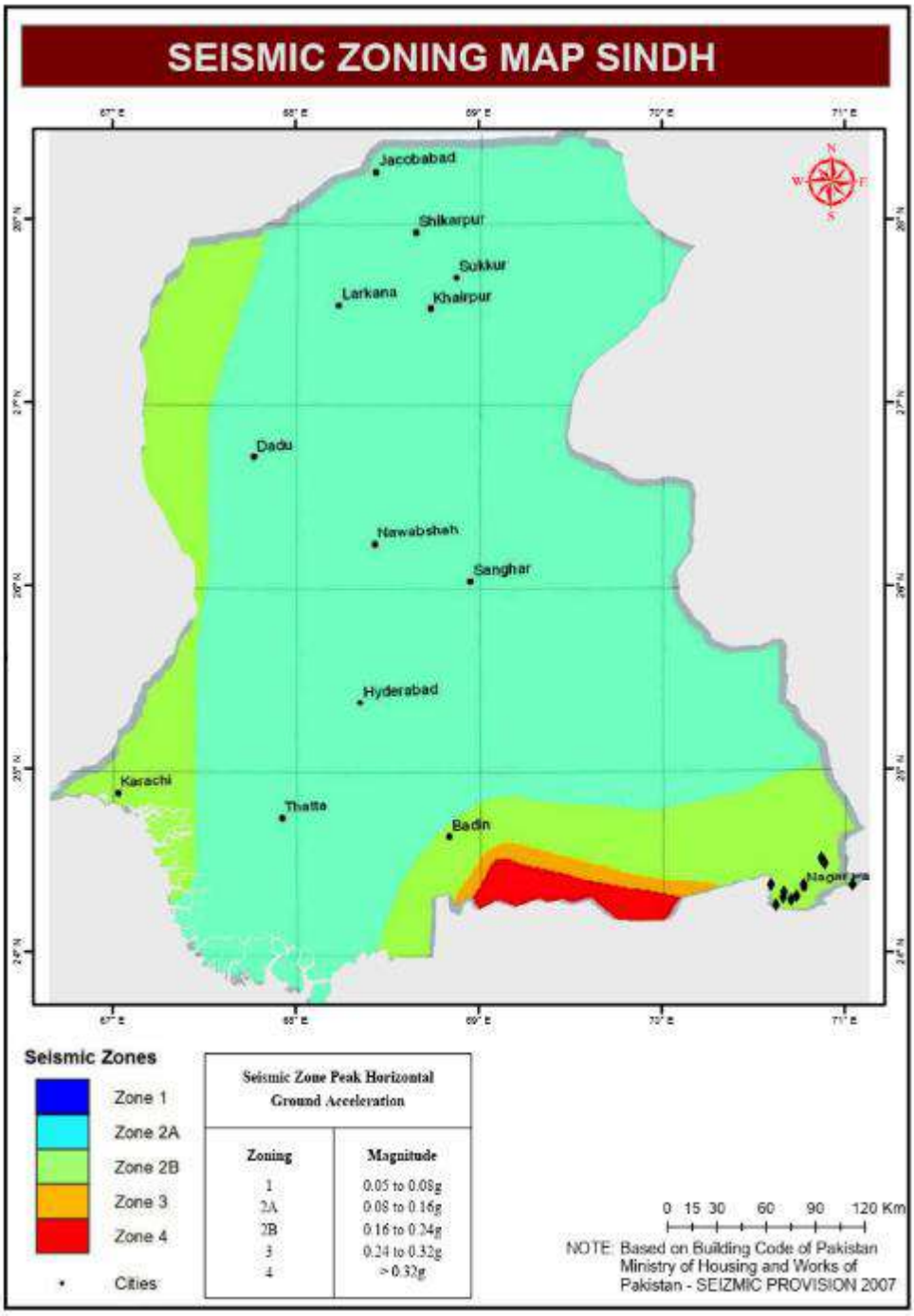
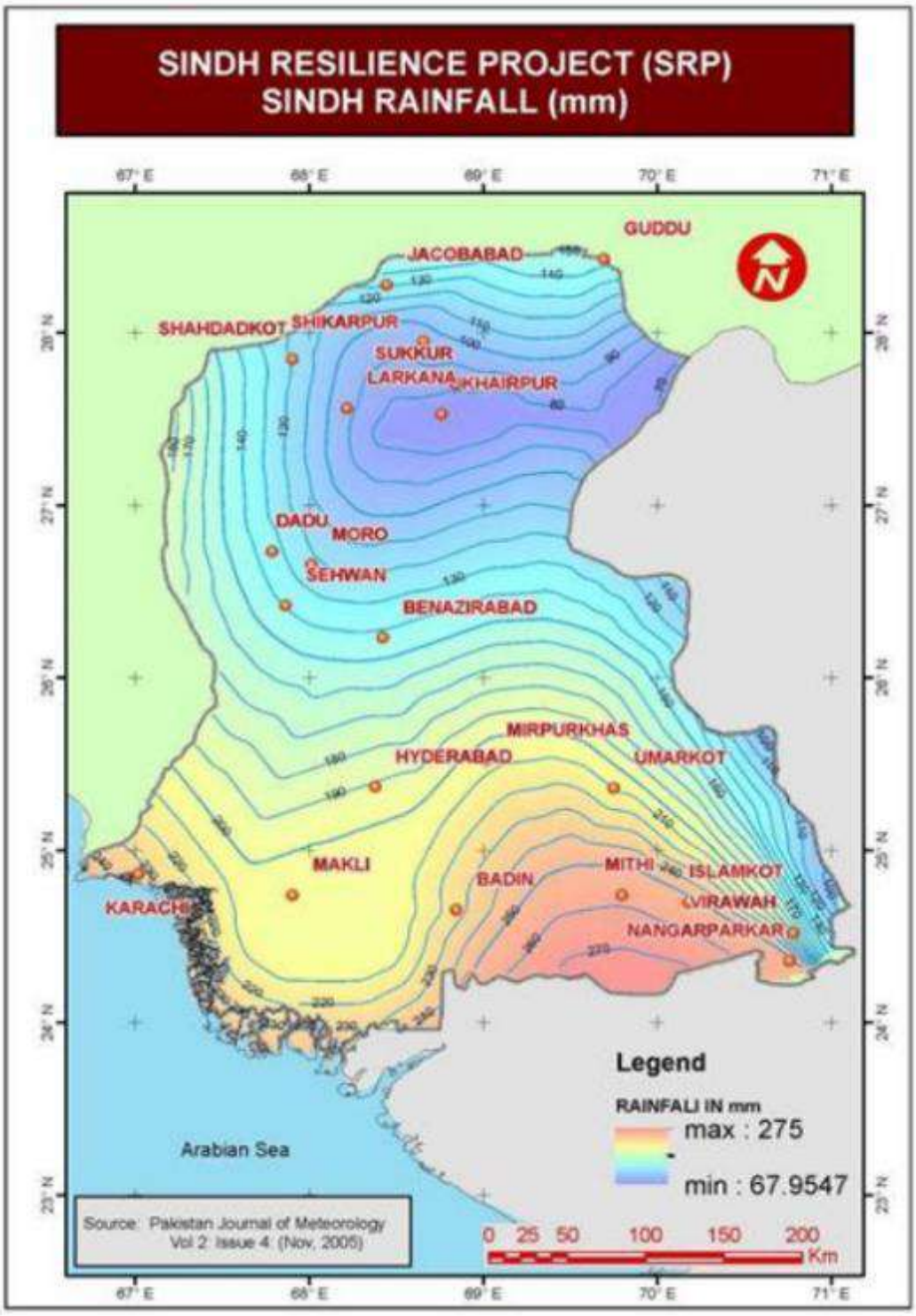


Figure 9: Seismic Zones of the Sub Project Area



(Source: Retrieved from http://db.world- housing.net/building/176 on 11th Nov-2015)

Figure 10: Annual Rainfall in Sub-Project Area

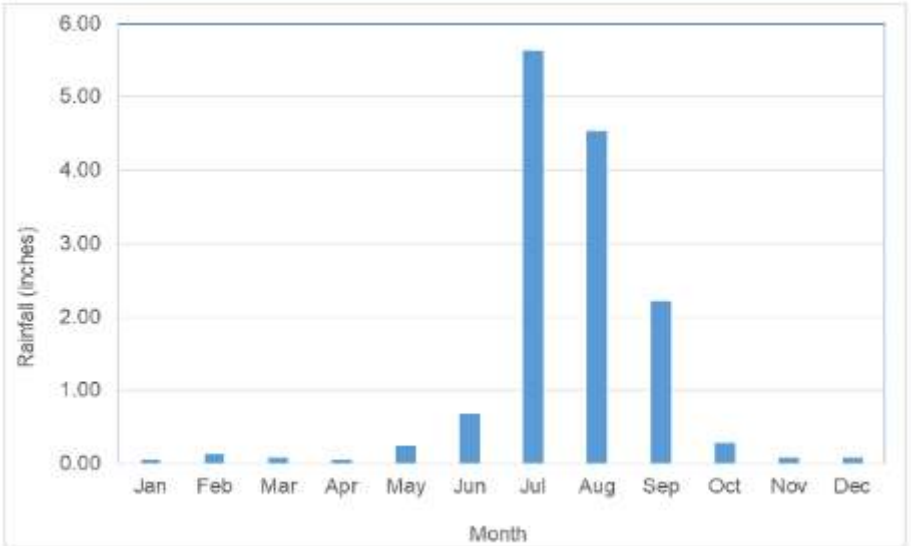


Figure 11: Monthly Average Rainfall at Nagarparkar

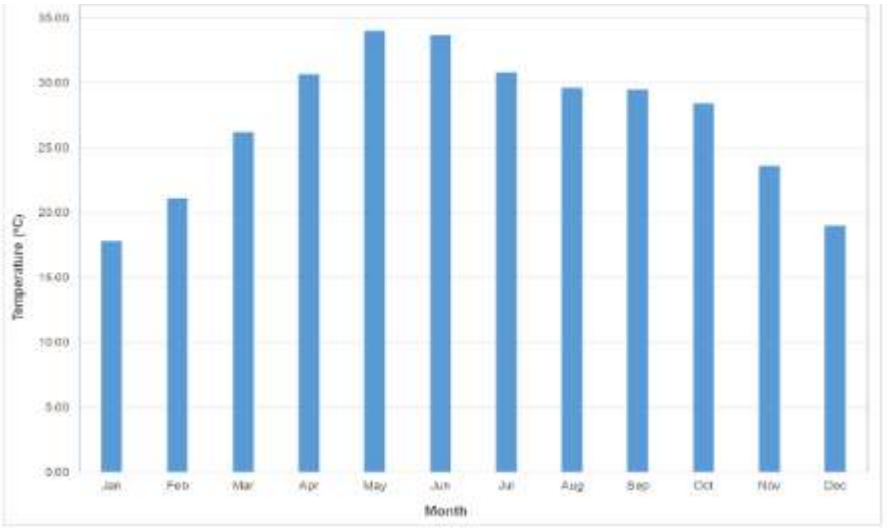


Figure 12: Monthly Average Temperature at Nagarparkar

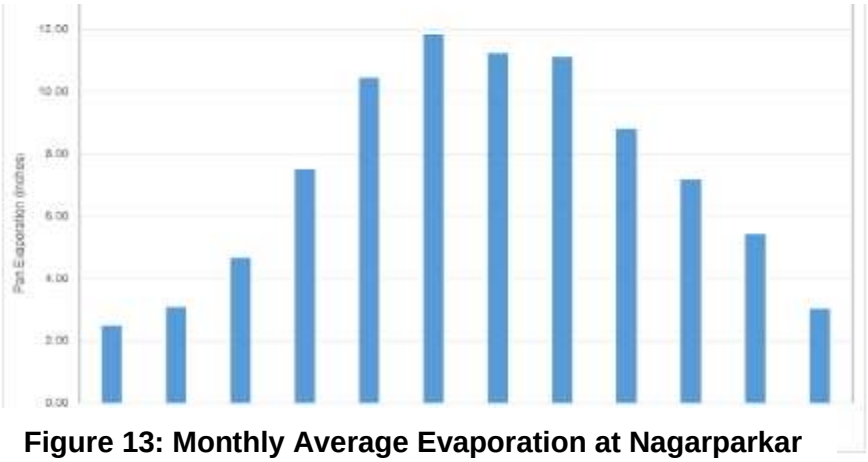


Figure 13: Monthly Average Evaporation at Nagarparkar

5.4 Water Resources and Quality

i. Surface Hydrology

Practically, no rivers exist in Nagarparkar and the drainage is internal. Rainwater flows tithe nearest topographic low, as sheet flow that eventually either evaporates and/or infiltrates.

None of the canal exist in the sub-project area, while nearby wetland is Runn of Kutch. Distance of wetland from proposed dam sites is given in Table – 12 below.

Table 12: Distance and Direction of Runn of Kutch from Proposed Dams

Sr. No.	Name of Proposed Dam	Away (Down Stream) from Proposed dam (m)	Direction
1	Bhata Siro	1020	North East
2	Sohrio Wah	1230	North East
3	Namaro	3510	North
4	Viakasor	2800	West
5	Gordhro-2	15000	South East
6	Sudran	12000	West
7	Adhigam - Syed Alam Shah	9000	South West
8	Layari -1	8500	South
9	Jhanjhoo	8500	South
10	Pathar	3000	South West
11	Targaam Bhodesar	2000	South East

Streams / Nais/Nalas in Nagarparkar (Sub-Project Area)

Nagarparkar is situated in the extreme south-east corner of the Sindh Province extending in the Runn of Kutch. It is spread over an area of about 1,560 sq. km.[3] Nagarparkar area (sub project area) has small Nala/Nadi and rivers originate from Karunjhoor hills and drain towards the Runn-of-Kutch. None of the rivers is perennial and as such, there is no base flow. Only flood flow keeps on flowing for a few hours to a couple of days after each sizeable rainfall event.

The average annual rainfall in the Nagarparkar area is 337 mm (13.25 inch) while the monthly rainfall given in the Figure - 12. Due to rocky and granite formation of Karunjhoor hills, the runoff generally goes into Runn of Kutch. Some portion of this runoff goes to the groundwater recharge before reaching the Runn of Kutch. Similarly, some of the rainwater is stored in the open ponds in nullah beds, which is the major source of water for domestic use throughout the year. The rainwater can be harvested by the construction of recharge dams.

[3] http://documents1.worldbank.org/curated/en/379961468071327827/SFG1723-REVISED-EA-P155350-Box396261B-PUBLIC-Disclosed-5-25-2016.pdf

ii. Groundwater

There is no surface perennial water available in the area. Based on the results of dug wells' inventories, covering about 8500 km^2 area between Gadro and Virawah in the eastern Thar (Nagarparkar, sub project area)along the Pakistan border, it is observed that the perched aquifers are hosted in friable sandy/silty layers sealed underneath by clay layers (Ploethner, 1992)[4]. The depth to water-table varies from 40 to 180 ft in and around sub project area, the majority of the dug wells have a depth to groundwater ranging from 60 to 250 ft. In general, the quality of groundwater ranges from saline to brackish during dry season and normal to saline during rainy seasons (wet season).

iii. Surface and Groundwater Analysis

Sampling from different locations in the sub project area was done by Evergreen Environmental Lab experts, and were analysed in their laboratory (SEPA Approved).The selection of locations for monitoring was done with due consideration to sensitive receptors. The identification of appropriate monitoring locations was finalized during the baseline survey, site walkover and visit to the surrounding areas. Table – 13 depicted the rationale for the sampling Locations. These results are given in Table – 14 & 15, Surface & Drinking Water analysis results respectively.

The samples were tested for thirty one (31) parameters as per Sindh Environmental Quality Standard - 2016 (SEQS). The analysis shows that all the toxic metals are below the limits except turbidity (because surface water have been used for drinking) salt contents (due to shallow brackish water) and microbiological contaminations (due to unavailability of sewerage system or open defecation in the area), as sets in the SEQS. Presence of Total Coliform is the source of concern, which will be mitigated by providing the water filtration system for the construction crew and elaborated in the mitigation section. The baseline monitoring locations and detail results has been appended as Annexure – III.

Table 13: Rationale for the Baseline Environmental Monitoring

Sr. No	Monitoring Parameters	No. of samples	Rationale
1	Ambient Air	7	Taken from area having nearby population or near the sensitive receptor
2	Drinking Water/Ground Water	11	at every proposed Dam site from nearby well or potable water
3	Surface/ Waste Water	7	where available because streams as are non-perennial
4	Noise	30	1 from Proposed Dam site, 2 from nearby sensitive receptors

[4] Ploethner, D., 1992, Groundwater investigations in desert areas of Pakistan: German Federal Institute for Geosciences and Natural Resources report Archives No. 108858, vol.2, p. 84-135.

Table 14: Surface Water Analysis Results

Sr. No.	Parameter (mg/l unless otherwise defined)	Analysis Method	SEQS Limit	Bhata Siro Dam	Sohrio Wah Dam	Vikasor Dam	Jhanjhoo Dam	Pathar Dam	Targam Bhodesar Dam
1	Temperature	SMWW 2550 B	**≤ 3°C**	22.0	23	24	22	24	24
2	pH	SMWW 4500 H+ B	**6.0-9.0**	6.9	6.98	7.4	7.5	7.3	7.6
3	Biochemical Oxygen Demand (BOD5)	SMWW 5210-B	**250**	10	9	9	11	<5	<5
4	Chemical Oxygen Demand (COD)	SMWW 5220 B	**400**	23	22	24	20	17	21
5	Total Suspended Solids (TSS)	SMWW 2540 D	**400**	33	38	43	35	32	32
6	Total Dissolved Solids (TDS)	SMWW 2540 C	**3500**	167	188	211	232	176	211
7	Phenolic Compounds (as Phenols)	SMWW 5530 D	**0.3**	0.0	0.0	0.0	0.0	0.0	0.0
8	Grease and Oil	USEPA 1664 B	10	0	0	0	0	0	0
9	Chloride (Cl-)	SMWW 4500 Cl- B	1000	25	34	18	19	27	41
10	Fluoride (F-)	SMWW 4500 F- C	10	0	0	0	0	0	0
11	Cyanide (CN-)	SMWW 4500 CN- F	1	0	0	0	0	0	0
12	An-ionic Detergents (as MBAs)	SMWW 5540-C	20	0	0	0	0	0	0
13	Sulfate (SO42-)	SMWW 4500 SO4-2 C	**600**	27	20	39	22	30	34
14	Sulfide (S2-)	SMWW 4500 S-2 F	**1**	0	0	0	0	0	0
15	Ammonia (NH3)	SMWW 4500-NH3 D	**40**	0	0	0	0	0	0
16	Cadmium (Cd)	SMWW 3113 B	**0.1**	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
17	Chromium (Cr)	SMWW 3113 B	**1.0**	0.004	0.004	0.005	0.006	<0.004	0.007
18	Copper (Cu)	SMWW 3113 B	**1.0**	0.165	0.169	0.171	0.169	0.168	0.164
19	Lead (Pb)	SMWW 3113 B	**0.5**	0.006	0.008	<0.005	<0.005	<0.005	<0.005
20	Mercury (Hg)	SMWW 3112 B	**0.01**	0.002	<0.001	<0.001	0.001	<0.001	<0.001
21	Selenium (Se)	SMWW 3114 B	**0.5**	<0.01	<0.01	<0.02	<0.02	<0.01	<0.02
22	Nickel (Ni)	SMWW 3113 B	**1.0**	0.024	0.022	0.022	0.022	0.024	0.025
23	Silver (Ag)	SMWW 3113 B	**1.0**	0.009	0.008	0.006	0.007	0.006	0.006
24	Total Toxic Metals	Calculated Value	**2.0**	0.271	0.249	0.289	0.282	0.248	0.276
25	Zinc (Zn)	SMWW 3111 B	**5.0**	0.062	0.056	0.058	0.051	0.057	0.059
26	Arsenic (As)	SMWW 3114 B	**1.0**	0.007	0.009	0.008	0.008	0.008	0.008
27	Barium (Ba)	SMWW 3113 B	**1.5**	0.008	<0.002	0.005	0.008	0.006	0.004
28	Iron (Fe)	SMWW 3113 B	**8.0**	0.62	0.626	0.624	0.623	0.625	0.628
29	Manganese (Mn)	SMWW 3111 B	**1.5**	0.022	0.018	0.021	0.022	0.027	0.024
30	Boron (B)	SMWW 3113 B	**6.0**	0.03	0.01	0.04	0.03	0.01	0.03
31	Residual Chlorine (Cl2)	SMWW 4500 Cl- B	**1.0**	0.0	0.0	0.0	0.0	0.0	0.0

Table 15: Drinking Water Analysis

Parameter	Analysis Method	SEQS	Bhata Siro Dam	Sohrio Wah Dam	Namaro Dam	Vikasor Dam	Gordhoro-2 Dam	Sudran Dam	Adigam-Syed Alam Shah Dam	Layari-1 Dam	Jhanjhoo Dam	Pathar Dam	Targam Bhodesar Dam
Color	SMWW 2120 C	**≤ 15 TCU**	0	0	1	0	0	0	0	0	0	0	0
Taste (Non- Objectionable)	SMWW 2160 C	**N-O**	N-O	N-O	N-O	N-O	N-O	N-O	N-O	Salty	Salty	N-O	N-O
Odor	SMWW 2150 B	**N-O**	N-O	N-O	N-O	N-O	N-O	N-O	N-O	N-O	N-O	N-O	N-O
Turbidity	SMWW 2130 B	**< 5 NTU**	0	21.5	56.9	0	0	0	0	0	9.77	15.59	0
Total Hardness (as $CaCO_3$)	SMWW 2340 C	**< 500 mg/L**	176	160	90	178	212	176	174	670	680	120	290
Total Dissolved Solids (TDS)	SMWW 2540 C	**< 1000 mg/L**	346	358	220	304	698	414	474	1924	1982	172	507
pH	SMWW 4500 H+ B	**6.5- 8.5**	7.97	7.66	7.78	7.61	7.58	7.82	8.03	7.57	7.66	8.31	7.92
Aluminum (Al)	SMWW 3111 B	**≤ 0.2 mg/L**	0.002	0.003	0.002	0.004	0.003	0.005	0.002	<0.001	0.004	0.003	0.004
Antimony (Sb)	SMWW 3114 B	**≤ 0.005 mg/L**	0.006	0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Arsenic (As)	SMWW 3114 B	**≤ 0.05 mg/L**	0.04	0.05	0.005	0.005	0.045	0.05	0.05	0.07	0.05	0.04	0.005
Barium (Ba)	SMWW 3113 B	**0.7 mg/L**	0.02	0.02	0.004	0.01	0.022	0.03	0.1	0.03	0.02	0.01	0.021
Boron (B)	SMWW 3113 B	**0.3 mg/l**	0.021	0.024	0.023	0.026	0.021	0.028	0.021	0.023	0.03	0.022	0.03
Cadmium (Cd)	SMWW 3113 B	**0.01 mg/L**	0.009	0.009	0.008	0.009	0.006	0.009	0.008	0.007	0.009	0.008	0.008
Chloride (Cl-)	SMWW 4500 Cl- B	**< 250 mg/L l**	41	65	25	15	100	50	50	724	734	8.4	124
Chromium (Cr)	SMWW 3113 B	**≤ 0.05 mg/L**	0.028	0.023	0.024	0.028	0.028	0.025	0.024	0.026	0.028	0.026	0.023
Copper (Cu)	SMWW 3111 B	**2.0 mg/L**	0.266	0.215	0.164	0.246	0.244	0.245	0.235	0.274	0.246	0.275	0.262
Cyanide (CN-)	SMWW 4500 CN- F	**≤ 0.05 mg/L**	0	0	0	0	0	0	0	0	0.042	0	0
Fluoride (F-)	SMWW 4500 F- C	**≤ 1.5 mg/L**	0	0	0	0	0	0	0	0.06	0.083	0	0
Lead (Pb)	SMWW 3114 B	**≤ 0.05 mg/L**	0.049	0.045	0.049	0.092	0.046	0.042	0.048	0.046	<0.001	0.044	0.049
Manganese (Mn)	SMWW 3113 B	**≤ 0.5 mg/l**	0.075	0.087	0.095	0.081	0.074	0.079	0.085	0.088	0.018	0.095	0.069
Mercury (Hg)	SMWW 3114 B	**≤ 0.001 mg/L**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.02	<0.001	<0.001
Nickel (Ni)	SMWW 3113 B	**≤0.02 mg/L**	0.016	0.014	0.018	0.012	0.012	0.014	0.019	0.015	0.254	0.012	0.019
Nitrate (NO3-)	SMWW 4500 NO3- B	**≤ 50 mg/L**	1.62	1.41	18.28	1.05	0.89	1.58	0.82	0.86	0.78	0.02	0.04
Nitrite (NO2-)	SMWW 4500 NO2- B	**≤ 3.0 mg/L**	0.08	0.07	1.28	0.06	0.05	0.08	0.05	0.05	0.04	0	0.01
Selenium (Se)	SMWW 3114 B	**0.01 mg/L**	0.01	<0.01	<0.01	<0.01	0.02	0.01	0.01	<0.01	0.02	0.01	0.03
Residual Chlorine (Cl2)	SMWW 4500 Cl- B	**0.5 mg/L**	0	0	0	0	0	0	0	0	0	0	0
Phenolic Compounds	SMWW 5530 D	**NGVS**	0.05	0.04	0.13	0	0	0	0	0.06	0	0.01	0
Zinc (Zn)	SMWW 3113 B	**5.0 mg/L**	0.12	0.096	0.25	0.198	0.255	0.246	0.219	0.262	0.254	0.259	0.252
Microbiological Analysis													
Total Coliforms	SMWW 9222 B	**0/ 100 mL CFU**	8	10	12	1	2	1	3	11	13	12	2
Fecal Coliforms	SMWW 9222 D	**0/ 100 mL CFU**	0	0	3	0	0	0	0	2	4	3	0

5.4.1 Air Quality

The sub-project areas of Nagarparkar in Tharparkar district are located in a sparsely populated areas with no industrial or commercial activity. Vehicular traffic on the dirt roads causes some dust emissions whose effect is fairly localized. The main pollutants emitted by vehicle exhaust pipes are particulate matter, carbon monoxide, sulphur dioxide, and nitrogen oxides. These emissions generally affect the air quality in the vicinity of the roads. However, traffic on the roads in the sub project area is low compared to the national highways or other major roads. The ambient air quality tests were carried out by Ever Green Environmental Lab in the month of October 2020. Table - 16 Results reveals that all parameters are within permissible limits of SEQS ambient air quality. Detailed ambient air quality laboratory reports are attached as Annexure – III.

Table 16: Ambient Air Quality Results

Sr. No.	Proposed Dam Sites	Carbon Monoxide (CO) - 10.0 mg/m^3	Sulphur Dioxide (SO_2) - 120.0 µg/m^3	Nitrogen Monoxide (NO) - 40.0 µg/m^3	Nitrogen Dioxide (NO_2) - 80.0 µg/m^3	Particulate Matter (PM_{10}) - 150.0 µg/m^3	Particulate Matter ($PM_{2.5}$) - 75.0 µg/m^3
1	Bhatta Siro 2	0.7	9.2	2.5	12.55	131.5	32.5
2	Sohrio Wah	0.795	8.65	2.75	8.8	128	27
3	Gordhro-2	1.08	8.95	3.2	9.65	121.5	31.5
4	Sudran Nadi	1.02	7.9	2.65	10.65	108.5	31
5	Nagar - 2 (Layari)	0.73	7.2	3.6	8.3	90.5	27
6	Pathar	0.86	9.1	3.7	10.2	127	31.5
7	Targaam Budhesar	0.95	9.15	2.6	10.25	132.5	28.5

5.4.2 Noise

Proposed sub-projects are in sparsely populated areas where traffic is very less and no existence of other noise sources are in the reported areas. During the baseline survey ambient noise levels were recorded in the sub-project areas and found within permissible limits of SEQS and WHO standards. Details are present in Table – 17.

Table 17: Ambient Noise Levels in Sub-Project Areas

Sr. No.	Proposed Dam Site	Location of Noise Monitoring	Coordinates	55 dBA (SEQS) Noise Levels		
				Min	Max	Average
1	Bhata Siro 2	Dam Axis	24°30'34.47"N 70°52'33.07"E	30.5	32.9	31.7
		Mosque	24°31'7.64"N 70°51'22.25"E	36.3	37.8	37.05
2	Sohrio Wah	Dam Axis	24°30'1.81"N 70°52'53.63"E	34.9	38.6	36.75
		Near Mosque	24°31.1960'N 70°51.5200'E	31.5	33.9	32.7
		School	24°29'54.36"N 70°52'41.49"E	40.7	42.3	41.5
3	Namaro	Mosque	24°28'41.71"N 70°53'0.35"E	32.3	36.8	34.55
		Dam Axis	24°28'40.96"N 70°53'12.03"E	48.2	50.2	49.2
		Village	24°28'29.32"N 70°53'10.64"E	45.5	49.7	47.6
4	Viakasor	Dam Axis	24°21'52.57"N 70°36'6.48"E	31.5	33.9	32.7
		Village	24°21.6390'N 70°36.3640'E	43.2	46.2	44.7
		Temple	24°21'42.61"N 70°36'16.47"E	38.3	40.8	39.55
5	Gordhro-2	Dam Axis	24°21'52.96"N 70°46'35.33"E	32.5	36.4	34.45
		Road	24°21'25.31"N 70°46'28.02"E	35.3	36.8	36.05
		Main Road	24°21'14.88"N 70°45'33.86"E	40.8	43.9	42.35
6	Sudran	Dam Axis	24°19'31.84"N 70°40'8.01"E	41.3	43.6	42.45
		Village	24°19.3750'N 70°39.7040'E	43.5	45.9	44.7

Sr. No.	Proposed Dam Site	Location of Noise Monitoring	Coordinates	55 dBA (SEQS) Noise Levels		
				Min	Max	Average
		Bazar	24°19'32.72"N 70°39'39.41"E	42.1	43.7	42.9
7	**Adhigam - Syed Alam Shah**	Dam Axis	24°17'57.44"N 70°40'5.46"E	37.6	41.5	39.55
		Temple	24°18'8.38"N 70°39'38.95"E	39.5	43.5	41.5
		School	24°18'4.50"N 70°39'29.15"E	35.3	36.8	36.05
8	**Layari - 1**	Dam Axis	24°18'4.65"N 70°44'17.22"E	31.5	33.9	32.7
		Village	24°17'54.74"N 70°44'11.61"E	44.2	46.2	45.2
9	**Jhanjhoo**	Dam Axis	24°17'20.65"N 70°42'24.21"E	48.7	53.4	51.05
		Mosque	24°17'17.87"N 70°42'27.69"E	31.5	35.4	33.45
		Village	24°17'10.14"N 70°42'30.06"E	45.9	55.9	50.9
10	**Pathar**	Dam Axis	24°15'29.33"N 70°37'30.75"E	43.9	55.3	49.6
		School	24°16'8.48"N 70°38'0.82"E	37.6	41.5	39.55
		Mosque	24°16'16.39"N 70°38'6.91"E	41.5	43.7	42.6
11	**Targam Bhodesar**	Dam Axis	24°22'22.71"N 71° 2'29.65"E	39.5	43.5	41.5
		School	24°23'23.00"N 71° 2'14.34"E	38.4	42.3	40.35
		Main Track	24°23'13.51"N 71° 2'1.89"E	42.9	45.9	44.4

5.5 BIOLOGICAL ENVIRONMENT

The sub project area has a diverse habitat, which supports a large variety of animal from the desert ecosystem of Nagarparkar. Common animal habitats are mountains, desert and deltaic region. These habitats support the peculiar species according to their requirements. The following broad categories have been identified for this report focusing on the sub-project areas.

5.5.1 Fauna of the Sub-Projects Area

During the field study of proposed dams four (4) large mammal species were observed including Desert fox and Grey Mongoose, Indian wild boar and Asiatic Jackal recorded from different locations near the proposed dam area. All mammalian species area common and listed as Least Concern (LC) in IUCN red list. 4 small mammals recorded from micro habitats of same site are common and least concern in IUCN list. 11 species of reptiles were recorded from the study area. These include: 4 lizards, one Agama (*Trapelus agilis)*, two Geckos and three snakes. Of three snake species Saw scale viper (*Echis carinatus)* and Indian black cobra (Naja naja) are the poisonous while one Sand boa (*Eryx conicus*) is non-poisonous. Star tortoise (*Geochelone elegans*) is vulnerable by IUCN red list has been reported by Zoological Survey of Pakistan (SZD). Twenty-six bird species were recorded from the dam site and its surrounding area, among them Indian Peafowl is one of the beautiful and important bird can be observed frequently near the human population, it is susceptible to infectious diseases and die by viral attack. Indian Peafowl is protected by protected by Sindh Wildlife Act 1972. Its status is Least Concern (LC) by IUCN red list 2018Detail of Fauna of Nagarparkar Sub Project Areas is given in below Table – 18.

Table 18: Fauna in Nagarparkar- Sub Project Area

Sr. No.	Common Name	Scientific Name	Conservation by IUCN
Large Mammals			
1	Grey Mongoose	*Herpestes javanicus*	LC
2	Asiatic Jackal	*Canis aureus*	LC
3	Indian wild boar	*Sus scrofa*	LC
4	Desert fox	*Vulpes bangalinces*	LC
5	Indian wild ass	*Aquus hemionus ssp*	NT
Small Mammals			
1	Palm squirrel	*Funambulus pennantii*	LC
2	Kuhls' bat	*Pipistrellus kuhlii*	LC
3	Hedgehog	*Parachinus micropus*	LC
4	Indian desert Jird	*Meriones hurrianae*	LC
Reptiles and Amphibian			
1	Brilliant Agama	*Trapelus agilis*	LC
2	Tree Lizard	*Calottes versicolor*	LC

Sr. No.	Common Name	Scientific Name	Conservation by IUCN
3	Yellow-bellied house gecko	*Hemidactylus flaviviridis*	LC
4	Keeled Back Gacko	*Hemidactylus brookii,*	LC
5	Desert monitor	*Varanus griseus*	LC
6	Indian fringe-fingered lizard	*Acanthodactylus cantoris*	LC
7	Spiny tail ground Lizard	*Uromastyx hardwickii*	LC
8	Sand boa	*Eryx conicus*	LC
9	Indian cobra	*Naja*	LC
10	Indian Star tortoise (reported ZSD)	*Geochelone elegans*	VU
11	Saw scaled viper	*Echis carinat us*	LC
Birds			
1	Indian Peafowl	*Pavo cristatus*	LC
2	Indian Koel	*Eudynamys scolopaceus*	LC
3	Ashy crowned finch-lark	*Eremopterix griseus*	LC
4	Bank Myna	*Acridotheres ginginianus*	LC
5	Grey Shrike	*(Lanius excubitor*	LC
6	Black Drongo	*Dicrurus macrocercus*	LC
7	Desert Lark	*Ammomanes desert*	LC
8	Black winged Stilt	*Himantopus*	LC
9	Green Bee-eater	*Merops orientalis)*	LC
10	Blue-throat	*Luscinia svecica*	LC
11	Cattle Egret	*Bubulcus ibis*	LC
12	Collared Dove	*Streptopelia decaocto*	LC
13	Common Babbler	*Turdoides caudate*	LC
14	Common Crow Pheasant	*Centropus sinensis*	LC
15	Pied Kingfisher	*Ceryle rudis*	LC
16	Common Myna	*cridotheres tristis*	LC
17	Common/Barn Swallow	*(Hirundo rustica*	LC
18	Eastern Pied Wheatear	*Oenanthe pleschanka*	LC
19	Eurasian sparrow hawk	*Accipiter nisus*	LC
20	Hoopoe	*Upupa epops*	LC
21	Indian house crow	*Corvus splendens*	LC
22	Indian House Sparrow	*Passer domesticus)*	LC
23	Indian Pond Heron	*Ardeola grayil*	LC
24	Little Egret	*Egretta garzetta*	LC
25	Indian peacock	*Pavo cristatus*	LC
26	Black Redstart	*Phoenicurus ochruros*	LC
VU = Vulnerable, LC = Least Concern, NT = Near Threatened			

Asiatic Jackal

Sus sacrofa foot print

Herpestes javanicus

Vulpes

Figure 14: Large Mammals Observed at Study Area

Common Kingfisher

Hond heron

Junglr Babbler

House Sprow

Coller Dove

White cheek bulbul

Indian Peacock

White wagetail

Pide Kingfisher

Green Bee-eater

Indian Roller

Desert Lark

Figure 15: Birds in the Sub-Project Areas

5.5.2 Flora of Nagarparkar Sub-Project Area

Vegetation of the study area can be classified as scrub forest (dominated by herbs and shrubs). The plants are best adapted to the ecological conditions either for high or low temperature fluctuations as well as poor soil and rainfall ranges. The soils of the desert plains are loamy sand to loam; the soil in the eastern part is alluvial which supports good vegetation. The monsoon rain provides enough water for the annual herbs and grasses to flourish in the study area. The herbs abundantly grow around Karoonjhar hills of the Nagarparkar This type of vegetation may raise on the water temporarily adsorbed in the top soil layer, synchronic to precipitation. Further, this is supported with the added layer of moisture present in the subsurface soil and the sandstone laying beneath the soil. However, the dominance of perennial may indicate the resistance of species towards the harsh climate or access to plentiful moisture for long periods after monsoon rains

The common plants of Nagarparkar sub-project area are (*Euphorbia caducifolia*), Phog (*Calligonum polygonoides*), and (*Calotropis gigantea*). In irrigated tracts, Babul (or Babur), *Acacica nilotica*), Talhi (*Dalbergia sissoo*) Nim (Azadirachta indica), Jar (*Salvadora oleoides*), and Lai (*Tamarix gallica*) are found. Vegetation grown in desert ecosystem has its ethnobotanical values and used by local community for different propose, Nim (Azadirachta indica) is religiously respected by Hindu community. Ak and Neem are both are used as pesticide for crops and used cure for animal skin diseases. Sindhi Babor is good fodder for goat and camel.

Sand dunes are represented by xerophytic plants because of their topographical features. They are all of deserted nature with the sandy soil makeup. The dominant and frequent species like *Euphorbia caducifolia*, *Calligonum polygonoides*, *Aerva javanica*, *Salvadora oleoides*, Indigofera Spp., Aristida Spp and *Tribulus longipetalus* were forming common vegetation on them. There is no previous report available on the vegetation of this area. Details

of flora found in Nagarparkar Sub-projects areas are given in Table – 19 and a photo gallery of fauna and their habitats are given in Figure – 16.

Table 19: Flora of Nagarparkar Sub-Project Area

Sr. No.	Local Name	Scientific Name	IUCN Status	Plant type
1	Thuhar	*Euphorbia caducifolia*	NA	Shrub
2	Phog	*Calligonum polygonoides*	NA	Shrub
3	Ak	*Calotropis*	NA	Shrub
4	Babur	*Acacica nilotica*	NA	Tree
5	Talhi	*Dalbergia sissoo*	NA	Tree
6	Neem	*Azadirachta indica*	LC	Tree
7	Jjar	*Salvadora oleoides*	NA	Tree
8	Bare	*Ziziphus nummularia*	NA	Tree
9	Devi	*Prosopis juliflora*	NA	Tree
10	Kiri	*Tamarix gallica*	LC	Tree
11	Khabar	*Salvadora indica*	NA	Tree
12	Khip	*Calligonum polygonoides*	NA	Shrub
12	Kapah Gul	*Aerva javanica*	NA	Shrub
13	Gullabi Gul	*Indigofera spp.*	NA	Shrub
14	Sanokano	*Aristida spp.*	NA	Herb
15	Kandero	*Alhagi maurorum*	NA	Herb
16	Dela	*Capparis decidua*	LC	Shrub
17	Kano	*Saccharum spontaneum*	LC	Grass
18	Drabh	*Tetrapogon tenellus*	NA	Grass
LC=Least Concern, NA= Not Assessed				

Aerva javanica

Ziziphus nummularia

Acacia nilotica

Azadirachta indica

Capparis decidua

Aljai mauruoum

Euphorbia caducifolia

Leptadenia pyrotechnica

Prosopis juliflora

Salvadora oleoides

Figure 16: Key Floral Species of the Sub-Project Areas

5.6 Endemic/Endangered Species

Indian wild ass (*Aquus hemionus* ssp) is near threatened and Indian Star Tortoise (*Geochelone elegans*) is Vulnerable by IUCN red data book. As far as the sub project area is concerned, none of endemic or endangered species of both flora and fauna recorded from sub-project dam sites.

5.6.1 Trees

Since the sub project area lies in the arid zone, there is general scarcity of water, vegetation is scarce and consists of stunted scrub[5] and bushes. The main natural ground cover is provided by grasses which are nutritive and palatable fodder for the livestock. The trees present around the proposed dam structures were counted during field survey as shown in Table – 20.

[5]a plant community characterized by vegetation dominated by shrubs, often also including grasses and herbs

Table 20: Trees Identified on the Sub-projects

Sr. No	Name of Dam	Name of Species		IUCN Status	Mature (Girth more than 24")		Immature (Girth less than 24")	
		Common Name	Scientific Name		Existing	To be cut	Existing	To be cut
1	Bhatta Siro	Kirir	*Tamarix gallica*	*LC*	25	8	20	5
		Sindhi Babur	*Acacia nilotica*	*LC*	4	2	0	0
2	Sohrio Wah	Kirir	*Tamarix gallica*	*LC*	25	5	8	5
		Sindhi Babur	*Acacia nilotica*	*LC*	2	0	4	0
3	Namaro	Kirir	*Tamarix gallica*	*LC*	5	0	5	0
		Sindhi Babur	*Acacia nilotica*	*LC*	4	0	8	6
		Kandi	*Prosopis Cinereria*	*NA*	2	0	4	0
4	Viakasar	Kirir	*Tamarix gallica*	*LC*	5	0	10	8
		Bair	*Zizyphus nummularia*	*NA*	2	0	4	4
5	Gordhro-2	Sindhi Babur	*Acacia nilotica*	*LC*	2	0	8	o
		Bair	*Zizyphus nummularia*	*NA*	10	2	8	4
6	Sudran	Kandi	*Prosopis Cinereria*	*NA*	12	4	0	0
7	Adhigam - Syed Alam Shah	Kirir	*Tamarix gallica*	*LC*	10	0	15	5
8	Layari-1	Kirir	*Tamarix gallica*	*LC*	8	2	10	5
		Bair	*Zizyphus nummularia*	*NA*	6	2	5	2
		Kandi	*Prosopis Cinereria*	*NA*	1	0	0	0
9	Jhanjhoo	Kirir	*Tamarix gallica*	*LC*	15	6	20	5
10	Pathar	Sindhi Babur	*Acacia nilotica*	*LC*	2	0	0	0
		Kirir	*Tamarix gallica*	*LC*	5	0	5	2
11	Targaam Budhesar	Kirir	*Tamarix gallica*	*LC*	4	0	6	4
Sub Total					**149**	**31**	**140**	**55**
Total Number of Existing Trees					**289**			
Total Number of Cut Down Trees					**86**			
LC=Least Concern, NA= Not Assessed								

6. SOCIO-ECONOMIC PROFILE OF THE SUB-PROJECT AREA

6.1 Methodology

This section describes the socio economic condition of the subproject area. The team used a questionnaire and checklist for Focus Group Discussions (FGDs) (Attached at Annexure - IV). In order to have comprehensive detailed information, consultation meetings were also held with the stakeholders and general public. The main objectives of consultation were to provide a platform to the stakeholders to voice their concerns and suggestions to the project team and to develop a sense of collective ownership for the activities of sub project. The participants of the consultation meetings and focus group discussions actively provided support in data collection and understanding the socio- economic fabric of the people living in the sub-project area.

6.2 Livelihood Improvements due to the Small Dams

The construction of small dams would lead to improvement in overall socioeconomic conditions in the sub project areas. The people inhabiting these areas are exposed to drought and food insecurity and will be directly benefiting from the construction of small dams for rain water harvesting and recharging of groundwater aquifers.

It is expected that small dams would bring significant livelihood improvement in sub project areas. Since the local communities are heavily dependent livestock and rain fed agriculture and the small dams would recharge the ground water level. This would have multiplier effect not only on the sustenance of livestock and agriculture but on human population and environment as well. It is expected that dams will raise water table depth, and contribute in reduction of livestock mortality (current mortality rate is 8.5%) through water availability.

Moreover, it is expected that farmers will have crop residues and variety of grasses to feed their livestock. The increased availability of water, fodder for livestock and improved agriculture will impact positively on the migration pattern as the population used to migrate from the sub project areas to canal areas

6.3 Social Aspect for Study

The social economic survey was carried out to collect the following information's:

a) Demographic data,(population and literacy levels)
b) Occupations. Source of Livelihood and income Levels
c) Socio –Cultural fabric (Ethnicity, Language, religion, and vulnerability).
d) Access to civic facilities (water, sanitation, health, education, and communication)
e) Assessment of the impact of the proposed sub-project on the subject population
f) In case of negative impacts exposed, suggest mitigation measures.

A survey and consultation was carried out in 11 villages namely Bhata Siro , Sohrio Wah, Namaro, Vikasor, Gordhoro 2, Sudran Adhigam Sayed Alam Shah, Jhanjhoo, Layari - 1, Pathar, Targam Bhodesar located in Taluka Nagarparkar, District Tharparkar. All of these villages were within primary impact zone. This survey was conducted in the month of September 2020. In order to establish a social baseline of the project area. A list of the location of the villages visited is provided in Table – 21.

The information gained will assist in the measurement and determination of the impacts (positive and negative) on social services, livelihood and cultural pattern of the population under study. To make the analysis more compelling, qualitative data through focus group discussions (FGDs) was also collected. These FGDs were participated by village elders, community activists, farmers, herders, and religious leaders (Imams & Pundits). Separate male and female FGDs were conducted in each village to ensure that gender dimensions of vulnerability were captured

Table 21: Villages Visited for Socio-Economic Baseline Data

Sr. No.	Name of Sub-Project	Village	Distance from Proposed site (Km)	Union Council	Taluka	District	Coordinates	
							Northing	Easting
1	Bhata Siro	Sehrioon	02	Viranwah	Nagarparkar	Tharparkar	24`30`35.0'	70`52`34,2
2	Sohrio Wah	Sehrioon Wango	04	Viranwah	Nagarparkar	Tharparkar	24`30`01,2	70` 52`55.7
3	Namaro	Namaro Karki	02	Behrano	Nagarparkar	Tharparkar	24`28`36, 5	70 53` 08.3
4	Vikasor	Vikasro	02	Nagarparkar	Nagarparkar	Tharparkar	24`2154.27	70`36 09,65
5	Godhro-2	Fakir Darya Khan	1.5	Nagarparkar	Nagarparkar	Tharparkar	24`21`54,23	70`46`27,00
6	Sudran	Sudhran	02	Adhigham	Nagarparkar	Tharparkar	24`19`30,62	70`40`10`74
7	Adhigham-Sayed Alam Shah	Adhigham	1.5	Adhigham	Nagarparkar	Tharparkar	24`17`57`6	70`40`06, 1.
8	Lyari -1	Khariroon Lyari	2.5	Adhigham	Nagarparkar	Tharparkar	24`18`08.00	70`44`16,40
9	Jhajhoo	Jhanjhoo Kharirioon	1.5	Adhigham	Nagarparkar	Tharparkar	24`17`22.3	70`42`24,8
10	Pathar	Soatlai	2	Adhigham	Nagarparkar	Tharparkar	24`15`24,34	70`37`30,06
11	Targham Bhodesar	Bhodesar Targham	2.5	Behrano	Nagarparkar	Tharparkar	24`22`23,77	71`02`34`27

6.4 Population

The population in surveyed villages is heterogeneous, as the inhabitants living in the villages belongs to Muslims and Hindu religions. The Hindu population represents both lower and

higher caste groups. The lower caste groups include Kolhi, Rabari, Bheel, Bagri, Menghwar, while the higher caste groups consists on Rajjput and Thakur. The religious harmony is prevalent in the area and people of both religion maintain social relations and participate in each other's social and religious events. The area is deprived with high poverty line and low literacy rate. The main livelihood of the people is related to rain-fed agriculture and livestock rearing followed by daily wage earners who primarily work as labourers. People along with livestock temporarily move to barrage areas before start of drought season in order to avoid adverse effects during drought and return after drought impacts are minimized. The details of population and tribes in sub-project area are given in the Table – 22**.**

Table 22: Population and Tribes on Sub-Projects

Name of Sub-Project	Village	Tribes	Religion	HH	Population	Average Family size
Bhatta Siro	Bhatta Siro	Khaskheli, Kumbhar,	Muslims	50	400	7.3
Sohrio Wah	Sehrioon	Khaskheli, Samoon	Muslims	200	1600	7.4
Namaro	Karki	Kumbhar Khaskheli	Muslims	130	1040	7.3
Vikasor	Vikasar	Meghwar /Kolhi,Bhel	Hindu	110	880	7.4
Godhoro-2	Godhro	Meghwar/Kolhi,Bhel	Hindu	50	400	7.4
Sudhran	Sudhran	Meghwar/Kolhi,Bhel	Hindu	25	210	7.3
Adhigham Sayed Alam	Adhigham	Meghwar/Kolhi,Samoon, /Kumbhar	Hindu & Muslims	600	4800	7.4
Lyari -1	Nanger 2	Meghwar/Kolhi,Khosa, Chandi	Hindu	150	1200	7.3
Jhanjhoo	Jhanjhoo Kharirion	Meghwar/Kolhi/ Kumbhar,Khokhar	Hindu & Muslims	75	525	7.2
Pathar	Sootlai	Meghwar/Thakur ,Rajput	Hindu	200	1600	7.3
Targam Bhodesar	Bhodesar	Meghwar/Thakur Kolhi,Rajput, Khoso	Hindu & Muslim	80	850	7.3
		Total		1670	13505	

6.5 Languages

Sindhi is the dominant language spoken in the sub-project area, as 100 percent of the population speaks Sindhi. Moreover, people of the area also speaks Parkari and Dhatki languages. National languages Urdu is spoken and understood by the majority of the people in the sub-project area.

6.6 Family system

Majority of those in the study area live together with their extended families (parents living with married children and their families). Families believe this is a more economical way of living as they often work together on the same land and are able to share their joint incomes to support the entire family, including elderly relatives, who are unable to work. It is also thought

to be more efficient to share basic amenities such as water, electricity, housing and food rather than for each family to purchase immediately or from their own source. The sub-project wise details of population and average family size are given in the Table-22.

6.7 Religious Affiliation

During the socio-economic field survey, it was observed that in the in the sub-project area the Muslims and Hindu population live together within the same villages. In surveyed villages, 75 percent population belongs to Hindu religion, while 25 percent belongs to Muslim religion. They participate in each other's religious and cultural festivals. There are Mosques and Temples in most of the villages.

Figure 17: Temple and Mosque in the Sub-Project area

6.8 Occupations, Sources of Livelihood and Income Levels

Within the study area of sub-projects rain- fed agriculture, and livestock are the main sources of income for the people. Agriculture depends on rainfall, which is often erratic and falls between July and September only. After the rains, the subsoil aquifers are recharged and the pasture lands are regenerated. However, by February, the aquifers are often depleted and the pasturelands dry up. Generally, livestock depends on the grazing in pastures and crop residues. Women are especially involved in livestock herding and play an important role in this occupation.

In the sub project areas, livestock head per household is ranging from 4 to 135, while landholding per household ranges between 2.6 acres to 17.5 acres. The other sources of livelihood includes daily wage labourers, small business (shops) and tailoring.

Due to the lack of an industrial base, the sources of income of households are less diversified, with their heavy dependence on livestock and casual labor. The deplorable social indicators such as large household size, poor literacy level, higher mortality rate, inadequate infrastructure with poor access to education and health facilities shows a higher level of poverty and deprivation in the subproject areas.

Furthermore, during the survey, it was revealed that minimum monthly income level in the surveyed villages is Rs.10,000, while maximum monthly income level is Rs.40,000.

6.9 Village Wise Losses Due to the Drought

The village wise losses due to the drought were assessed during the focus group discussions (FGDs). It was revealed that due to the drought in 2018-2019 significant livestock mortality, agriculture losses and reduction in ground water levels was witnessed in the villages of sub project areas. The details are provided in below Table - 23.

Table 23: Village wise losses due to drought in 2018-2019

Dam	Village	Total Livestock Population	Livestock Mortality	Total Agriculture Area (Acres)	Reduction in Ground water
Bhata Siro	Bhatta Siro	855	85	1200	65%
Sohrio Wah	Sehrioon	2700	216	1600	66%
Namaro	Karki	961	73	1500	55%
Vikasor	Vikasar	1560	124	1050	57%
Godhoro-2	Fakir Darya Khan	250	20	700	55%
Sudran	Sudhran	550	44	1100	57%
Adhigham Sayed Alam Shah	Adhigham	1080	84	1600	50%
Lyari -1	Nanger 2	605	48	1200	55%
Jhanjhoo	Jhanjhoo Kharirion	800	64	1100	57%
Pathar	Sootlai	913	73	1500	56%
Targam Bhodesar	Bhodesar	1325	106	1400	57%

6.10 Social Cohesion and Conflict

Social organization in all the villages is strongly based on the community (tribal) system, where each tribe has a tribal leader. There is minor interaction between villages of different tribes and therefore low chance of tribal conflict. The villages are multi tribal and multi religion and live within the same villages, there is a single leader of the entire village, which is recognized by all tribes. Out of 11 surveyed villages, two villages are mono tribal (Muslims), four are mono tribal (Hindu), while five villages are bi tribal. The minor scale conflicts are resolved by the village leader.

The tribe leaders are mostly landlords and politically active. All families belonging to the same tribes have strong interactions with one another but mostly remain separate from other tribes.

This extends to marriages, where it is the preference for young tribal members to marry a member of the same tribe. During the survey it was found that most communities had built their own mosques and temples, while maintenance of these is the joint responsibility of community.

6.11 Social Vulnerability

Social vulnerability refers to inequality in social systems that discriminate against and marginalize certain groups of the people from accessing resources and services. People who have been marginalized in social, economic or political terms are vulnerable. Disasters, poverty and vulnerability are interlinked as it has been observed that, during the disaster, the most affected population is the poor of the community. In the surveyed villages, incidence of poverty has increased as droughts have reduced income level of the households by damaging their assets and sources of income and thus have aggravated the household poverty. In many households there is just one earning person with many dependents.

During the survey it was found that most people in the sub project areas lack job opportunities, health and educational facilities, which escalate the social vulnerability to various hazards including drought.

6.12 Conflict Resolution within Tribes and Villages

According to the socio-economic survey, there is no major dispute among the people (inter or intra tribal conflicts) in the sub-project area. The conflict resolution pattern in the project area is about the mutual conflicts, marriage settlements and other matters are usually resolved by the village head, while the head of tribes shall resolve intra baradari (community) disputes. It was found during survey that 95 percent of the conflicts were resolved at village level. Those living within the communities of the project area feel obliged to accept the decision of the village or tribal leaders.

In case of serious matters, local influential politicians (who are often also tribal leaders) intervene to settle the dispute. Occasionally, when parties do not agree on the decision of caste or tribal leaders, matters may go to the police and ultimate a court of law. The police and the court of law are the last options and these are rarely exercised.

6.13 Housing

The project area consists of rural population living comparatively in isolation. Majority of the population live in small settlements of 50 to 100 houses. Some of the houses usually have a boundary wall enclosing enough space for cattle and storage. Houses consists of huts called Chaunras with pointed thatched roofs of grasses which, are built on mud plastered platforms. It was observed that all the people were living in self-owned houses.

Figure 18: Housing pattern in the Sub-Project Area

6.14 Literacy and Education Facilities

Literacy rate in Tharparkar district is low. According to the district education officer Tharparkar the literacy rate in the district is 19.6% (28.3% for male and 7.1% females),

During socio-economic field survey, it was noted that, there are 11 primary boys' schools, in which 493 boys and 63 girls' are enrolled with 16 teachers. In some villages girls are getting education through the co-education system as the girls' schools in the sub-project are dysfunctional according to the community members. The education facilities in the sub-project areas are given in Table – 24.

Table 24: Education Facilities in the Sub Project Area

Name of sub-project	Boys primary school	Teachers	Enrollment		Boys Middle Schools	Teachers	Enrollment	Girls Middle Schools	Teachers	Enrollment
			Boys	Girls						
Bhata Siro	1	1	25	0	0	0	0	0	0	0
Sohrio Wah	1	1	30	0	0	0	0	0	0	0
Namaro	1	1	40	0	0	0	0	0	0	0
Vikasor	1	2	50	15	0	0	0	0	0	0
Godhro-2	1	1	30	9	0	0	0	0	0	0
Sudran	1	1	28	6	0	0	0	0	0	0
Adhigam-Sayed Alam Shah	1	4	150	22	0	0	0	0	0	0
Layari - 1	1	1	33	0	0	0	0	0	0	0
Jhajhoo	1	1	25	0	0	0	0	0	0	0
Pathar	1	2	55	11	0	0	0	0	0	0
Targam Bhodesar	1	1	27	0	0	0	0	0	0	0
Total	**11**	**16**	**493**	**63**	**0**	**0**	**0**	**0**	**0**	**0**

6.15 Health Facilities

It was found that in sub- project area many of the people have suffered from hepatitis, typhoid, malaria, eye problems, diarrhea and other hygiene related complaints. Sometime women die during the delivery cases. Majority of the women are malnourished usually being the last ones to eat their meals in the family. In the project area, there are no health facilities like Basic Health Units (BHU) dispensary midwifery centers and medical stores in immediate vicinity. The serious ill patients are taken to Mithi District Hospital and other cities including Mirpurkhas, Hyderabad and Karachi. However, in some villages quakes were operating as reported by the community.

6.16 Transport

Most of the surveyed villages have an average 6.8 km village tracks or unsurfaced (Katcha) roads that are in bad condition except some of the villages. The construction and maintenance of the village roads is the responsibility of local government. The sub-projects area is connected with Mithi-Nangarparkar road, while the district is accessible through National highway (Karachi-Via Thatta).

The socio-economic baseline survey reveals that the major source of the human transport in the villages of the sub-project area is public transport including buses, Van/Pickups, Jeeps, Quinqi Rickshaw, while individual cars and motor bikes are another mode of transport in the sub-project area. The farm inputs and outputs are transported through trucks and tractor trolleys. The animals from the sub-project area are transported to Hyderabad and Karachi by trucks. The firewood is also transported through trucks and trolleys. Transport facility of sub-project area is given in Table – 25.

Table 25: Transport Facilities in the Sub Project Area

Name of sub-project	Van/Pickup	Bus/Truck	Car	Khekhro	Motor Bike	Distance from Village to Main Road(km)
Bhata Siro	3	1	0	1	10	7
Sohrio Wah	2	1	0	0	7	7
Namaro	3	1	0	1	5	7
Vikasor	4	2	0	0	10	4
Godhoro-2	3	2	0	0	5	2
Sudran	2	1	0	0	3	1
Adhigam-Sayed Alam Shah	5	2	2	1	20	5
Nanger-2.Lyari	3	1	1	0	3	5
Jhanjhoo	4	1		0	5	15

Name of sub-project	Van/Pickup	Bus/Truck	Car	Khekhro	Motor Bike	Distance from Village to Main Road(km)
Pathar	3	1	1	0	10	23
Targam Bhodesar	2	1	0	1	7	18
Total	**34**	**14**	**4**	**4**	**85**	**-**

Figure 19: The view of transportation in sub-project areas

6.17 Telecommunication

During the field survey, the community reported that there is no landline facility available in the sub-project area. Mobile phone communication is not widely spread in sub-project area. While Nagarparkar town is connected with some networks.

6.18 Energy Sources

All the surveyed villages in the sub-project area are without electricity. The area people collect firewood from the surrounding area and some people purchase firewood from nearby town. The fire wood per 40 kg cost is Rs.500. Moreover use of solar system for irrigation purpose was also witnessed in some villages of sub-project area.

6.19 Drinking Water and Sanitation

It was observed that women and children were responsible for fetching of water for drinking and domestic use. The underground water results sheet Table – 17 reveal that, all ground water quality parameters are within SEQS & WHO permissible limits, except TDS and total coliforms, which were exceeding permissible limits in some sub project areas. The reason for exceeding coliform might be due to unavailability of the sewerage system or open defecation in the area. Additionally, whenever there were rainfalls, caused flash floods. The floodwater flushes to low-level areas and finally entered into the stream carrier channel (Nai) and was carried to Runn of Kutch, so the soil is dried up to 5 to 6 hrs. The details of sources of drinking water are provided in Table – 26. The underground water was mostly good quality in the areas. While in the sub project area there is no any drinking water source and the villagers use the rain water stored in earthen reservoir. Or hand pumps were additional source of drinking water.

Sanitation: during the survey, it was found that there was no proper sanitation in surveyed villages. In most of the villages open defecation is practiced, while small segment of population use direct pit latrines.

Within the sub-project area, people drain out used water in an open place and dump solid waste in the open. All of the streams in the sub project area are non-perennial.

Table 26: Drinking Water Source in the Sub-Project Areas

Sr. No.	Name of the Dam	Hand pumps	Dug wells	Water Table (Min-Max) ft	Number of Tube-Wells and Use			Piped water
					Number	Drinking	Irrigation	
1	Bhata Siro	2	10	50-150	2	✓	✓	0
2	Sohrio Wah	1	10	70-180	0	✓	✓	0
3	Namaro	1	3	40-120	0	✓	✓	0
4	Vikasor	1			0	✓	✓	0
5	Godhro-2	1			1	✓	✓	0
6	Sudran	0			1	✓	✓	0
7	Adhigam-Sayed Alam Shah	3	5	50-150	1	✓	✓	0
8	Lyari - 1	0	1	70-180	1	✓	✓	0
9	Jhajhoo	1	1	50-150	1	✓	✓	0
10	Pathar	2	5	40-120	1	✓	✓	0
11	Targham Bhodesar	1	2	70-180	1	✓	✓	0
Total		**13**	**37**	**-**	**9**	✓	✓	**0**

Rain water harvesting through local Trais (Ponds)

Women are fetching water from dug well

Figure 20: The main sources of the water in Sub-Project Area

6.20 NGOs

During the field survey it was observed that four major NGOs were reported working in the sub-project area namely Baanh Beli, Sindh Education Foundation, Thardeep Rural Development Program (TRDP) and Shifa Foundation.

Baanhn Beli:

Baanhn Beli is one of the pioneer organizations working in the sub project areas. The organization is working on the promotion of non-formal education, social justice, protection of environment and human institutional development. The organization is covering 75 villages in four union councils in the sub-project areas.

Thardeep Rural Development Program (TRDP):

Thardeep Rural Development Programme (TRDP) works with poor and vulnerable segments of society particularly women in the sub-project araes. Currently TRDP is working on numerous projects including National Poverty Gradutaion Programme, Sustainble Land Management Project, Intrest free loan and adult, adolescent literacy programme in six union councils of sub-project areas.

Sindh Education Foundation (SEF):

Sindh Education Foundation is one of the prominent organization in Sindh Province which is striving for the promotion of quality education in the rural areas of the Sindh province. SEF is supporting elementary and primary schools for girls and boys in sub-project areas.

Shifa Foundation:

The Shifa Foundation is Islamabad based organization and working in the Sindh province since the mega flood of 2011. Its area of intervention is health, nutrition and mother and child health care, mother neonatal and antennal care. In Tharparkar, the Shifa Foundation has its main office in District headquarter Mithi. The organization is working in sub project areas covering 163 villages in seven union councils. The thematic areas include nutrition and reproductive health

6.21 Priority Needs of Community

During consultation meetings with the male and female groups they prioritized their needs. The ranking of prioritized needs is derived from the individual rankings of priorities generated from the discussion with the separate groups in each village. During the male and female consultation meetings in the sub-project area different types of problems were identified and priorities for each village are summarized as follows;

- Demanded male and female vocational centers for the youth.
- Provision of the sewing machines to the women of sub-project areas, who are unable to buy due to poverty.
- Demanded for construction of road pavement and link roads
- Demanded for the provision of basic health facilities
- Demanded for the employment opportunities for local people
- Demanded the potable drinking water

6.22 Archaeological and Cultural Heritage

During baseline survey no archaeological sites observed in the impact zone of dam sites and no graveyard is situated within the sub-projects impact area. But as far as district level is concerned, the area has a rich cultural and historical background with various ancient buildings. However, these are not situated within the primary impact zone of the sub-project area.

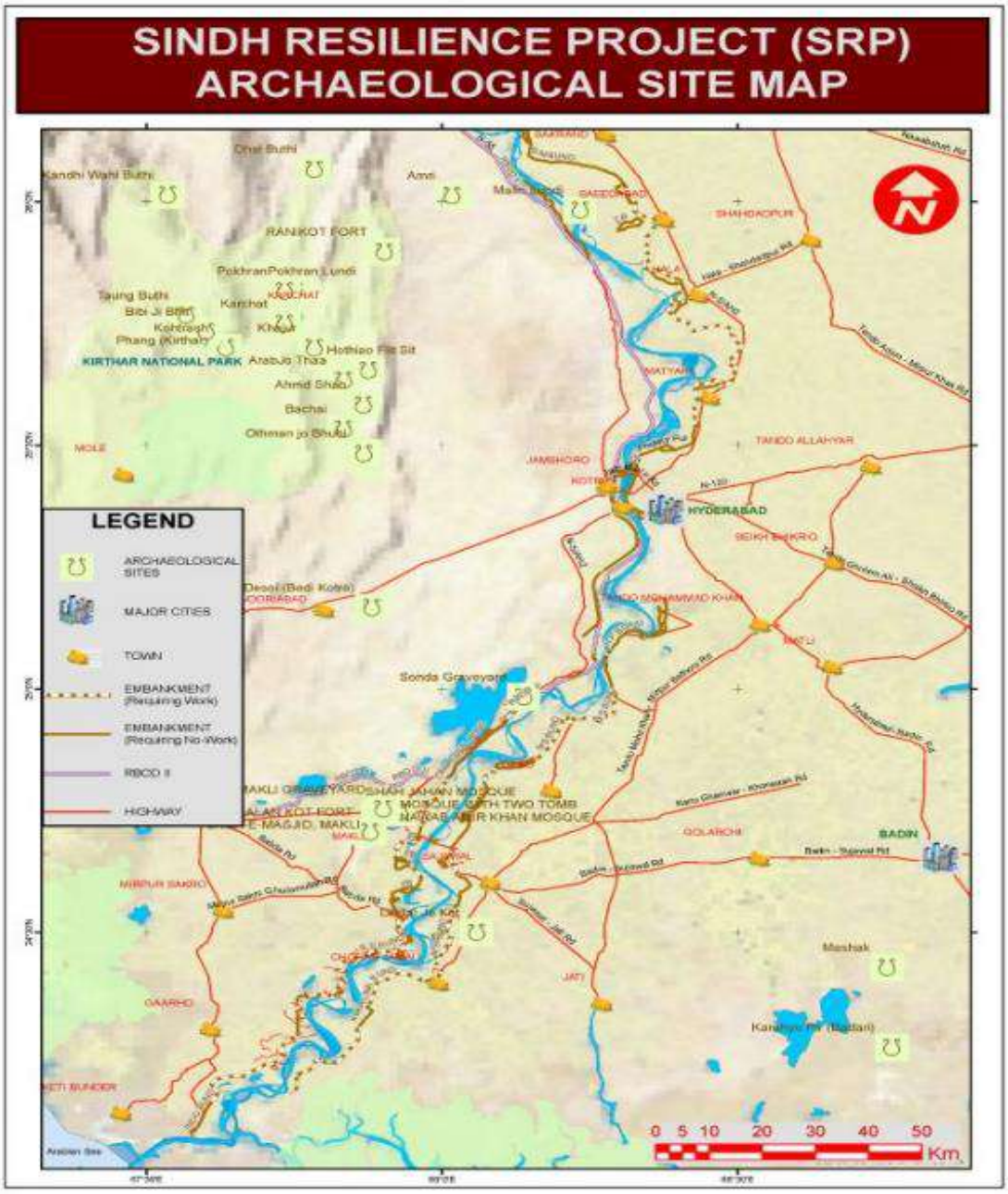


Figure 21: Archaeological Map of the Study Area

7. STAKEHOLDER CONSULTATION AND INFORMATION DISCLOSURE

The objective of conducting stakeholder consultations during the ESMP process was to inform all the stakeholders about the project, record and take into account their opinions, suggestions and concerns and establish confidence amongst the project stakeholders that the project was developed in a responsible way. This was achieved by informing the stakeholders in a timely manner about the proposed project, its potential consequences on the environment and local community itself, and by encouraging their feedback.

7.1 Consultation

This section provides the objectives, process and outcome of the stakeholder consultation conducted as part of the ESMF and ESMP. The primary objective of consultations was to disseminate the subproject information and to incorporate recommendations/ concerns of the stakeholder's particularly the local communities in the subproject design and implementation plan. Subproject stakeholders were identified through initial social impact assessment of each subproject. Stakeholder consultations were carried out during the preparation of the subproject through community meeting focused group discussion and interviews of key informants.

7.2 Community Consultation for Sub-Projects

The consultation was carried out during field visits conducted from 16 September 2020 to 7 October 2020. SRP has developed SOPs in light of WB guidance for COVID 19. The SOPs were implemented to mitigate COVID 19 related risks. Meetings were arranged in open locations or rooms with cross ventilation. Face-to-face community interaction has had to be conducted in small groups in suitable locations allowing for light, air, and for participants to sit at a reasonable distance. Field team comprising on the Environment and Social Safeguard team of consultants along with staff of concerned sub-divisions of Sindh Irrigation Department visited the nearby villages of dams' sub-projects to get the views of the people of the sub-project, who are going to be affected and beneficiaries. They appreciated the Sindh Irrigation Department for taking up the initiatives for building small dams to recharge groundwater. The community was eager to have small dams in their area. According to the community, these small dams would serve water requirement for human population, agriculture and livestock. (Annexure – V Photo Log).

Detailed consultation has been conducted with the villages which are within the primary impact zone (refer Table 27) while the villages of the secondary impact zone have also been consulted through village elders/leaders (refer Table 34). However, the lower riparian will directly benefit by getting perennial groundwater supplies for drinking and domestic purposes.

All the 11 villages were visited falling in (primary impact zone) and 25 villages are located in the downstream and secondary impact zone of the proposed dam sites.

Table 27: List of Villages Visited During the Consultation

Name of Proposed Dam	Name of Village	Date of Consultation	No of Participants
Vikasor	Vikasar	September 18, 2020	21
Sudran	Sudhran	September 18, 2020	19
Adhigham Sayed Alam Shah	Adhigham	September 18, 2020	18
Pathar	Sootlai	September 18, 2020	21
Jhanjhoo	Jhanjhoo Kharirioon	September 18, 2020	22
Bhata Siro	Sehriyoon	September 21, 2020	19
Sohrio Wah	Sohrio Wango	September 21, 2020	21
Namaro	Namaro Karki	September 19, 2020	20
Bhodesar Targam	Bhodesar Targham	September 22, 2020	18
Lyari -1	Kharirioon Wandhio	September 22, 2020	19
Godhoro-2	Fakir Daya Khan	September 24,2020	17
Total			**215**

Community Consultation at Village Aadhigam

Community Consultation at Village Sootlai

Community Consultation at Village Sudran

Community Consultation Meeting at Darya Khan

Figure 22: Public Consultations at Sub-Project Area

7.3 Community Consultations with Females of the Sub Project Areas

During the survey, consultations with women were also conducted by female resource person with women of all ages, where local males were discouraged from attending. Eleven sessions were conducted with women in all sub-project areas, while total attendees were 125. The details of project were described and explained using simple language. During the meetings the women were encouraged to ask questions and share their views and concerns related to the project, which were noted accordingly.

They were informed that with the successful completion of the sub-projects, it will boost up living standard of the inhabitants through conservation of the flood flows and to utilize the same for irrigation and other purposes etc. They were happy and told that these sub-projects are most important for their better livelihood and also help them during drought period. They also told that these sub-projects will leave positive impacts on villagers and their livestock and they do not have any concerns with these sub-projects.

Table 28: List of villages visited during the women consultation

Name of the dam	Name of the village	Date of consultation	No of participant's
Bhata Siro	Sehriyoon	October 7, 2020	13
Sohrio Wah	Sohrio Wango	October 7,2020	12
Namaro	Namaro Karki	October 7, 2020	9
Vikasor	Vikasar	October 8, 2020	16
Gordhro-2	Fakir Darya Khan	October 8,2020	9
Sudran	Sudhran	October 8, 2020	10
Adhigham Sayed Alam	Adhigham	October 8, 2020	13
Pathar	Sootlai	October 9, 2020	11
Jjanjhoo	Jhanjhoo Kharirioon	October 9, 2020	13
Lyari - 1	Khaririion Wandhio	October 9, 2020	10
Targam Bhodesar	Bhodesar	October 10, 2020	9
		Total	**125**

Community Consultation Meeting of females at Village Sudran

Community Consultation Meeting of at Village Layari - 1

Community consultation meeting of females at village Jhanjhoo

Community consultation meeting of female at village Vikasor.

Figure 23: Community Consultations with Females of the Sub-Project Areas

During consultation process, they were briefed that the barren land/ excavated earth will be used for borrow material and contractor will be bound to take borrow material from nearby areas from proposed small dam sites. If material borrowed from private land or someone want to sell the material, the contractor will have to do written agreement with the landowner and after completion, the purpose the contractor will restore the land as per approved site-specific environmental management plan. They applauded the efforts of Sindh Irrigation Department. They were also informed that the continuous liaison with local community will be maintained to update them about status of sub-projects implementation. Their complaints, if any will be redressed through Grievances Redress Mechanism. It will provide local community a chance to address their concerns during construction activities. During public consultation/ interviews, the people of the sub-project areas were fully involved and they came up with positive conclusion: Some comments/ observations with actions/ responses from the community (male and female) are as follows.

Comments /Observations	Action /Response
Employment should be given to local persons especially to those from villages within the study area, Participants from the sub-project villages, during the consultation strongly demanded that unskilled labour should be hired from local area, as there is availability of unemployed young men.	Participants were told that local community people would be employed and this is strictly mentioned in monitoring plan.
Participants were of the views that proper dissemination of information about the sub-project may be ensured	Participants were briefed about the sub-project in detail during field focus group discussion, interviews, consultation while preparing ESMP. They were informed that community members are on board and are aware about the sub-projects,

	while the interaction between project and community would be ongoing process throughout project.
Livestock is scared by the increase in traffic and noise from machinery during project construction and operation, which may cause stress and disease. The community is dependent on the livestock for income.	Techniques to reduce the noise will be employed. Road and traffic route will be planned to avoid disturbance to community
The privacy of women may be affected due to the project. Women currently collect fuel wood, tend to livestock etc. and the family is not concerned about their safety. However, with the increase of outsiders this freedom of movement for women will be reduced.	Cultural emersion and sensitization training will be a part of the induction program for new employees. Moreover, specific clause would be made part of contract/ bidding document as below: No interaction of labor with women and children.

Keeping in view the comments and responses, it is very essential that the concerns of people may be addressed by applying good governance and management practices before and during the construction work.

7.4 Consultation with Institutional Stakeholders

Institutional consultations were conducted with the representatives of government departments and major NGOs working for environmental conservation. In these stakeholder consultations, the identified institutional stakeholders were briefed about the salient features of proposed sub projects and their opinion about the sub projects were requested. The list of identified institutional stakeholders and date of consultation with their representatives is given in Table 29. Moreover it has been confirmed that there is no protected area except the Runn of Kutch which is a wildlife sanctuary. All proposed dams are outside the protected area.

Table 29: List of Institutional Stakeholders

Stakeholder	*Date of Consultation*
SDFO Range Management Mithi, Tharparkar	September 23, 2020
Agriculture and Livestock Mithi, Tharparkar	September 23, 2020
World Wide Fund for Nature (WWF)	November 23, 2020
International Union for Conservation of Nature (IUCN)	November 24, 2020
Sindh Wildlife Department	November 24, 2020

Stakeholder	*Date of Consultation*
Sindh Environmental Protection Agency (SEPA)	November 27, 2020

Summary of concerns raised by institutional stakeholders

Comments/Observations	*Actions Responses*
Generally, all the stakeholders agreed with the proposed sub project and positive opinions were found about the project along with a few concerns.	Noted.
Majority of the stakeholders expressed that they have no direct or indirect concerns or issues and they all appreciated the proposed development.	Noted.
The stakeholders suggested that lower riparian of small dams should not be affected	The small dams will recharge the groundwater and percolation would take place towards downstream areas. As a result, the downstream communities would be major beneficiaries of the dams.
The stakeholders suggested that construction of small dams would lead to improvement in overall socioeconomic conditions in the sub project areas.	Noted
The stakeholders suggested that construction work must be carried out with quality.	Adherence to construction standards with high quality is an integral part of the project implementation.
The stakeholders suggested that care must be given to protect fauna and flora during the construction phase	Adequate measures to protect fauna and flora have been provided in section 5.5
The stakeholders recommended that the project proponent help the local communities' plant fruit and palatable tree species in the nearby surroundings that would not only help in greening of the area, but also provide feed for livestock.	The planation would be undertaken with preference of local species no exotic species will be promoted.

Consultation with IUCN

Consultation with World Wide Fund for Nature (WWF)

Consultation with Sindh Wildlife Department

Consultation with Agricultural & Livestock

Figure 24: Photographs of Institutional Consultation

7.5 Information Disclosure

As disclosure requirement, the Environmental and Social Management Framework. (ESMF), has been uploaded on the SRP Sindh Irrigation Department website, while an executive summary of ESMP of the reported sub-projects will be translated into Sindhi after approval from the World Bank and same also will be uploaded on the website of SRP Sindh Irrigation Department. The hard copy would also be made available at the camp sites.

8. ENVIRONMENTAL & SOCIAL IMPACTS AND MITIGATIONS

The reconnaissance field visit was carried out to assess social and environmental impacts of the activities to be undertaken for the Construction of Small Dams/ Weirs. A checklist showing rapid assessment of potential environmental and social impacts, mitigation measures and residual impacts after mitigation reveals that the project activities will not cause significant disturbance and inconvenience to local community and natural environment of the area. All the impacts which have been identified during the reconnaissance, are associated with the construction phase, and minor to moderate in severity; and can easily be mitigated through planning or adopting appropriate management measures that are included in this ESMP. The minor impacts can be resolved through the best management practices. Social impacts such as getting borrow pit area, hiring of labourers and setting up of labour camp will be mitigated according to applicable policies and procedures. The subprojects will be highly beneficial for the inhabitants of water scarce areas of Nagarparkar. The nature and scope of the construction activities would bring a number of the associated potential social and environmental impacts.

The social impacts associated with borrow pit area will be managed by proper guidance and strict monitoring of subprojects activities. The labourers are expected to be recruited largely from local areas which will enhance economic opportunity for them. The environmental and social safeguards rapid screening depicts that: (i) the sub-project will not require land acquisition; and (ii) the sub-project will not involve any involuntary resettlement.

8.1 Impacts and Mitigations

8.1.1 Major Social & Environmental Impacts and Mitigations

Many positive impacts like socio economic uplift of the area and creation of job opportunities for the local people are envisaged during the construction and operation stages of the sub project. The groundwater table around the command area will rise and will be utilized for drinking and irrigation purposes. In other conditions flooding of the downstream area will be less as compared to past condition. Increase in per capita income and other opportunities and general uplift of the area are expected.

The possible negative impacts of the construction of proposed dams on air, water, land and also on socioeconomic matters, issues at the Dam-site as well as surroundings include agriculture, water quality, watershed erosion and siltation, downstream erosion and water borne diseases.

It is evident from the checklist that the sub-project is environment friendly with respect to the reservoir area and the command area. As regards the command area, the people of this area

will be the main beneficiaries. The following sections give in detail the possible environmental impacts and their mitigations.

8.1.2 Temporary Impacts during Construction Phase

During construction of proposed dams the surrounding area will face some undesirable effects. A number of impacts are of temporary nature and may occur during project construction or early years of project operation. Some of them are described below:

8.1.3 Health and Safety of Community and Construction Staff/Workers

During construction stage of proposed small dams there might be impacts to the health, safety and hygienic conditions of both the workforce and the local community. The potential impacts to the local communities shall be direct, such as being struck by moving plant or vehicles within and outside the sub project area, and indirect through the decrease in air quality surrounding the sub-project area. Air quality will reduce as a result of increased dust generated from construction and on transport routes, as well as due to emissions from plant and vehicles. The impact will continue for the duration of the works (12 months) and can be mitigated by using water bowsers (The water will be obtained from tube wells installed by the Contractors. The contractor shall strictly bound for not to use community tube well) to prevent the creation of dust and by keeping plant and vehicles to a high standard through regular servicing to ensure they meet the SEQS.

8.1.4 Health and Safety Related Mitigations

All works shall be excluded from within 500 m of any residential area. The following steps are suggested for proper management of traffic on routes to be used for material transport within the project area:

- The contractor will have to prepare an Occupational Health and Safety Plan and will submit to the PISSC and PMT for review and approval. When approved, the contractor will implement the OHS plan during construction period according to Sindh Occupational Safety and Health Act 2017. This plan will need to describe all jobs, their risks, and the controls that will reduce risks; these controls may include PPEs, restrictions on activities or locations, and other measures. The plan also needs to describe what type of training will be given to the workers. Those who work near water, at heights, with heavy equipment will need special training so those hazards can be managed and minimized.

- The contactor will ensure the use of Personal Protective Equipment (PPEs) for his labours during construction period;

- The contractor will train his crews on the aspects covered in the above described OHS Plan;

- The contractor shall fence the working area and unauthorized shall not be allowed to enter in the area;

- The contractor will hire an HSE officer with an adequate experience to address above impacts.

- The Contractor will display sign boards and banners about traffic diversion at places on detour routes;

- Provision of speed breakers at appropriate places in consultation with/approval of the Engineer which should be removed after completion of the project;

- Establish and obey speed limits;

- The Contractor will maintain workers hygienic conditions in labour camps.

- The Contractor shall make available the First aid kit and bandages at all the times and all the sites. Moreover, paramedic staff will be available on site and cost of hiring will be a part of BOQ item. The location of these kits shall be clearly marked and shall be easy to access by all.

- No private property without permission of the owner will be used for transportation;

- Drivers will fix net on containers while transporting stones and soil etc.

Community liaison will be maintained during construction stage and GRM will be established to address complaints related to safety hazards. Contractor will prepare an emergency response plan to address events such as fire, floods, earthquakes, injury/death, and accidents.

8.1.5 Health and Safety of Community and Construction Staff/Workers related to COVID-19

During construction stage of small dams there might be impacts of Corona Virus on the health conditions of local community through work force.

8.1.6 COVID -19 Related Mitigations

Addressing COVID-19 at a project site goes beyond occupational health and safety, and is a broader project issue which requires the involvement of different members of a project management team. Given the project context, a designated team would be established to address COVID-19 issues, at PMT level, PISSC level, and at the contractor level. Detailed SOPS are prepared as per World Bank SOPs of COVID-19. Detailed Mitigation measures are given in SOPs attached in Annexure - VIII.

8.1.7 Noise Pollution

During the Construction stage, Noise will be created as a result of the works. The main impact will be from traffic along haulage routes and the operation of construction machinery like (Excavators, Dozers, Compactors and Graders). Due to the limited number of settlements present within the vicinity of work areas where noise levels shall be elevated, the magnitude of this impact is judged to be minor adverse.

8.1.8 Noise Related Mitigation

The mitigations shall be to limit working hours to between 8 am and 6 pm, six days a week. The camp sites shall be situated at least 500 m from any settlement. Noise monitoring will be conducted every month as recommended in ESMP as per SEQS. In spite of this, On-demand noise monitoring will also be carried out in case of any complaint or request by the affected communities. Noise level of machines to be used during the construction will be controlled and measured will be taken to limit the levels as SEQS, as far as possible and the workers will be provided earmuffs, where necessary. Additional mitigation measures will be identified and implemented in case the noise levels exceed the permissible limits. Community liaison will be maintained to ensure that complaints and grievances are addressed as soon as possible. As the proposed Dam sites is far away from the population so, excavation noises for weir would not affect the local population and only vehicular movement would cause minor noise and would disturb the air quality. While no noise issue is anticipated during operational stage as there would be no machinery movement and other noise related activities.

8.1.9 Air Pollution

Keeping in view the distance of proposed dam sites and population there would be no major impact of air and noise pollution. During the course of construction following minor issues may arise and are as under,

i) Air Quality

Air quality would be disturbed during construction stage due to cuttings for excavation of weir construction, vehicular movement and release of particulate matter $PM_{2.5}$ from vehicular

emission. Construction activities will generate dust and pollute the surrounding area. The emission from the machinery used in earth work activities will also degrade the air quality of the site. Exhaust of noxious gases from movement of heavy machinery will further pollute air which will adversely affect health and vigor of plants. Smoke emission from the vehicular movement and heavy machinery would slightly cause smoke problem in the nearby villages, which are located on the way of proposed dam site.

ii) Dust

Impact of dust is restricted only to the few villages, which is very closely located on the route to the proposed dam sites. The dust problem is expected to be minimal. During the entire construction period dust laden polluted air will form a dust film on leaves thus blocking sunshine and stomata consequently hindering photosynthesis processes causing detrimental effect on the plant health.

During operational stage, the area would be dust free as there would be no operational activities and heavy vehicular movement.

8.1.10 Air Pollution Mitigation Measures

The air related mitigation is discussed as follows, during the construction phase of the proposed sub-projects, some adverse impacts on the environment by suspended dust are foreseen. These will be effectively mitigated by adopting the following preventive measures;

- Regular spraying of water should be undertaken to minimize the dust pollution. The water would be obtained from tube wells installed by the Contractors or may be grey water from the camp areas and reuse of wastewater from batching plant.

- All vehicles, machinery, equipment and generators used during construction activities will be kept in good working condition to minimize the exhaust emissions.

- The Contractor will regularly spray water on the site traffic routes to minimize the dust pollution.

- Enforce the maximum speed limit to 10km/h for vehicles to reduce the dust emission.

- Native species tree shall be planted, no rapidly growing trees, shrubs and grasses in the project area shall be allowed during operation stage of the sub project with the collaboration of Forest department.

8.1.11 Water Related Impacts

i. Water Quality

The water samples were collected from the dug wells and ponds near the proposed dam site and were analyzed from the SEPA approved lab; the results have already been summarized earlier.

The streams are basically non-perennial and flow only few hours during rain months. During the construction stage different types of activities such as cutting, earth work and concrete work would alternately result in deteriorating the surface water quality.

A secondary adverse impact is potential spillage of chemicals, hydro-carbons and other pollutants as part of the construction process as well as contamination arising from the improper disposal of wastes (organic and inorganic) at the camp and work sites. Such wastes are detailed in Table - 30.

Table 30: Site Waste

Type of Waste	Description
Campsite or domestic waste	Biodegradable: Foodstuffs, fruits and vegetables, wood, Campsite or domestic waste bones, grass etc.
	Non-Biodegradable: Paper, metals, glass, plastic bottles, scrap metal, textile and shoes, bottles and jars, fluorescent tubes.
Sewage and grey water	Kitchen and washing areas sewage
Workshop waste including solid and Fluid	Used oil, ferrous /nonferrous materials, batteries etc.
Medical waste	Syringes, glass bottles, Bandages, expired drugs, dressing etc.
Packing waste material	Paper, plastic, textiles, cardboard, rubber, wood, glass, tin cans etc.
Excavated and Demolition waste	Rocks, sand, silt/clay, concrete, bricks and other building materials
Excess construction material	Sand, aggregate, stones and other construction materials

The groundwater which is a source of drinking in some areas may be potentially contaminated by the release of untreated sewage from construction camps and office.

ii. Anticipated Aquatic and Terrestrial Life

Impacts on aquatic and terrestrial life during the construction stage are given below.

- **Impact on Impoundment Area**

Reservoir area houses the population of plants, animal habitats, and reptile animals except fish fauna due to non-perennial system in the reservoir. After the construction of the dams, a positive impact on plants, animal habitats and reptile animals in the impoundment area are anticipated. It is expected that reservoirs would retain water for two to three weeks.

- **Impact on Command/Lower Riparian**

All eleven dams are recharge Dams. These dams have been planned on non – perennial stream of the sub project area. The following table depicted that only 1684 acre ft out of 6697 acre ft (25.1%) of water will be retained for groundwater recharge in these proposed dams with respect to the water availability in their corresponding streams. While in the regional context this portion will be very negligible which is only 0.94%. Moreover, one stream has one proposed dam except Jhanjhoo Nai. The stream have two dams one is Jhanjhoo dam which has been proposed under SRP-AF and the other one is Sabusan Dam which has already been constructed under SRP. The distance between these small dams is about 8 km. Sabusan Dam is downstream of proposed Jhanjhoo Dam on separate catchment area (Refer annexure I). Proposed Dam will share only 40 Acre ft (6.2%) of water of Jhanjhoo nadi catchment area.

It can be seen from the map that catchment of proposed dams varies, as there are number of other streams merging in the sub project area and ultimately Runn of Kutch. So, there is enough potential of water available for rain water harvesting in the area.

Table 31: Quantification of Water Diverted to Dams

Sr .No.	Proposed Dam	Type of Dam	Water Availability (Ac-ft) in non-perennial streams	Water to be retained by the Small Dams (Ac-ft)	% of retention for groundwater recharge	Water Availability in whole catchment area (Ac-ft) of Runn of Kutch	% of retention (regional) for groundwater recharge
1	Bhata Siro	Recharge	374	173	46.3	180000	0.10
2	Sohrio Wah	Recharge	270	69	25.6		0.04
3	Namaro	Recharge	727	289	39.8		0.16
4	Vikasor	Recharge	694	245	35.3		0.14
5	Gordhoro-2	Recharge	1857	278	15.0		0.15
6	Sudran	Recharge	459	130	28.3		0.07
7	Adigam-Syed Alam Shah	Recharge	561	55	9.8		0.03
8	Layari-1	Recharge	166	83	50.0		0.05

Sr .No.	Proposed Dam	Type of Dam	Water Availability (Ac-ft) in non-perennial streams	Water to be retained by the Small Dams (Ac-ft)	% of retention for groundwater recharge	Water Availability in whole catchment area (Ac-ft) of Runn of Kutch	% of retention (regional) for groundwater recharge
9	Jhanjhoo	Recharge	648	40	6.2		0.02
10	Pathar	Recharge	725	151	20.8		0.08
11	Targam Bhodesar	Recharge	218	171	78.4		0.10
Total Combine storage Capacity			**6697**	**1684**	25.1	**180000**	0.94

Further, the parts of Runn of Kutch in Nagarparkar area receive their freshwater contribution of rains through some well-defined nais such as Kharoro, Mudro, Mulji, Sudran, Adigam, Jhanjhoo, Kasbo, Surachand, Ghartiari, Gordhro Bhitiani and Chitrasar and through natural drainage of surrounding area towards low lying marshy lands. The total catchment area of Runn of Kutch is spread on 4687 km sq. and the total catchment areas of 11 proposed dams of Nagarparkar are 83.50 sq. km. These dams will store the rainwater before it is released into salty marshes of Runn of Kutch as refer Figure 25.

It may further be noted that in sub-projects area, local population is already collecting rainwater for their use by constructing earthen embankments near proposed dam locations. The sub-project will replace those poor structures with properly designed safe structures with spillways. In fact practically there will be no additional intervention to the rainwater runoff towards salty marshes due to construction of these dams. Thus, there will be negligible impact of the sub-projects on eco-system of marshy lands. Since all the dams are of small reservoir capacity there will be very small retention as compared to total flows in streams. Thus there will be negligible impact on the down stream flows. On the other hand the groundwater recharge will percolate towards downstream areas, hence, the downstream communities would be major beneficiaries of these dams.

The bio-diversity including plants and animals in the command / downstream area during the construction period would experience little or no adverse impacts. After construction of the dams, the command area and lower riparian will directly benefit by getting perennial groundwater supplies for drinking and domestic purposes

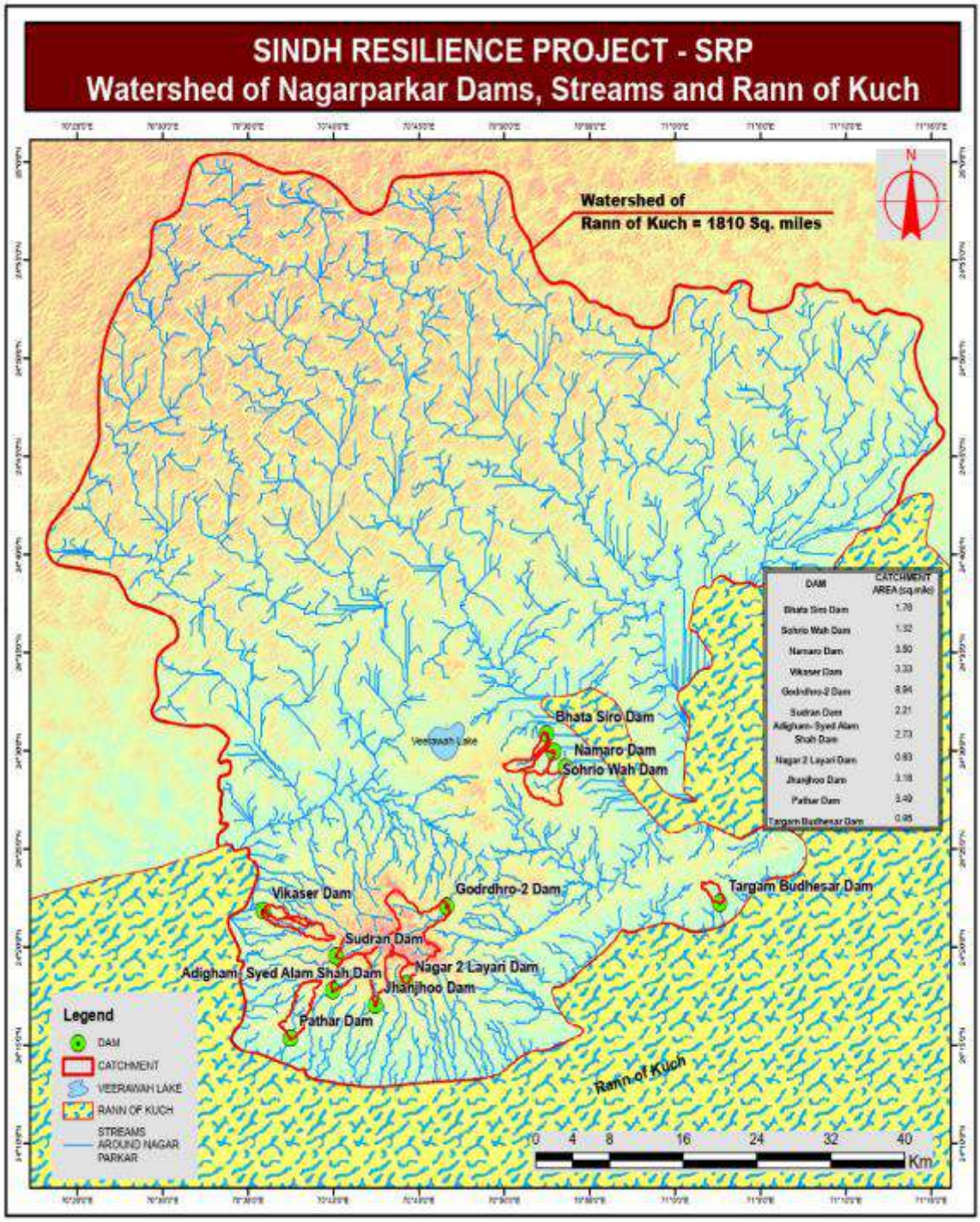


Figure 25: Watershed of Proposed Small Dams in Nagarparkar Region

Impacts of Dam Breach

The study of dam break was conducted as a part of detailed design by PISSC. In their report titled “Detailed Design” the results of the dam break study are given in Table - 32 below.

Table 32: Summary of Dam Break Study

Sr. No.	Parameters	Bhata Siro Dam	Sohrio Wah Dam	Namaro Dam	Vikasor Dam	Gordhoro-2 Dam	Sudran Dam	Adigam-Syed Alam Shah Dam	Layari-1 Dam	Jhanjhoo Dam	Pathar Dam	Targam Bhodesar Dam
1	**Flood Volumes:**											
1.1	Reservoir Volume at Normal Reservoir Level (Acre-ft)	173	69	289	245	278	130	55	83	40	151	171
1.2	Design (100-year) Flood Hydrograph Volume (Acre-ft)	1,766	1,283	2,702	1,256	8,765	2,046	1,870	73	1,266	3,014	883
1.3	Combined volume: Dam Breach+100-year Flood (Acre-ft)	1,939	1,352	2,991	1,501	9,043	2,176	1,925	156	1,306	3,165	1,054
2	**Discharge Peaks:**											
2.1	Case 1: Breach Hydrograph Peak (cfs)	14,361	20,628	17,208	18,316	14,361	17,996	13,666	16,278	7,684	19,788	13,511
2.2	Case 2: Design (100 year) Flood Peak (cfs)	2,141	1,990	4,220	4,476	13,279	4,251	4,936	2,526	4,917	3,944	1,269
2.3	Case 3: Combined : Dam Breach + 100 year Flood (cfs)	16,502	22,618	21,428	22,792	27,640	22,247	18,602	18,804	12,601	23,732	14,780
3	**Inundated Area (Sq.Miles):**											
3.1	Case 1: Dam Breach only	1.26	1.17	3.20	1.10	5.36	2.53	4.42	3.48	1.12	2.07	3.27
3.2	Case 2: Design (100-year) Flood only	2.10	2.08	4.12	5.19	12.46	4.99	3.30	2.66	3.29	2.20	3.61
3.3	Case 3: Combined : Dam Breach + 100 year Flood	3.10	3.12	6.06	6.19	15.58	6.86	3.34	5.68	4.35	3.33	4.67
4	**Estimated population affected according to Land Scan Population Grid:**											
4.1	Case 1: Dam Breach only	12	20	31	17	774	845	147	208	221	19	8
4.2	Case 2: Design (100-year) Flood only	17	25	49	117	2,434	1,030	299	281	388	20	9
4.3	Case 3: Combined : Dam Breach + 100 year Flood	22	28	53	137	3,382	1,121	319	361	390	27	10

It has been concluded from the dam break study, the reservoir area of all eleven (11) dams is small, and not exceeding 0.27 sq. Kilometers. Thus, the area inundated in worst case scenario (Combined dam breach + 100 year flood) 40.35 sq. Kilometers (15.58 sq. Miles) at Gordhoro – 2, and number of person affected in the worst case scenario is 3,382 person. Overall the areas inundated by breach of dams are small and consequently the population affected in case of dam breach is small. Therefore, the incremental impact of dam breach on 100-year design flood is not appreciable. The number of population affected depends on the human settlements downstream of the dam. In case of Gordhoro – 2 Dam appreciable population may be affected in event of high flood. An emergency preparedness plan will be prepared for all dams.

8.1.12 Water Related Mitigations

A contractor will make his own arrangement and would not rely on existing community resources and would not extract from sources currently used by the community. The water would be obtained from tube wells installed by the Contractors. The contractor shall strictly bound for not to use community tube well as this may compete the local water resource in dry season when water table decline. The contractor will conduct Electrical resistivity surveying test along with pump-out test to assessing the groundwater potential required for the construction activities before tube wellbore. This condition will be included in the Bid document as contractual binding. Moreover, the Contractor must provide the following facilities at each campsite: Latrines; lined washing areas; septic tanks and soaking pits for toilet waste. Key mitigation measures are listed below.

- All hydro-carbons and other potential pollutants should be properly confined, there should be proper septic tanks and soaking pits for sewage treatment and disposal, sewage/sanitation at work camps and proper wastewater collection facilities. Wastewater effluent from contractors' will be passed through an oil skimmer and to gravel/sand beds to remove oil/grease contaminants before discharging it into natural streams. Similarly, the wastewater effluent from the campsite will be treated before disposal into a stream. According to SEQS, the BOD_5 concentration in sewage must be brought down to less than 250 mg/l before being disposed with a capacity to dilute the effluent further by 10 times.

- To overcome the contamination issue, at each construction camp, the contractor shall install domestic water filter/150GDP with Ultraviolet (UV) to ensure the safe and healthy drinking water for the workforce.

- Proper collection and disposal of water used for construction (to be the contractor's responsibility).

- Collection drains and oil interceptors.

- Regular monitoring of water quality shall be carried out by the PISSC and ESMU of PMT.

- Contractor / PISSC will purchase water from nearby available resources as well as dig his own well.

- Water consumption will be monitored during construction stage and record will be maintained to avoid any wastages.

- Diesel, oil and lubricants should be properly stored in accordance with the petroleum regulations. This will be the responsibility of the contractor.

- Appropriate arrangements will be made to stop stones and soil to slip in the river water.

- Community liaison will be maintained and GRM will be established to address complaints related to waste disposal.

8.1.13 Impacts of Solid Waste

Domestic waste will be the main type of waste generated from construction camps. Domestic waste contains high percentage of readily degradable hydrocarbon which gives a bad smell on decomposition, especially in hot and humid environments.

Proper management of solid waste is also important because of the risk that improper solid waste handling and disposal poses to human health and the environmental degradation. Careless and indiscriminate open dumping of wastes can create unsightly and unsanitary conditions within the project area.

The total quantity of domestic waste generated will vary depending on the strength of labor that the contractor poses to use. It has been estimated that strength of labor will be about 600 at the peak of the works. Most of the labor will be locals who will return to their homes at the end of the working day. Maximum of about 25 % of labour comprising mainly skilled labour will reside at construction camps at the peak of the works. Solid waste generation in Pakistan ranges between 0.283 to 0.612 kg/capita/day and the average dry weight per capita solid waste generated per day turns out to be 0.447 kg/capita/day. From the construction camps it is estimated that up to 72 kg of domestic waste (including food waste) would be generated daily during the peak of the works.

8.1.14 Mitigation for Solid Waste

For solid wastes, the following mitigation measures are recommended:

- Implement resource conservation, and encourage staff (through training) to reduce waste, reuse waste and recycle waste wherever possible
- Provide garbage bags near labour camps for collection of domestic camp waste
- Arrange for regular collection of camp waste and transfer to storage area/disposal with the cooperation local admiration.
- Collect all biodegradable domestic camp waste and dispose of at the designated area.

The planned sub-project is expected to provide required water quantity, improve water quality and stabilize the current water supply losses. It will also be contributing to the reduction of water pollution and water-borne diseases. The area and the local communities will gain many directly related positive impacts and benefits as briefed.

8.1.15 Income and Employment

The employment opportunities generated by the growth in the local agricultural sector by enhanced availability of ground water both in quantity and quality and some other sectors, the economy that stem from the agriculture improvement and live stock will increase significantly.

8.1.16 Land and Property Value

Due to improvement in the environmental quality in terms of groundwater availability and quality, some increase in land and property value is also expected.

8.1.17 Development of Borrow Land

The proposed raising of the proposed dams involves concreting and earthworks. Borrow areas for bunds are proposed in existing bunds to increase their capacities. Therefore no major effects on the borrow areas is anticipated.

8.1.18 Reclamation of Land

During operational stage no water logging, salinity and erosion properties are anticipated, so, no reclamation of the land would be required at later stages.

8.1.19 Development of Roads

For the transportation of construction material, equipment and heavy machinery the existing National Highway N5 Karachi to Nagarparkar via Thatta and Badin and from Nagarparkar to Proposed dam sites is 30 Km link road will be used. No permanent or temporary roads therefore required to be constructed for accessibility of the dam site.

8.1.20 Land Use Changes

During the construction of the dams and associated works some technical staff, workers and officials would be staying near the dam-site and would require land for their residence such as contractor's camp, staff residences, dam and reservoir During the construction stage, necessary localized arrangements for electric power and telephone exchange is needed as the area is lacking these two facilities. No adverse impacts are foreseen during the construction and operation of the proposed Dam.

8.1.21 Biodiversity

A detailed baseline of the main habitats and mammals, reptiles, amphibians and birds present in the sub-project area is given in Section 5.

During the baseline survey of the sub project area, no endemic or rare species were observed in the primary impact zone. All species recorded during the field survey have a wide range of distribution. Since the proposed dam and camp sites will occupy small areas and will be located in existing clearings, because of sparse vegetation cover, the impacts are reversible and localized by adopting the mitigation measures. However, dense patches of vegetation wherever encountered along the small dam axis will be avoided to the extent possible. Furthermore, development of new tracks will be avoided existing tracks will be used. Use of local vegetation as fuel by labor will be prohibited. Work force while working along will concentrate within a corridor of 4.5m.

No hunting, harassment or netting of wildlife will be permitted. Major project activities will be completed before the arrival of migratory birds on wetlands and other sensitive areas like Runn

of Kutch No clearing of bushes will be allowed during nesting/breeding season of birds. Maximum effort will be made to save rodent colonies during construction.

Due to establishment of labor camps, food storage, setting up of kitchens production of sewage and waste water may result in multiplication of rodents like rats, mice and shrew etc. and vectors like mosquitoes, bugs and flies which will have a negative impact Temporary impacts during the construction of the proposed dams on wildlife (small reptiles and some birds losing their nests etc.) are envisaged. Indian Star tortoise is reported by IUCN list in Runn of Kutch area, which is located at 1 kilometers away (average distance), project activities will be kept limited to the construction area.

Moreover, as the total catchment area of proposed Dams in Nagarparkar is small. The total catchment area of Runn of Kutch is spread on 4687 sq. km (1810 sq.-miles) and the total catchment areas of proposed dams is small 87.5 sq km (32.24 sq. miles – 1.7%). Hence, there will be no impact on Indian tortoise or any other species due to project activities. After the creation of reservoirs diverse wildlife including migratory birds may be attracted.

During the transect walk in the sub-project area especially proposed dam construction areas none of the species have been observed. Average aerial distance of Runn of Kutch from the proposed dam sites are given in following Table – 13. Only four proposed small dams are within 3000 m (3 Km) from the Runn of Kutch area. In these proposed Dams construction activities strictly limited and monitored by the environmentalist/ecologist.

Composite Camp should be established by clustering the proposed dams. Located at least 500 m away after the approval of environmentalist. The camps will be properly fenced and gated to check the entry of wild animals in search of eatable goods. Similarly, wastes of the camps will be properly disposed of to prevent it being eating by wild animals, as it may be hazardous to them. Furthermore, working order for near Runn of Kutch is given in Table – 33.

Table 33: Ecological Management Plan for Runn of Kutch

Area	Mitigation Measure	Responsibility
Construction Mitigation Measures	Construction activities will be confined in the designated areas like where dam weir will be constructed and barricaded camp area. Heavy equipment will be cleaned to prevent the importation of non-native plant species, hydraulic fittings will be tightened, and it will be ensured that hydraulic hoses are in good condition and shall be replaced and repaired if petroleum leaks observed.	Contractor, PISSC and PMT

Area	Mitigation Measure	Responsibility
	All major Environmental parameters will be checked and ensured that impacts stay within the parameters of the project area and do not escalate beyond the scope of the environmental assessment.	Contractor, PISSC and PMT
	It will be ensured and implemented that the project remains within the parameters of Sindh Environmental Quality Standards.	Contractor, PISSC and PMT
	The orientation of the project activities in the form of Tool Box Talk (TBT) will be provided regularly to all construction workers to increase their understanding and sensitivity to the challenges of the special environment in which they will be working.	Contractor, PISSC and PMT
	Proper and timely maintenance will be provided for vehicles and equipment used during construction to reduce the potential for mechanical breakdowns	Contractor, PISSC and PMT
	It will be ensured that all construction equipment has functional exhaust/muffler systems.	Contractor, PISSC and PMT
	Truck and related construction equipment speeds will be limit in active construction areas to a maximum of 10-15 KM/hr and strictly adhering to regulations and posted speed limits.	Contractor, PISSC and PMT
	Water bowsers will be used to control excess airborne particulates at staging areas, active construction zones, and unpaved roads leading to/from active construction areas.	Contractor, PISSC and PMT
Near Wildlife Habitats	Effects of light and noise on adjacent habitats shall be limited through controls on construction equipment.	Contractor, PISSC and PMT
	Adequate education will be provided and enforcement to limit construction worker activities that are destructive to wildlife habitats.	Contractor, PISSC and PMT
	Firing any gun or doing any other activities which may disturb any animal or bird shall be prohibited which interferes with the breeding places.	Contractor, PISSC and PMT

Area	Mitigation Measure	Responsibility
	Noisy work shall be performed (such as the operation of heavy equipment) between the hours of 6:30 a.m. and 5:00 p.m. to minimize disruption to the nearby community.	Contractor, PISSC and PMT
Waste Management Measures	Trash will be properly secured during the workday and all trash shall be removed from the site at the end of each workday. The waste will be disposed of according to its nature such as non-hazardous waste shall be buried in a deep pit away from the camp site, wildlife, and settlements whereas hazardous waste shall be disposed of by the contractor through a third-party waste management contractor approved by Sindh EPA.	Contractor, PISSC and PMT
Breaking up of Land for Cultivation or mining purpose	It will be ensured that project activities will remain isolated as per design excavations, no other activities will be permitted.	Contractor, PISSC and PMT
Polluting water	Potential impacts related to water pollution sources will be identified and their mitigation measures also proposed in the Contractor's CESMP.	Contractor, PISSC and PMT
Operation Phase disturbance to Wildlife	Potential impacts related to hunting and poaching of wildlife during the operation phase have been identified, and their mitigation measure has been proposed in ESMP and will be updated in the Contractor's CESMP. During the operation phase, flora and fauna will flourish, and this has been also observed on other dams completed so far in the first phase.	Sindh Wildlife Department / Local Community

In addition to this no-poaching or hunting will be allowed to project staff, also Sindh Wildlife Department (SWLD) is vigilant for the protection of wildlife in the sub project area. The Contractor's staff and labor will be strictly directed not to damage any vegetation such as trees or bushes. They will use the paths and roads for movement and will not be allowed to trespass through farmlands or forested areas. Special measures will be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding. Staff working on the project should be given clear orders, not to shoot, snare or trap any bird.

8.1.22 Watershed Erosion and Sedimentation

As there would be no intervention in the watershed area, therefore no erosion is expected due to the construction activities of the dams. However, during operation stage watershed erosion may result in the accumulation of silt in the reservoir resulting the effective life of the dams. Proper watershed management is, therefore, required in the catchment area.

8.1.23 Downstream Erosion and Siltation

The water quality may be temporarily disturbed at dam-sites due to construction activities and temporary residential areas for the workers/staff which is one of the causes for water borne diseases. Water utilization would be minimal as the distance of the dams to the nearest settlements is significant that would prevent use of water on the daily basis.

8.1.24 Wastewater Discharge

Domestic wastewater from the contractor's camp will be collected in the septic tanks, before reaching top level treated water will be collected in the water tanker then after same water will be used for sprinkling purpose on the haul routes to settle down the dust. Therefore, no adverse impact is foreseen in the area. However, the design of septic tanks will be done during construction stage by contractor on the basis of occupancy in the camp and same will be ensured in Contractors' ESMP.

8.1.25 Socio Economic Impacts

The sub-projects will be instrumental in considerably improving the socio economic conditions of the local population, both during the construction and operation stages, through provision of considerable job opportunities. Employment, health, life style and cultural uplift are the direct benefits during these stages.

i. Population and Settlement Pattern

During the construction stage considerable job opportunities will be created. The standard ratio will be applied by the contractor while hiring labour i.e. 70% local and 30% non-local. For skilled jobs people from other parts of the country would be employed. There would be some temporary increase in the visitor population who would however leave the area after the completion of the construction activities. During the operation stage no adverse impact is envisaged.

ii. Human Resource Development

During the construction stage local population would get jobs in the form semi and unskilled labor. The wages for unskilled labour would be Rs.600/day, semi-skilled labour Rs.800/day, while skilled labour Rs.1200 to 1500/day. Due to their interaction with skilled labor, their skills would be developed for future development activities of this kind.

iii. Impacts of Labor Employed from Outside

Some social impacts could arise due to labour influx. There shall also be a risk to community health from HIV/AIDS or other transmitted infections as a result of the presence of a migrant construction labour. There could be risk of gender based violence from the migrant labour, who often remain away from home on the site. This may lead to inappropriate behavior including sexual harassment of women girls and boys of the local community. This could especially be relevant in case the nearby population is from any marginalized group e.g. Hindu community. Cultural sensitization is necessary as a mitigation. Problem of child labour could also arise due to increased opportunities for the host community to sell goods and services to the incoming workers can lead to child labor to produce and deliver these goods and services, which in turn can lead to enhanced school dropout.

Besides this, some adverse environmental impacts could also arise due to labour influx. Impacts like, inadequate waste disposal and illegal waste disposal sites due to large populations of workers, wastewater discharges from camp could also emerge. Major health risks can occur if latrine pits spill over into local streams that are used for drinking water by the host community. The provision of clean drinking water and water for hygiene purposes can result in increased pressure on freshwater resources. Impacts in ecologically sensitive areas, workers' camps can have impacts on the local wildlife. This may include disturbance of species, as well as illegal hunting. In the same context, new access routes for workers' camps may have impacts on natural habitats.

As part of the mitigation process, the contractors shall locate/ construct camps for their staff at least 500 meters away from communities in order to avoid social conflict as well to avoid the possible adverse impacts of the construction camps on the surrounding communities. Fencing will be provided around the camp site and security will be provided by the Contractor. Camp layout plan and workers code of conduct will be prepared by contractor and will be submitted for review and approval of the Engineer.

Preference will be given to local labour for work, most of the labour will go back to their homes on daily basis. Limited number of labours (35 – 40) labour would be resident in the camp. The contractor shall include information about HIV/AIDS and the spread of sexually transmitted diseases within the workers code of conduct. The contractor shall also include proposals for awareness on HIV/AIDS and the spread of sexually transmitted diseases in the CESMP and

in training plan. The contractor will train the workers regarding (Gender Based Violence GBV) and also train workers about sexual harassment, child abuse, child labour, human trafficking for reducing the risk of GBV. First aid and medical facilities will also be provided by Contractor on site and camp areas.

Moreover, Contractor will purchase water from nearby available resources, as well as dig his own well, for the consumption of water in camps for domestic purpose. In ecological sensitive areas, construction activities will be confined in the designated areas. No new access routes will be developed for borrow areas or for the movement of supply vehicles. Existing routes will be used for such activities.

iv. Socio Economic Uplift

During the construction stage of the sub-project socio economic condition of the population of the area may improve as a result of increase in per capita income through creation of direct and indirect opportunities of jobs. During operation stage of small dams, the communities of targeted command area would get perennial groundwater.

The 11 recharge dams of Nagarparkar region will be constructed on well-defined nais (rivers). The natural drainage pattern of surrounding areas is towards Runn of Kutch and after the overspill the remaining water will also flows to Run of Kutch area. Thus, construction of these dams will not have any significant impact on lower riparian, however, the command area and lower riparian will directly benefit by getting perennial groundwater supplies for drinking and domestic purposes. All the 11 villages visited (primary impact zone) and 25 villages are located in the downstream and secondary impact zone of the dam sites are mentioned in Table – 34.

Table 34: Consulted Villages Located at Lower Riparian and Secondary Impact Zone

Name of Dam Site	Name of Downstream Villages	Distance from the proposed dam site (km)	No of HH	Population
Bhatta Siro	Pawriari	5	150	1200
	Edal Jo Vandhio	6	115	920
	Pabasaro	9	250	2000
Sohrio Wah	Sankar	6	310	2480
Namaro	Dhed Vero	9	345	2760
	Sehriyoon	6	150	1200
Vikasor	Bhaka	7	340	2720
Sudran	undher	7	150	1200
	Sukhpur	5	300	2400
	Adhigham	6	700	5600
Godhoro-2	Narisar	9	150	1200
	Piplia	7	200	1600
	Sardharo Mundar	8	50	400
	Ghartiari	12	415	3320
	Karai	7	80	640

Adigam Sayed Alam Shah	Sudhran	6	50	400
	Dhedlai	6	250	2000
	Abasar	7	330	2640
	Dherlai	9	20	160
	Sindhi ji vandhio	16	350	2800
Jhanjhoo	Rarko	13	300	2400
	Sindhi jo Vandhio	16	350	2800
Targam Bhodesar	Didwa	12	150	1200
	Behrano	13	200	1600
	Churia Monder	8	400	3200
Total no of villages 25			6,105	48,840

8.2 Cumulative Impacts on Valued Ecosystem Components (VECs) of the Project Area

The proposed eleven dams under SRP-AF, Planned under SRP and already constructed dam in the sub project area (as refer Annexure I) will have mostly positive and slightly negative impacts in the subproject area. The cumulative impacts have been evaluated for construction and operation phases. Cumulative Impacts are focused on Valued Ecosystem Components (VECs) which include the Biodiversity component i.e., valued fauna and flora, Ecological component i.e., Ecosystem's flow regulation ability, Social Component i.e. Project affected People (PAP), Economic component i.e., Government and private/local Revenues.

Valued flora and fauna may have temporary and reversible impacts on habitat and wildlife within the subproject area. The first could be the loss of habitat due to the clearing of vegetation and the other one is a sensory disturbance to wildlife species due to the physical presence of people, vehicles, and equipment at two dam sites.

In terms of valued flora and fauna of VECs, the impacts of small dams will be mitigated through appropriate measures such as the clearing of habitat will only be done at dam axis points moreover, and the camp areas have been proposed at already cleared/barren land. The flora present around the proposed dam structures was counted during the field survey as shown in Table-20. A total of 86 mature and young trees out of 289 trees, are expected to be damaged/uprooted during the construction phase. All species are common and widespread in the vicinity of the subproject areas furthermore, all of the impacted flora has the Least Concern status as per IUCN.

No permanent or temporary road will be constructed existing alignment will be used. In terms of other terrestrial wildlife species, previous studies have shown the effect of sensory disturbance during construction of projects on small mammals, reptiles, and birds to be insignificant. Large mammals have a large home range and therefore, disturbance during construction may only result in short-term displacement from the immediate work areas, not having any impact on the survival of the species. Moreover, all of the proposed dams' sites

are outside the Runn of Kutch wildlife sanctuary. The construction activities at the proposed small dams which are close to Runn of Kutch (refer to Table 13 like Bhata Siro, Sohrio Wah and Targaam Bhodesar) might be completed before the arrival of winter migrants or suggested to be done in phases. Runn of Kutch is key feature of the area and impacts on this will be minimized by minimizing the duration of activities in their vicinity and restricting it to the summer season. Moreover, the camps will be properly fenced and gated to prohibit the entry of wild animals in search of eatable goods. All these mitigation measures will be strictly implemented by the contractor's environmentalist and monitored by the supervisory consultant

During the operation phase of proposed dams in addition to the other already constructed and planned dams may create a positive impact on VECs in terms of habitat restoration and vegetation cover enhancement which ultimately support the fauna of the area. This was also evaluated in the 'Performance Evaluation Study of Small Dams in Sindh Province' report that after the construction of small recharge dams in the area the biodiversity/habitat (trees and vegetation) is increased. A good number of jungle trees including; *Acacia nilotica, Prosopis Cinereria, Tamarix gallica,* herbs, and shrubs were observed growing in the vicinity of dams. Since all nais/streams are non-perennial hence there is no fish farming practice observed so the impacts on aquatic fauna will be insignificant or negligible.

The VECs will be improved due to the availability of groundwater in a sustainable manner. Regarding a research paper published in Civil Engineering Journal on Land Covers Change Assessment After Small Dam's Construction Based on the Satellite Data (Accepted 08 March 2019). It has been concluded that the constructions of small dams have a positive impact not only on land cover changes but also on livelihood resources directly and indirectly and reduce the wastage of water and store the water for future needs.

During the operation phase reduction in water flow could be the main cumulative impact on VECs of these two small dams in addition to other already constructed dams and planned dams. VECs regarding the Ecosystem's flow regulation ability, there is only one dam which is already constructed under SRP which shares the catchment area of Jhanjhoo nadi with the proposed Jhannjhoo Dam of SRP-AF. While the rest of the other proposed dam have their separate catchment areas. (Refer Annexure XVI). Mean Annual flow of Jhannjhoo nadi is 648 Ac.ft, while total expected recharge of proposed Jhanjhoo dam is 40 Ac.ft (6.2%) whereas and the constructed dam has total expected recharge is 492 Ac.ft (86 %). It can be seen from the Figure - 25 that catchment of proposed dams varies, as there are number of other streams also merging in the Jhanjhoo stream at downstream hence there is enough potential for lower riparian and for water harvesting. While with the context of reduction of run off to the Runn of Kutch, only 0.94 % water will be retained which is very negligible because it can also be seen from Figure -25 that there are several other streams also draining in the Runn of Kutch. The proposed eleven dams in addition to other small dams in the area will not impact adversely lower riparian, as there is enough potential to construct the other dams as well.

Previously whenever there were rainfalls, caused flash floods. People confirmed that there were high flash floods in 2019 due to very high rains, low in 2018, and partial in 2017. The floodwater flushes to low-level areas and finally entered into the stream carrier channel (Nai) and was carried to Runn of Kutch, so the soil is dried up to 5 to 6 hrs. While construction of small dams in the area will reduce the effects of the flood by a control/holding the rainwater at its upstream for 4-8 weeks depending upon soil permeability, The water available upstream of a dam becomes very much beneficial for the drinking of livestock and other domestic needs. Importantly groundwater aquifer is also recharged.

The dams (under SRP & SRP-AF) will have a synergistic impact on overall water conservation and rainwater harvesting during the operation phase. Cumulatively, due to the construction of small dams the groundwater level both in upper and lower riparian will be increased. The recharging of groundwater aquifers will also improve water quality from very poor to good. Currently, the groundwater level near all proposed dams sites ranges 40 to 180 ft (as refer Table 26). and it would be increased and available for a longer period as well. Moreover, as refer earlier “Performance Evaluation Study of Small Dams in Sindh Province-” of previously constructed small dams in Sindh Province also conclude that due to construction of small recharge dam in the area have positive impacts on groundwater recharge. For the instance in one case, the water table depth before the construction of the dam is 70 feet, which was raised after the construction of the dam 30-35 feet and Groundwater quality was poor which improved after the dam construction of the small dam. Moreover, during droughts, the water level in wells drops up to 45 feet but is available for the whole of the year, which dries up completely before the dam.

During the construction of the project social component of the VECs may have some adverse impacts due to the labor influx, transportation of material and machinery movement. The presence of outside construction workers inevitably causes some degree of social disruption with the local community because of social/cultural differences. During the operation phase, human migration influx may be expected due to the availability of water, excessive agriculture activity may also increase.

During the construction of the dams cumulatively about 250 to 300 workers will be hired by the contractor, thus their livelihood will be secured till the construction period. Good relations with the local communities will be promoted by encouraging the Contractors to provide opportunities for skilled and unskilled employees to the locals. However, the contractor will restrict his outsider staff to mix with the locals to avoid any social problems. Local vendors will be provided regular business by purchasing campsite goods and services from them. The contractor shall include information about COVID-19 and the spread of sexually transmitted diseases (HIV/AIDS) within the worker's code of conduct. Better management and administrative control as described in section 10.3 & 10.4 Environmental Code of Practices (ECoP) & Contractor’s Plans respectively, will supersede the impacts while comparing the benefits of the small dam project on the social component of VECs.

Keeping in view the terrain and topography and available facilities in the project area, there are very few chances of human migration influx (reverse migration) or enhanced agriculture activity due to the unavailability of water. According to the recent study conducted in April 2020 conducted in the project area, shows that, before the construction of small dams, the community of 53% migrated to other areas due to the unavailability of water. Out of these 37% resettled back (reverse migration) to their villages after rainwater availability but 16% did not come back and settled at other places. However, locals of 31% after the construction of small dams never migrated in drought conditions because of groundwater availability. So, the migration ratio has been decreased due to the construction of small dams in the area and the reverse migration ratio has been an increase.

VECs concerning Economic components i.e., Government and private Revenues will increase due to the development activities in the area. Construction of these small dams will invite the entrepreneurs which ultimately brings the much-needed revenue to the country‘s economy in the broader perspective. Small dams are very important for local economy because the construction of such dams enables the sustainability of livelihood for local communities related to livestock rearing & increase in agriculture yield. The dam holds rainwater at its upstream for few times depending upon soil permeability, from where livestock drinking and other domestic needs of local communities are completed. Most importantly aquifer is also recharged. Since rearing livestock is the only source of local’s livelihood and water upstream is also available for the almost whole year so livestock is increased in the sub-project areas.

Hence, in the light of the above discussion, it has been concluded that cumulative impacts will be positive because due to the construction & operation of these small dams the shortage of water for domestic and livestock use is reduced. Moreover, the Small Dams Organization of Sindh Irrigation Department conducted a study in April 2020 through consulting firm for 32 Small dams namely “Performance Evaluation Study of Small Dams in Sindh Province-” of previously constructed small dams in Sindh Province. This study also concludes that due to construction of small recharge dams in the area has positive impacts on Valued Ecosystem Components (VECs) which include the Biodiversity component, Ecological component, Social Component, Economic component.

9. GRIEVANCE REDRESS MECHANISM (GRM)

It is proposed to establish the following GRM mechanism prior to commencing project implementation activities including pre-construction activities:

- A Public Complaints Centre (PCC), which will be responsible to receive, log, and resolve complaints;

- A Grievance Redress Committee (GRC), responsible to oversee the functioning of the PCC

- A non-judicial decision-making authority e.g. Project Management Team or Secretary Irrigation Government of Sindh for resolving grievances that cannot be resolved by PCC;

- Grievance Focal Points (GFPs), which will be educated people from each community on each sub-project site. The GFPs should be community members who easily approached by the community. The GFPs will be provided training by the Environment and Social Section of the PISSC and PMT, SRP.

9.1 Public Complaints Centre (PCC)

In its capacity as the Project Implementation Body, the PMT, in consultation with the Secretary Irrigation, Government of Sindh has already established a Public Complaints Centre (PCC) in the PMT, SRP office. The PMT and the local government bodies will issues public notices to inform the public within the project area of the Grievance Redress Mechanism. The PCC's phone number, fax, address, the email address will be disseminated to the people through displays at the respective offices of the Deputy Commissioner Tharparkar.

The PCC will be staffed by a full-time officer from the PMT and will be independent of the PISSC and contractor/operator. The officer should have experience and/or training in dealing with complaints and mediation of disputes. The PCC officer will have resources and facilities to maintain a complaints database and communicate with contractor, Site Engineers, PISSC.

The PCC will be responsible to receive, log, and resolve grievances. Given that the female community members have restricted mobility outside of their villages and homes, the female PMT staff will be required to undertake visits to the local communities. The frequency of visits will depend on the nature and magnitude of activity in an area and the frequency of grievances.

9.2 Grievance Redress Committee (GRC)

The GRC will function as an independent body that will regulate the grievance redress process. It will comprise of, Environmental and Social Specialists of PMT, Senior Engineer

from PMT, Representative of DC office of Tharparkar, also senior members from civil society from sub-project areas. Decisions or findings taken in the Grievance Redress Committee would be binding upon the contractor.

9.3 Grievance Focal Points (GFPs)

The GFPs will be literate people from each community that will assist and facilitate the community members in reporting grievances resulting from project activities. The GFPs will be provided training by the PMT/PISSC in facilitating grievance redress. The GFP will be selected by the E&SS team of the contractor in consultation with the community. While selecting, preference would be given to literate person with willingness to perform the role.

Two GFPs (a female and male) will be selected for each sub-project.

9.4 Role and Responsibilities of PCC

The responsibilities of the PCC are:

- The PCC will log the complaint and date of receipt onto the complaint database and inform the PISSC and the Contractor;
- The PCC will instruct Contractors and PISSC to refer any complaints that they have received directly to the PCC. Similarly, the PCC will coordinate with local government to “capture” complaints made directly to them;
- The PCC, with the PISSC and the Contractor, will investigate the complaint to determine its validity, and to assess whether the source of the problem is due to project activities, and identify appropriate corrective measures. If corrective measures are necessary, PCC, through the PCI, will instruct the Contractor to take necessary action;
- The PCC will inform the Complainant of investigation results and the action taken;
- If the complaint is transferred from local government agencies, the PCC will submit interim report to local government agencies on status of the complaint investigation and follow-up action within the time frame assigned by the above agencies;
- The PCC will review the Contractors response on the identified mitigation measures, and the updated situation;
- The PCC will undertake additional monitoring, as necessary, to verify as well as review that any valid reason for complaint does not recur.

During the complaint investigation, the PCC should work together with the Contractor and the PISSC. If mitigation measures are identified in the investigation, the Contractor will promptly carry out the mitigation. PISSC will ensure that the measures are carried out by the Contractor.

9.5 GRM Steps and Timeframe

Procedures and timeframes for the grievance redress process are as follows:

Stage 1: In this stage services of Community Liaison Officer (CLO) of Contractor will be utilized at site to register the complaints and grievances in the community. When a grievance arises, the affected person may contact directly with the contractor/operator and the project manager to resolve the issue of concern. If the issue is successfully resolved, no further follow-up is required;

The contractor will also formally maintain a record of all complaints and issues raised, through CLO assigned for each sub-project. The contractor will also display prominent signage containing the contact details of PCC in Sindhi language.

Stage 2: If no ad hoc solution can be found at stage-1 at site level, the affected person/s will submit an oral or written complaint to the PCC by themselves or through GRM entry points (the CFP, PMT, PISSC, and Contractor/Operator). For an oral complaint, the PCC must make a written record. For each complaint, the PCC must investigate the complaint, assess its eligibility, and identify an appropriate solution. It will provide a clear response within five (5) working days to the complainant, PMT, and Contractor. The PCC will, as necessary, through PISSC; instruct the Contractor to take corrective actions. The PCC will review the Contractor's response and undertake additional monitoring. During the complaint investigation, the PCC will work in close consultation with the Contractors, and the Supervising Engineer (during construction) and with the SID (during operation). The contractors during construction and the PMT during operation should implement the redress solution and convey the outcome to the PCC within seven (7) working days;

In addition, the E&SS team of PISSC and PMT will also encourage oral and written feedback from the community during monitoring visits.

Stage 3: If no solution can be identified by the PCC or if the complainant is not satisfied with the suggested solution under Stage 2, the PCC will organize, within two (2) weeks, a multi-stakeholder meeting under the auspices of the SID, where all relevant stakeholders (i.e., the complainant, PMT, contractor/operator, relevant local government offices) will be invited. The meeting should result in a solution acceptable to all, and identify responsibilities and an action plan. The contractors during construction and the PMT during operation should implement the agreed-upon redress solution and convey the outcome to the PCC within seven (7) working days;

Stage 4: If the multi-stakeholder hearing process is not successful, the PCC will inform Project Steering Committee (PSC) or Secretary Irrigation Department Government of Sindh accordingly, and the PSC or Secretary SID will organize a special meeting to address the problem and identify a solution; and

Stage 5: If the affected people are still not satisfied with the reply in Stage 4, he or she can go through to local judicial proceedings.

9.6 Reporting

The PCC will record the complaint, investigation, and subsequent actions and results in the monthly Environmental Management and Monitoring reports. In the construction period and the initial operational period covered by loan covenants, the PMT will periodically report progress to the World Bank, and this will include reporting of complaints and their resolution. The tracking and documenting of grievance resolutions within the PCC and/or PMT will include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) dedicated staff to update the database routinely; (iii) systems with the capacity to analyse information so as to recognize grievance patterns, identify any systemic causes of grievances, promote transparency, publicize how complaints are being handled, and periodically evaluate the overall functioning of the mechanism; (iv) processes for informing stakeholders about the status of a case; and (v) procedures to retrieve data for reporting purposes, including the periodic reports to the PMT and including PCC reports into the monthly ESMP Compliance monitoring report to the World Bank.

9.7 Conclusion

The sub-projects will not harm the environment. The anticipated adverse impacts on the regional environment can be avoided or minimized by taking necessary mitigation measures and properly implementing environmental and social monitoring plan. There are number of positive effects of the proposed sub-project which in general will improve the environment and social aspects of the sub-project area: These may include the following.

- Increased water supply through wells due to the recharging of the aquifer
- Good quality water for drinking thereby eliminating water-borne diseases and good health.
- Extra supplies to grow more food crops like bajra, moong dal, and vegetables.
- More anticipated income means a rise in the standard of living.

10. ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

10.1 Objectives of ESMMP

This chapter provides an overall approach for managing and monitoring environment and social issues and describes the institutional framework and resource allocations required to implement the ESMMP for the sub project. The environmental and social management plan and its institutional requirements have been given in tabular form in Table - 37.

The ESMMP will help the Proponent to address the adverse environmental impact of the project, enhance project benefits and introduce standards of good environmental practice. The primary objectives of the plan are to:

- Define the responsibilities of project proponents, contractors and other role players and effectively communicate environmental issues among them.
- Facilitate the implementation of the mitigation measures identified in Chapter - 7 by providing the instructions on how to handle the issues and providing an implementation schedule.
- Define a monitoring mechanism and identify monitoring parameters to ensure that all mitigation measures are completely and effectively implemented.
- Identify training requirements at various levels and provide a plan for implementation.
- Identify the resources required to implement the ESMMP and outline corresponding financing arrangements.

10.2 Institutional Arrangements for Implementation of ESMMP

10.2.1 Project Management Responsibilities

Implementation of the ESMMP will be a contractual obligation between the Contractor and Project Management Team (PMT), SRP. The Contractor shall engage full time technical staff capable of carrying out the monitoring activities as proposed in the ESMMP as contractual obligations under the contract agreement.

Project Implementation Support and Supervision Consultants (PISSC) in coordination with Environmental and Social Management Unit (ESMU)-PMT will carry out monitoring activities related to the project during the construction phase by using check lists and notify the Contractor of any violations of the ESMMP, check the progress reports, advise the client and

contractor regarding any violations which require further action, and maintain a record of events and surveys for reference.

In addition, ESMEC as independent consultants will regularly monitor the environmental, ecological and social aspects of ESMMP implementation including those associated with the Contractor's activities as and when required.

The overall responsibility for SRP project as well as Environmental and Social Management and Monitoring will rest with the PMT, Irrigation Department, Government of Sindh to be headed by a Project Director. The PD is supported by Additional Director Dams, Additional Director Bunds/Flood Levees, Additional Director Coordination and Technical Assistant. In addition, the PMT will be supported during ESMMP implementation by ESMU to be established within PMT and PISSC respectively.

The specific responsibilities of the institutions involved in the ESMMP implementation is shown in the Figure – 26 and described below.

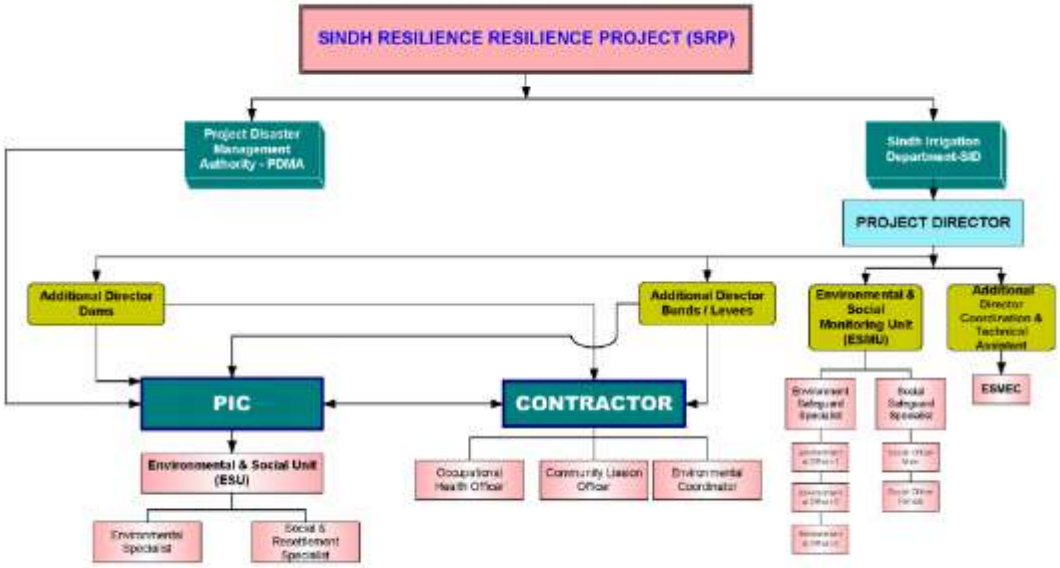


Figure 26: Organizational Chart of Sindh Resilience Project (SRP)

10.2.2 Project management Team (PMT)

The overall responsibility for the supervision of ESMMP will rest with the PMT under Sind Irrigation Department and PDMA that will act as apex body of the project to take care of Social/Gender, Ecological and Environmental issues and to take policy decisions at project level. An Environmental and Social Management Unit (ESMU) has been established within PMT under the supervision of Additional Director Coordination and Technical Assistant. Key

positions within the ESMU include: Environment Specialist; Ecological Expert Social/Resettlement Specialist.

The ESMU shall be responsible for supervision of implementing and monitoring the ESMMP. The Staff of ESMU shall be answerable to the Project Director (PD) SRP. The ESMU shall be responsible for the monitoring defined in the ESMMP as part of their overall monitoring of the social and environmental management.

10.2.3 Project Implementation Support and Supervision Consultants (PISSC)

The Project Implementation Support and Supervision Consultant (PISSC) have been engaged by the project proponent and is responsible for day to day monitoring of the ESMMP on behalf of the Client/ PMT during execution of the Civil Works for sub-projects under the SRP and shall submit periodic reports to the PMT regarding the ESMMP and implementation status. The SMPs prepared or to be prepared shall be part of the Contract documents. In general the PISSC has the following responsibilities pertaining to the environmental aspects of the project:

- Prepare the required documents, review and update the available documents relevant to the sub project (including ESIA, ESMPs and RAP) and those to be prepared by the Contractor.

- Monitor the implementation of ESMPs and RAP on a regular basis during execution of civil works by the Contractor. An Environmental and Social Unit (ESU) within PISSC has been established which include the following key positions:

    a) Environmental Specialist
    b) Assistant Environmental Specialist
    c) Social and Resettlement Specialist
    d) Assistant Sociologist (s)

The ESU of PISSC shall be responsible for monitoring the contractor's compliance with the ESMMPs. The role of the ESU-PISSC shall be day to day monitoring of the supervision of the ESMMP with the assistance of social and environmental staff of the Contractor and reporting any non-compliances to the PISSC Chief Resident Engineer, Resident Engineers as well as PMT.

10.2.4 Environmental/Social Monitoring and Evaluation (ESMEC) Consultant

The ESMEC is an independent body responsible for regular environmental and social monitoring for the SRP Project on behalf of PMT. The ESMEC have environmental and social experts and shall carryout intermittent third party monitoring of the project.

10.2.5 Contractor

The Contractor will be responsible for the on-field implementation of the ESMP as well as maintaining responsibility for environmental protection liabilities under Sindh Environmental Protection Act (SEPA), 2014, World Bank safeguard policies, ESMF, sub-project specific ESMPs and other applicable national as well as provincial policies and regulations. The Contractor will also be responsible for training his crews on all aspects and implementation of the ESMP. The bid should include an environmental and social mitigation budget as part of the engineering costs of the respective works. The key positions to be filled within the contractor's staff for implementation of the ESMP include:

Environmental Coordinator(s); Occupational Health and Safety (OHS) Officers; and Community Liaison Officers.

10.3 Environmental Code of Practices (ECOPs)

The objective of preparation of the Environmental Code of Practices (ECOPs) is to address less significant environmental impacts and all general construction related impacts for the proposed SRP sub project implementation. The ECOPs will provide guidelines for best operating practices and environmental management guidelines to be followed by the contractors for sustainable management of all environmental issues. This ECOPs have been available on web for guideline in the general conditions of all the contracts to be carried out under the SRP sub project.

10.4 Contractor's Plans

This Environmental and Social Management Plan (ESMP) has been prepared prior to Contract award, and therefore, certain mitigations which are dependent upon the methodology chosen by any Contractor to deliver the project, could not be specified in it. For example, haulage routes are dependent upon the exact camp site locations chosen by the Contractor. Therefore, it is required that the Contractor shall prepare plans within 30 days of the signing of the contract or before mobilization and implement the plans described below with the help of mitigation measures discussed in Section 7. Once approved by the Engineer and Environment Specialist of PISSC, these documents will become part of the ESMP (Site Specific Environmental management Plan -SSEMP) for the Contract.

10.4.1 Corona Virus Management Plan (COVID-19)

The contractor shall provide the details of prevention measures, arrangements planned for the Management of COVID. The Plan shall include the details of the designated quarantine area, disinfection facilities for Vehicles, and inventory arriving on site. The plan shall also include

necessary supplies, such as face mask, soap, hand sanitizers, temperature monitoring infrared guns, etc. Disposal of COVID related waste plan shall also be prepared.

10.4.2 Biodiversity Management Plan

The contractor shall prepared the comprehensive biodiversity management plan and get the approval from PISSC before contractor mobilization. This plan must include the role and responsibilities (in the form of TOR) of wildlife /Ecologist expert who will be monitored the all construction related activities as described in ESMP.BMP will be prepared by the Contractor on the basis of ECPs 8, 9 and 10 and mitigation measures proposed to address impacts.

10.4.3 Pollution (air, land and water) Control Plan

The Contractor shall provide details of the principal pollution control facilities proposed and of contingency plans in the event of failure of these facilities. The plan shall include the details of the designated and licensed tip, oil treatment facilities and hazardous waste disposal sites which shall be used to dispose of waste. Plan shall also include Environmental effects monitoring.

10.4.4 Waste Management Plan

The Contractor shall include details of the procedures for the collection and disposal of wastes. The Plan shall deal with each waste stream separately.WMP will be prepared and implemented by the Contractor on the basis of ECPs 1, 2, 5 & 10 and WBG EHS Guidelines (2007), as well as the mitigation plans given in the report. The Plan will include the camp layout, details of various facilities including supplies, storage, and disposal.

10.4.5 Traffic Management Plan

The basis of the Contractor's Traffic Management Plan and further information is to be provided. The Contractor is required to provide further details once camp/work site locations and material sources are finalized. The Traffic Management Plan must include details of the proposed access routes to the project area as well as haulage and access routes throughout the project area (including access to and from borrow pits).

10.4.6 Plan for Handling of Hazardous Materials

The Contractor shall identify control measures to ensure no environmental or health impacts from the handling of hazardous materials and the collection and safe disposal of hazardous materials (this may be including within the Pollution Control Plan).

10.4.7 Occupational Health and Safety

Upon mobilisation, and within 15 days of commencement, the Contractor shall prepare an Occupational Health and Safety Plan in accordance with Sindh Occupational Safety and Health act 2017, which shall be relevant to his chosen methodology. This plan shall detail the following:

- Health and safety management structure, responsibilities, supervision and reporting scheme
- Health and safety goals for the project
- Identification of potential hazards (health risks, safety risks)
- Proposed measures to reduce the risk of identified hazards
- Arrangements to implement such measures
- A system for reporting and investigating accidents, incidents and near misses
- A plan for emergency transfer of staff or public from site to medical facilities
- Fire and emergency procedures
- Site security.
- Management and Monitoring of COVID-19

10.4.8 Environmental and Social Awareness Training Plan

This shall include details of the Contractor's environmental and social awareness training program proposed for the workforce. Details are given in Table – 35 given below.

Table 35: Environmental and Social Awareness Training Plan

Areas of Training	Key Aspects to be Covered	Target Group	Frequency	Budget.
Environment & Social	**a.** Environmental and social awareness; **b.** Key environmental and social issues associated with the project and subprojects ESIAs and ESMPs findings; **c.** Subproject monitoring and reporting;	PMU, PIC and Contractor staff as well as relevant communities.	Before project/physical works commencement, during construction and after construction.	Total nine types of trainings for 11 proposed dams are to be conducted throughout the life of sub projects. Training

	d. Occupational Health and Safety Issues associated with Construction. **e.** Grievance Redress Mechanism implementation **f.** Gender Based Violence (GBV) **g.** Child Labor **h.** COVID -19 Management and Monitoring **i.** Safety measure for COVID-19			will cost about 1,977,000 rupees.

10.4.9 Emergency Response Plan

The contractor will prepare an emergency plan to address emergencies/events such as fire, floods, earthquake, accidents, and death/injury. The Plan will include the following details:

- Contacting the relevant agency (e.g., Fire Brigade)
- Procedure for shutdown of site;
- Indicators on site that shall prompt the shutdown of areas of work (linked to natural events)
- Emergency evacuation procedure of staff and members of the public within range of likely impact.)

10.4.10 Tree Plantation and Maintenance Plan

The Contractor is required to prepare an inventory of the trees to be cut/uprooted before the commencement of the physical works in presence of PISSC and PMT staff, submit a detailed tree plantation plan, defining the proposed plantation methodology, species and plantation locations. The plantation location shall be approved by Sindh Forest Department, the PISSC Engineer and PMT approval. All trees to be planted shall be of native species as they have more chances of survival and plantation of invasive species shall be prohibited. The Contractor shall be responsible for the aftercare of the saplings/plantation for one year.

10.4.11 Emergency Preparedness Plan in Case of Dam Break

A consolidated emergency preparedness plan will address emergencies in case of Dam break; this plan will be prepared by the supervisory consultant for all dams covered under SRP-AF by (Supervision & Design Consultants) before the completion of all dams and the same will be submitted to the World Bank.

10.5 Mitigation and Monitoring

Mitigation measures for reduction of environmental degradation and social impacts especially relating to air quality, soil contamination, pollution of water resources, loss of habitat and disruption to wildlife will need to be implemented and monitored. Monitoring tasks will vary over the construction and operation stages of the sub-projects. Physical, biological and sociocultural parameters will be measured/monitored to determine compliance with national and international standards and compliance with the ESMP itself. Monitoring during the construction phase will largely consist of compliance with mitigations identified in Section 7. Table 39 presents the mitigation and monitoring plan.

10.6 Compliance and Effects Monitoring

PISSC shall carry out monitoring within the subproject area using the monitoring checklists to be prepared based on this mitigation and monitoring plan. To aid the monitoring process, the Contractor will complete the following:

- Submit the plans detailed earlier in Section 8.
- Train construction staff for the implementation of the ESMP and safety measures.
- Submit various progress reports to the Environmental and Social Specialists of PISSC and ESMEC.
- Explain the implementation of various environmental aspects to visiting national and international agencies and representatives of the donor.
- Receive monitoring reports/notes issued by ESMU and PISSC and take action to mitigate various violations to ESMP.
- Regularly submit Reports to PISSC Engineer and Environment Specialists about the compliance to the ESMP and various issues related to the HSE including but not limited to the following:
- OHS Measures adopted (OHS statistics)
- Fuel and hazardous material consumption
- Workforce statistics (employment/deployment etc.)
- Compliance monitoring to check whether the actions proposed in the ESMMP is being carried out.

- Effects monitoring to record the impacts of mitigation measures adopted on the biophysical and social environment; as applicable, these effects are repeatedly measured.

Compliance monitoring will be completed by PISSC and ESMU-PMT with independent monitoring by ESMEC. The effects monitoring shall be the responsibility of PISSC. Examples of compliance and effects monitoring parameters are included in Box below. Both approaches will be conducted using the monitoring parameters given in Table 40 by visual observation, photographic documentation, and measurement where necessary. A record of events and surveys will be maintained. Compliance monitoring will also be facilitated using checklists included to be prepared by PISSC and ESMU of PMT during the project implementation.

Box 10.1

(i) Compliance Monitoring:

- Frequency of anti-dust water sprays during construction period;
- Installation of signage regarding community health and safety
- Safety at workplaces and working hours during construction;
- Incidence of liquid/solid waste in the vicinity of work camps (type and amount of waste, amount, interference with local residents, fauna, flora and crops);
- Plantation of saplings of new trees against trees cut
- Survival rate of saplings of new trees
- Arrangements made at construction sites for protection of floral and faunal resources
- Assurance of installation of signage regarding community health and safety

(ii) Environmental Effects Monitoring

- Ambient air quality (Particulate matter) during construction phase;
- Surface water quality during construction phase especially at diversion sites
- Ground water quality at camp sites;
- Ground water table at construction sites;
- Number of patients suffering from malaria, cholera, diarrhoea, respiratory ailments during construction phase
- Noise levels (in dBA), monitored at fixed locations and planed schedule during construction
- Extent and degree of functionality of diversion channels to ensure un-interrupted water supply;
- (iii) Social Effects Monitoring
- Number of local people recruited on project works.
- Incidence of child labour and disproportionate wages
- Conflict at community level
- Chance find archaeological site
- Grievance redressal mechanism is in place
- Health screening of labour at site

10.7 Environmental Non-compliances and Corrective Measures

The Contractor will be notified of any violations of the ESMMP, as well as any corrective actions required. Outlined below are some steps, relating to the increasing severity of environmental problems, which will be implemented. The principle is to keep as many issues within the first few steps as possible.

Step 1. PISSC discusses the problem with PMT and Contractor to work out mitigations together and record the facts and the decision implemented.

Step 2. A more serious infringement is observed and PISSC notifies the Contractor of the issues in writing, with a deadline by which the problem must be rectified. All costs will be borne by the Contractor.

Step 3. PISSC/PMT shall order the Contractor to suspend part, or all, of the works. The suspension will be enforced until the offending parties, procedure, or equipment is corrected and/or remedial measures put in place if required. No extension of time will be granted for such delays and all costs will be borne by the Contractor.

Step 4. Breach of contract - One of the possible consequences of this is the removal of a Contractor and/or equipment and/or the termination of the contract. Such measures will not replace any legal proceedings that PMT may institute against the Contractor.

10.8 Communication Reporting and Documentation

The following environmental meetings are proposed:

- Primary meetings between ESMU-PMT, PISSC, and Contractor for setting out the format for the regular meetings shall be held before the commencement of the project.

- Scheduled Environmental and Social Progress Review Meeting (ESRPM) meetings between ESMU-PMT, PISSC, and Contractor shall be done every month.

The purpose of the meetings is to discuss the conduct of the operation, non–compliances noted by the PISSC and ESMU environmental and social teams and measures recommended for their remedy.

The Contractor and PISSC's environmental and social teams will produce monthly, quarterly and works completion reports of the sub-projects based on the social and environmental issues. The distribution of the reports shall be to PMT, ESMEC, and World Bank.

A photographic record of the project area shall be kept. Photographs will be taken at key locations using a digital camera of the project area in a walkthrough survey by contractor, PISSC, and ESMU-PMT. The following data shall be recorded for each photograph:

- Shot number
- All the photographs will be referenced with GPS Coordinates
- Title of photograph
- Date and Time, and
- Photographic features.

The photographic record shall be incorporated into the monthly reports. Completed monitoring. Checklists to be prepared separately during the implementation of the project by PISSC, ESMU of PMT, and ESMEC shall be appended to the monthly reports.

Complaints Register. The Contractor will maintain a complaint register at the campsite and workplaces to document all complaints received from the local communities. The register will also record the measures taken to mitigate the reported concerns. The final report will be communicated to the ESMU of PMT. All complaints/issues of the community will be reported in the monthly progress report of the following month along with the status of the last month's complaints and will be reviewed by PISSC, ESMEC, and ESMU of PMT.

Moreover, telephone numbers and addresses of all concerned tiers within the GRM would be displayed in Sindhi and Urdu at all sites, and the same would also be distributed in community training/meetings.

Change Record Register. There are two scenarios in which a review of this ESMP will be triggered:

- A change to the designs which deviate from the parameters which are safeguarded in this ESMMP.

- A discovery in the baseline socio-environmental conditions which is not recognized or covered by this ESMMP.

In the event of either scenario, the ESMMP shall be updated and reissued accordingly. The design change record shall be maintained by the Contractor and PISSC to document any change in the project design/operation. The ESMU and ESMEC would supervise the number of design change applications and suggestions received from the local people and its implementation by PISSC and Contractor.

10.9 Environmental and Social Management and Monitoring Cost

It is estimated that 86 trees will be felled for the construction of the proposed dams. The replanting of 5 times trees to this number would cost Rs 430,000 rupees @ the rate of Rs. 1000 per tree. Adding the cost in budget for the implementation of the ESMP has been allocated. Details are given in Table 37 below. The cost of Rs. 216,132,190/- budget for the implementation of the ESMMP has been allocated. Details are given in Table – 36 below.

Table 36: Cost of Environmental / Social Management and Monitoring

Items	Unit Cost	No of Units	Estimated
A. Bhata Siro			
Training	3000	56	168,000
Generators & Construction Machinery Stack +Noise Monitoring (for 12 months)	7000	25	2,100,000
Drinking-Water Quality Monitoring (During Cons) (per month)	10000	12	120,000
Workers Communicable Disease Screening Test (HIV, HB, HC)	7000	56	392,000
COVID-19 Test for staff and worker for two rounds	6000	112	672,000
Personal Protective Equipment	3500	56	196,000
Fire Fighting Equipment purchase and refilling	3000	25	75,000
Health, Hygiene and COVID-19 Management and Monitoring as per SOPs	Lump sum	--	150,000
Ambient Air Monitoring(Pre-Cons, During Cons,) at one construction location	27000	12	324,000
Ambient Noise Monitoring (Pre-Cons, During Cons:) at one construction location.	700	12	8,400
Environmental, Social and OHS Officer Salaries (One Lac for each person) three different persons will be deputed on site)	300000	12	3,600,000
General Community support needs (if any)	Lump sum	--	10,000,000
		Subtotal	**17,805,400**
		Contingency Cost 10%	**1,780,540**
		Total	**19,585,940**
B. Sohrio Wah			
Training	3000	58	174,000
Generators & Construction Machinery Stack +Noise Monitoring (for 12 months)	7000	22	1,848,000
Drinking-Water Quality Monitoring (During Cons) (per month)	10000	12	120,000
Workers Communicable Disease Screening Test (HIV, HB, HC)	7000	58	406,000
COVID-19 Test for staff and worker for two rounds	6000	116	696,000
Personal Protective Equipment	3500	58	203,000
Fire Fighting Equipment purchase and refilling	3000	22	66,000
Health, Hygiene and COVID-19 Management and Monitoring as per SOPs	Lump sum	--	150,000
Ambient Air Monitoring(Pre-Cons, During Cons,) at one construction location	27000	12	324,000
Ambient Noise Monitoring (Pre-Cons, During Cons:) at one construction location.	700	12	8,400

Environmental, Social and OHS Officer Salaries (One Lac for each person) three different persons will be deputed on site)	300000	12	3,600,000
General Community support needs (if any)	Lump sum	--	10,000,000
		Subtotal	**17,595,400**
		Contingency Cost 10%	**1,759,540**
		Total	**19,354,940**
C. Namaro			
Training	3000	61	183,000
Generators & Construction Machinery Stack +Noise Monitoring (for 12 months)	7000	23	1,932,000
Drinking-Water Quality Monitoring (During Cons) (per month)	10000	12	120,000
Workers Communicable Disease Screening Test (HIV, HB, HC)	7000	61	427,000
COVID-19 Test for staff and worker for two rounds	6000	122	732,000
Personal Protective Equipment	3500	61	213,500
Fire Fighting Equipment purchase and refilling	3000	23	69,000
Health, Hygiene and COVID-19 Management and Monitoring as per SOPs	Lump sum	--	150,000
Ambient Air Monitoring(Pre-Cons, During Cons,) at one construction location	27000	12	324,000
Ambient Noise Monitoring (Pre-Cons, During Cons:) at one construction location.	700	12	8,400
Environmental, Social and OHS Officer Salaries (One Lac for each person) three different persons will be deputed on site)	300000	12	3,600,000
General Community support needs (if any)	Lump sum	--	10,000,000
		Subtotal	**17,758,900**
		Contingency Cost 10%	**1,775,890**
		Total	**19,534,790**
D. Viakasor			
Training	3000	58	174,000
Generators & Construction Machinery Stack +Noise Monitoring (for 12 months)	7000	26	2,184,000
Drinking-Water Quality Monitoring (During Cons) (per month)	10000	12	120,000
Workers Communicable Disease Screening Test (HIV, HB, HC)	7000	58	406,000
COVID-19 Test for staff and worker for two rounds	6000	116	696,000
Personal Protective Equipment	3500	61	213,500
Fire Fighting Equipment purchase and refilling	3000	26	78,000
Health, Hygiene and COVID-19 Management and Monitoring as per SOPs	Lump sum	--	150,000
Ambient Air Monitoring(Pre-Cons, During Cons,) at one construction location	27000	12	324,000

Ambient Noise Monitoring (Pre-Cons, During Cons:) at one construction location.	700	12	8,400
Environmental, Social and OHS Officer Salaries (One Lac for each person) three different persons will be deputed on site)	300000	12	3,600,000
General Community support needs (if any)	Lump sum	--	10,000,000
		Subtotal	**17,953,900**
		Contingency Cost 10%	**1,795,390**
		Total	**19,749,290**
E. Gordhoro-2			
Training	3000	61	183,000
Generators & Construction Machinery Stack +Noise Monitoring (for 12 months)	7000	23	1,932,000
Drinking-Water Quality Monitoring (During Cons) (per month)	10000	12	120,000
Workers Communicable Disease Screening Test (HIV, HB, HC)	7000	61	427,000
COVID-19 Test for staff and worker for two rounds	6000	122	732,000
Personal Protective Equipment	3500	61	213,500
Fire Fighting Equipment purchase and refilling	3000	23	69,000
Health, Hygiene and COVID-19 Management and Monitoring as per SOPs	Lump sum	--	150,000
Ambient Air Monitoring(Pre-Cons, During Cons,) at one construction location	27000	12	324,000
Ambient Noise Monitoring (Pre-Cons, During Cons:) at one construction location.	700	12	8,400
Environmental, Social and OHS Officer Salaries (One Lac for each person) three different persons will be deputed on site)	300000	12	3,600,000
General Community support needs (if any)	Lump sum	--	10,000,000
		Subtotal	**17,758,900**
		Contingency Cost 10%	**1,775,890**
		Total	**19,534,790**
F. Sudran			
Training	3000	56	168,000
Generators & Construction Machinery Stack +Noise Monitoring (for 12 months)	7000	25	2,100,000
Drinking-Water Quality Monitoring (During Cons) (per month)	10000	12	120,000
Workers Communicable Disease Screening Test (HIV, HB, HC)	7000	56	392,000
COVID-19 Test for staff and worker for two rounds	6000	112	672,000
Personal Protective Equipment	3500	56	196,000
Fire Fighting Equipment purchase and refilling	3000	25	75,000

Health, Hygiene and COVID-19 Management and Monitoring as per SOPs	Lump sum	--	150,000
Ambient Air Monitoring(Pre-Cons, During Cons,) at one construction location	27000	12	324,000
Ambient Noise Monitoring (Pre-Cons, During Cons:) at one construction location.	700	12	8,400
Environmental, Social and OHS Officer Salaries (One Lac for each person) three different persons will be deputed on site)	300000	12	3,600,000
General Community support needs (if any)	Lump sum	--	10,000,000
		Subtotal	**17,805,400**
		Contingency Cost 10%	**1,780,540**
		Total	**19,585,940**
G. Adhigam - Syed Alam Shah			
Training	3000	62	186,000
Generators & Construction Machinery Stack +Noise Monitoring (for 12 months)	7000	26	2,184,000
Drinking-Water Quality Monitoring (During Cons) (per month)	10000	12	120,000
Workers Communicable Disease Screening Test (HIV, HB, HC)	7000	62	434,000
COVID-19 Test for staff and worker for two rounds	6000	124	744,000
Personal Protective Equipment	3500	62	217,000
Fire Fighting Equipment purchase and refilling	3000	26	78,000
Health, Hygiene and COVID-19 Management and Monitoring as per SOPs	Lump sum	--	150,000
Ambient Air Monitoring(Pre-Cons, During Cons,) at one construction location	27000	12	324,000
Ambient Noise Monitoring (Pre-Cons, During Cons :) at one construction location.	700	12	8,400
Environmental, Social and OHS Officer Salaries (One Lac for each person) three different persons will be deputed on site)	300000	12	3,600,000
General Community support needs (if any)	Lump sum	--	10,000,000
		Subtotal	**18,045,400**
		Contingency Cost 10%	**1,804,540**
		Total	**19,849,940**
H. Layari - 1			
Training	3000	62	186,000
Generators & Construction Machinery Stack +Noise Monitoring (for 12 months)	7000	26	2,184,000
Drinking-Water Quality Monitoring (During Cons) (per month)	10000	12	120,000
Workers Communicable Disease Screening Test (HIV, HB, HC)	7000	62	434,000
COVID-19 Test for staff and worker for two rounds	6000	124	744,000
Personal Protective Equipment	3500	62	217,000

Fire Fighting Equipment purchase and refilling	3000	26	78,000
Health, Hygiene and COVID-19 Management and Monitoring as per SOPs	Lump sum	--	150,000
Ambient Air Monitoring(Pre-Cons, During Cons,) at one construction location	27000	12	324,000
Ambient Noise Monitoring (Pre-Cons, During Cons:) at one construction location.	700	12	8,400
Environmental, Social and OHS Officer Salaries (One Lac for each person) three different persons will be deputed on site)	300000	12	3,600,000
General Community support needs (if any)	Lump sum	--	10,000,000
		Subtotal	**18,045,400**
		Contingency Cost 10%	**1,804,540**
		Total	**19,849,940**
I. Jhanjhoo			
Training	3000	62	186,000
Generators & Construction Machinery Stack +Noise Monitoring (for 12 months)	7000	22	1,848,000
Drinking-Water Quality Monitoring (During Cons) (per month)	10000	12	120,000
Workers Communicable Disease Screening Test (HIV, HB, HC)	7000	62	434,000
COVID-19 Test for staff and worker for two rounds	6000	124	744,000
Personal Protective Equipment	3500	62	217,000
Fire Fighting Equipment purchase and refilling	3000	22	66,000
Health, Hygiene and COVID-19 Management and Monitoring as per SOPs	Lump sum	--	150,000
Ambient Air Monitoring(Pre-Cons, During Cons,) at one construction location	27000	12	324,000
Ambient Noise Monitoring (Pre-Cons, During Cons:) at one construction location.	700	12	8,400
Environmental, Social and OHS Officer Salaries (One Lac for each person) three different persons will be deputed on site)	300000	12	3,600,000
General Community support needs (if any)	Lump sum	--	10,000,000
		Subtotal	**17,697,400**
		Contingency Cost 10%	**1,769,740**
		Total	**19,467,140**
J. Pathar			
Training	3000	61	183,000
Generators & Construction Machinery Stack +Noise Monitoring (for 12 months)	7000	25	2,100,000
Drinking-Water Quality Monitoring (During Cons) (per month)	10000	12	120,000
Workers Communicable Disease Screening Test (HIV, HB, HC)	7000	61	427,000

COVID-19 Test for staff and worker for two rounds	6000	122	732,000
Personal Protective Equipment	3500	61	213,500
Fire Fighting Equipment purchase and refilling	3000	25	75,000
Health, Hygiene and COVID-19 Management and Monitoring as per SOPs	Lump sum	--	150,000
Ambient Air Monitoring(Pre-Cons, During Cons,) at one construction location	27000	12	324,000
Ambient Noise Monitoring (Pre-Cons, During Cons:) at one construction location.	700	12	8,400
Environmental, Social and OHS Officer Salaries (One Lac for each person) three different persons will be deputed on site)	300000	12	3,600,000
General Community support needs (if any)	Lump sum	--	10,000,000
		Subtotal	**17,932,900**
		Contingency Cost 10%	**1,793,290**
		Total	**19,726,190**
K. Targam Bhodesar			
Training	3000	62	186,000
Generators & Construction Machinery Stack +Noise Monitoring (for 12 months)	7000	22	1,848,000
Drinking-Water Quality Monitoring (During Cons) (per month)	10000	12	120,000
Workers Communicable Disease Screening Test (HIV, HB, HC)	7000	62	434,000
COVID-19 Test for staff and worker for two rounds	6000	124	744,000
Personal Protective Equipment	3500	61	213,500
Fire Fighting Equipment purchase and refilling	3000	22	66,000
Health, Hygiene and COVID-19 Management and Monitoring as per SOPs	Lump sum	--	150,000
Ambient Air Monitoring(Pre-Cons, During Cons,) at one construction location	27000	12	324,000
Ambient Noise Monitoring (Pre-Cons, During Cons:) at one construction location.	700	12	8,400
Environmental, Social and OHS Officer Salaries (One Lac for each person) three different persons will be deputed on site)	300000	12	3,600,000
General Community support needs (if any)	Lump sum	--	10,000,000
		Subtotal	**17,693,900**
		Contingency Cost 10%	**1,769,390**
		Total	**19,463,290**
		TOTAL (A+B+C+D+E+F+G+H+I+J+K)	**215,702,190**
		Compensatory tree Plantation	**430,000**
		GRAND TOTAL COST	**216,132,190**

Table 37: Environmental, Social and COVID Management and Monitoring Plan

Activity	Environmental and Social Impacts	Mitigation Measures	Monitoring Indicators	Frequency	Responsibility
Design and Pre- construction Phase					
Site Selection	No Impacts has been envisaged during site selection which require mitigation measures	Not required	Nil	Nil	Nil
Construction Phase					
Establishment of camp and machinery/equipment/ stone stacking yard/workshop etc.	Conflict due to use of privately owned agriculture land for camp construction	Establishment of camp on designated sites or at alternative suitable site within state owned land/ Irrigation Department. Community consultations will be carried out and liaison will be maintained Approval of camp site from the Engineer will be obtained.	Approval obtained from the Engineer; Photographic record maintained; Camp established on designated government land.	At time of camp establishment	Execution by contractor Monitoring by PISSC/PMT
Social conflicts due to influx of external workforce	Establishment of camp on designated sites or at alternative suitable site within Right of Way of the bund belong to irrigation department. Contractor to obtain approval from the Engineer.	Camp shall be established at least 500m away from the nearest community; Local hired workforce; Any complaint from the local community.		Fortnightly	Execution by contractor Monitoring by PISSC/PMT
	Child labor	Hiring of work force from local communities; Awareness raising of residents for safety protection. Awareness raising of labor to ensure respect for local customs. No child labor will be used.	Presence of National Identity card or relevant document.		
	Conflicts arising due to mixing of local and migratory job seekers.	Preference to provide jobs to local job seekers; Motivation to the workers for a good workmanship.	Jobs will be given to locals; Any complaint will be registered in complaint box.	Fortnightly	Monitoring by PISSC/PMT

Activity	Environmental and Social Impacts	Mitigation Measures	Monitoring Indicators	Frequency	Responsibility
Workers safety and hygienic conditions	Health risks due to unsafe and unhygienic living environment	Preparation and implementation of OHS Plan. Safety measures taken by the contractor such as installation of firefighting equipment, safe storage of hazardous material, fencing, provision of first aid facilities etc.; Contingency measures in case of accidents; Obligatory insurance of contractor's staff and laborers against accidents; Provision of adequate sanitation, washing, lighting, cooking and dormitory facilities. OHS trainings to construction and camp staff.	Approved OHS Plan. Evidence of OHS trainings conducted Accident/Incident reported.	Fortnightly	Execution by contractor Monitoring by PISSC/PMT
Camp site security	Security hazards. Security related conflicts with local community.	Proper fencing of the camp site; Deployment of guards for security; Friendly relations with the local community.	Any security issue emerged.	Monthly	Execution by contractor Monitoring by PISSC/PMT
Parking/repair of machinery and equipment	Soil and water contamination due to spillage of liquid wastes (Lubricants, fuel, chemicals from the machinery yard).	Proper maintenance of machinery and equipment; Ensuring proper storage and disposal of used oil etc.; Ensuring good housekeeping practices at workshop areas; Avoiding waste oil spill into soil and adjoining area; Appropriate arrangements such as usage of concrete base drip pans to avoid spills during fueling/oil change	Any spill observed; Availability of sealed containers for used oils and lubricants;	Fortnightly	Execution by contractor Monitoring by CSC/ PIU/SEMU
Operation of diesel operated generators	Deterioration of air quality; Noise exceeding 80 dB is harmful for receptors.	Proper tuning and maintenance of generators.	Low smoke emissions; Noise levels within permissible limits (80 dB at day time and 65dB at night time).	Fortnightly	Execution by contractor Monitoring by PISSC/PMT
Use of water for construction and consumption	Conflict with local water demand.	The contractor to make his own arrangements for water required for construction ensuring that water availability and supply to nearby communities remain unaffected.	Any conflict on the water availability.	Fortnightly	Execution by contractor Monitoring by PISSC/PMT
Water supply to labour camp	Water related health risks (Gastroenteritis, Diarrhea etc.)	Provision of safe drinking water supply at the camp as well as at working places by the contractor. Ensuring water quality as per SEQS from a SEPA certified laboratory.	Any water borne disease observed; Water quality analysis reports.	Quarterly	Execution by contractor Monitoring by PISSC/PMT
Sanitation and wastewater disposal	Soil and water contamination	No disposal of sewage into adjoining area; Construction of sewage treatment arrangement such as lined septic tank and collection chamber/ soaking pit;	Inspection to ensure that sewage system is actually operating; Photographic record;	Monthly	Execution by contractor Monitoring by PISSC/PMT

Activity	Environmental and Social Impacts	Mitigation Measures	Monitoring Indicators	Frequency	Responsibility
Solid waste generation	Land pollution	Ensure proper collection and disposal of waste generated from camp at designated disposal pit (away from the camp site) approved by the Engineer; Prohibition on burning of waste; Good housekeeping practices to minimize Waste generation.	Covered disposal containers placed at camp; Designated disposal pit available; Visual inspections.	Fortnightly	Execution by Contractor Monitoring by PISSC/PMT
Storage, handling, and transport of hazardous materials	Work safety and human health risks	Provision of double containment for storage of hazardous material (if any).	Record of harmful incident occurred.	Fortnightly	Execution by contractor Monitoring by PISSC/PMT
Restoration of camp area	Low aesthetic value if campsite is not restored to its original landscape	Remove all types of waste, debris, and discarded construction materials and machinery from the camp site and other site facilities.	Camp area restored. Photographic record;	At time of demobilization of the contractor	Execution by Contractor Monitoring by PISSC/PMT
Work Places					
Manpower at work	Occupational Health and Safety (OHS) issues	During activity of steel formation, concreting work, entry of unauthorized persons will be restricted. Without PPEs no any person will be allowed to enter in work area. Job specific PPEs will be provided. Prior to activity TBTs will be provided. Training on the benefits of use of PPEs, and work at height will be provided on periodically basis. Housekeeping will be maintained on site and in Camp areas to avoid any trip hazard. Provision of first aid facilities and standby emergency vehicle (ambulance). Occupational Health and Safety officers will be deputed on site to supervise the OHH related issues. Orientation of project will be provided to all construction workers to increase their understanding and sensitivity to the challenges of the special environment in which they will be working	Approved OHS Plan. Evidence of OHS trainings conducted. PPE provided and used; First aid facilities provided; Record of injuries/ illness and near misses.	Preparation at the start of execution of civil works and monitoring of its implementation on daily basis.	Execution by contractor Monitoring by PISSC/PMT
	Workers code of conduct.	The contractor will prepare workers code of conduct plans and Camp layout plan and get it approved from the Resident Engineer and PMT for implementation at site. Especially working near Runn of Kutch.	The approved code of conduct is implemented.	During the life of contract.	
	Child Labor	The contractor should maintain the labor registry for workers at site, and age verification should be conducted	Labor register is made available at site containing	During the life of contract.	

Activity	Environmental and Social Impacts	Mitigation Measures	Monitoring Indicators	Frequency	Responsibility
		upon employment to make sure that children are not employed in the project	complete data of all employees hired by the contractor		
	Prohibition of gender based violence.	Awareness will be raised regarding prohibition of gender-based violence through trainings.	Evidence of training	During the life of contract.	
	Employment opportunities for local community	The contractor would hire employees from the local community (skilled and unskilled) and this would be part of the contract with the contactor.	Employment data from the contractor On site verification of the data provided by the contractor	During the all phases of contract.	
Operation and movement of machinery and equipment	Deterioration of air quality due to exhaust gases and dust emissions	Proper engine tuning of machinery/equipment; Water sprinkling at dust prone areas.	Gas emissions minimized; Dust emissions controlled.	Monthly	Execution by contractor Monitoring by PISSC/PMT
		Heavy equipment will be cleaned to prevent importation of non-native plant species, hydraulic fittings will be tighten , and it will be ensured that hydraulic hoses are in good condition and shall be replaced and repaired if petroleum leaks observed. Proper and timely maintenance will be provided for vehicles and equipment used during construction to reduce the potential for mechanical breakdowns	Check the fitness of the heavy machinery / equipment.		Execution by contractor Monitoring by PISSC/PMT
	Noise from vehicles, compaction rollers concrete mixers and construction equipment exceeding 75 dB is harmful for receptors.	Proper engine tuning of machinery/equipment; Avoid night time traffic particularly near communities.	Levels within permissible limits (75dB at day time and 65dB at night time).		Execution by contractor Monitoring by PISSC/PMT
Transportation of construction material	Smoke and dust generation; Fall of transported material; Chance of accidents;	Use earth material with the approval of the Engineer; Prepare traffic Management Plan to procure shingle from approved quarry and get approved by the Engineer; Regular inspection, tuning, and maintenance of transport vehicles; Material transport in closed containers or covered with canvas (Tarpal) sheets. Avoid night time activity;	Vehicles properly maintained; Designated borrow and quarry areas used; No fall of transported material; Damaged road repaired. Evidence of	Fortnightly	Execution by contractor Monitoring by PISSC/PMT

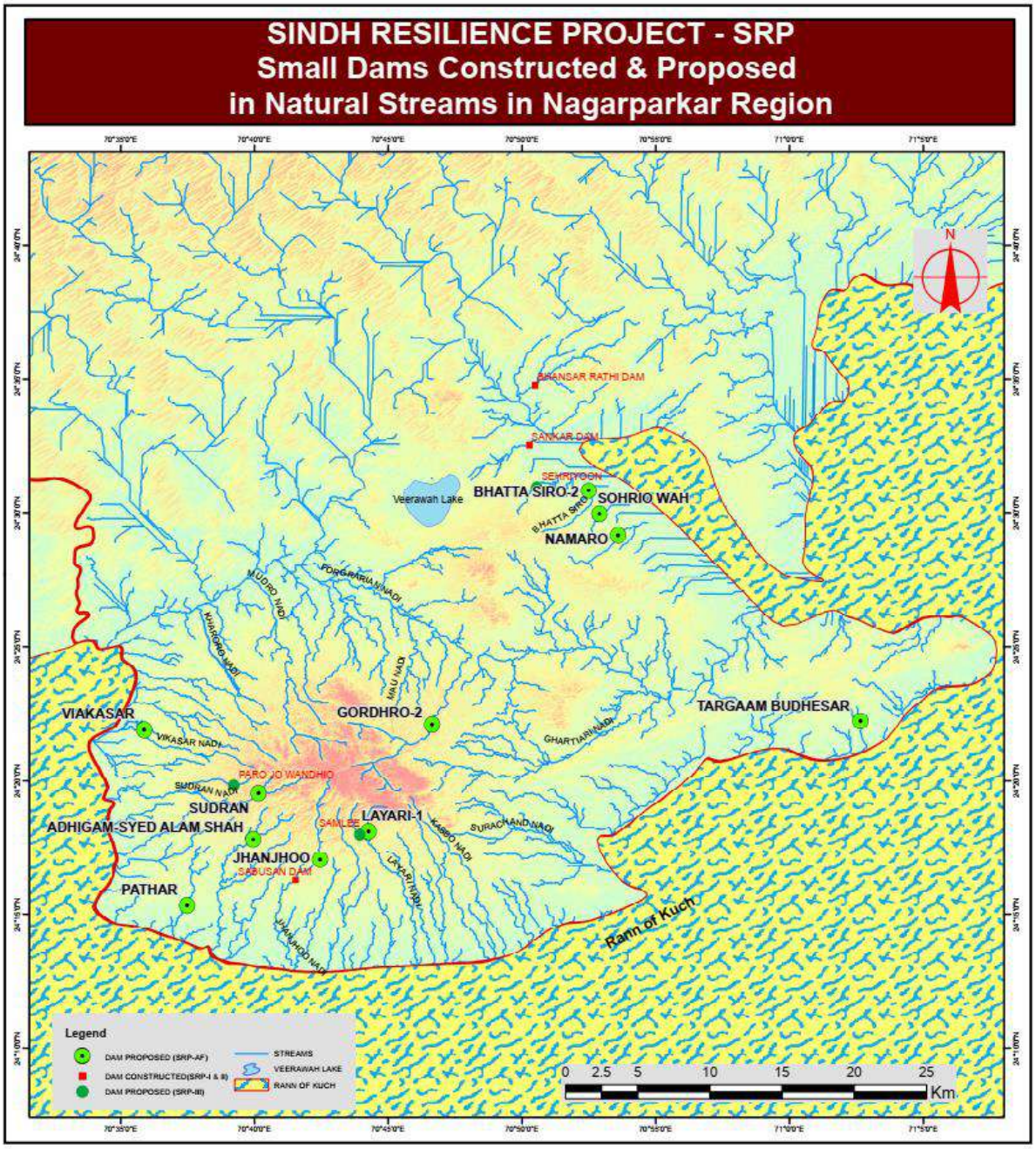
Activity	Environmental and Social Impacts	Mitigation Measures	Monitoring Indicators	Frequency	Responsibility
	damage to access roads.		implementation of Traffic Management Plan.		
		Maintain liaison with communities; Repair of damaged roads.			
		Truck and related construction equipment speeds will be limit in active construction areas to a maximum of 15 KM/hr. and strictly adhering to regulations and posted speed limits in other areas while inside boundaries			
	Soil erosion and contamination	Vehicle speeds to 15km/h.; Restriction on repair of vehicles and equipment in the field.	Monitoring compliance; Log of vehicle and equipment repairs; Soil erosion observed		Execution by contractor
	Air pollution	Use of machinery and vehicles with properly tuned to avoid the exhaust emissions. Sprinkling of water on site and on routes near communities. Water bowsers will be used to control excess airborne particulates at staging areas, active construction zones, and unpaved roads leading to/from active construction areas It will be ensured and implemented that the project remains within the parameters of Sindh Environmental Quality Standards.	Route maps of vehicle movement; Log of vehicle maintenance.	Fortnightly	Execution by contractor Monitoring by PISSC/PMT
	Water pollution	Avoiding washing of vehicles along the pond area. It will be ensured and implemented that the project remains within SEQS	Monitoring compliance; Water quality testing.	Monthly	Implementation by Contractor Monitoring by PISSC/PMT
	Noise pollution	Use of muffles (silencers) in vehicles to minimize noise; Avoiding movement of vehicles at night near communities.	No construction activities at night; Log of vehicle movement; Visual inspections of the vehicles.	Fortnightly	Execution by construction contractor Monitoring by PISSC/PMT
	Occupational, Health and Safety issues	Preparation and implementation of OHS Plan. Fixing of sign board at detours; Use of PPE; Awareness raising of drivers; Avoiding speedy movement of vehicles near communities; Training of construction workers and others; Regular liaison with communities.	Approved OHS Plan. Evidence of OHS trainings conducted. PPEs used by workers; Reflectorized road signs; Visual inspections.	Fortnightly	Execution by contractor Monitoring by PISSC/PMT
Construction works	Soil erosion and contamination	Proper compaction to minimize wind and water erosion; strengthening of bunds with earth filling and stone pitching	Erosion observed; Photographic record;	Fortnightly	Execution by contractor

Activity	Environmental and Social Impacts	Mitigation Measures	Monitoring Indicators	Frequency	Responsibility
		according to design specifications will minimize erosion; The top and slope of the proposed dam bunds will not be left un-compacted during construction works; Machinery and equipment will not be repaired and maintained at the site; No waste effluents will be released in to the ponds.	contamination signs observed.		Monitoring by PISSC/PMT
	Accident risks	Preparation and implementation of OHS Plan. Preparation of emergency response procedures (ERPs); Usage of PPEs; Provision of first aid kits and emergency vehicle. Trained drivers will be hired to operate machinery safely: Availability of trained operator to operate machinery.	PPEs provided and used; Record of any accident. Availability of ERPs	Fortnightly	Execution by contractor Monitoring by PISSC
	Loss of natural vegetation and associated fauna	86 Trees including young and mature expected to removed/relocated from site. On place of cut down/uprooted trees 430 new trees will be planted. Cost has been allocated for tree plantation for better environment in ESMP Implementation Cost. Tree plantation plan for indigenous species will be prepared including the type of species, location for plantation and other necessary information. No invasive species will be planted.	Record of tree cutting; Photographic record;	Fortnightly	Execution by contractor Monitoring by PISSC/PMT
	Damage to infrastructure	Restoration/ rehabilitation of damaged infrastructure with entire satisfaction of the affected persons. Construction activities will be confined in the designated areas.	Visual inspections; Photographic records; Consultations/Interviews Infrastructure restoration records.	Monthly	Execution by contractor Monitoring by PISSC/PMT
	Breaking up of Land for Cultivation or mining purpose	It will ensured that, project activities will remain isolated as per design excavations, no other activities will be permitted.	Review the designs and layout	Monthly	Execution by contractor Monitoring by PISSC/PMT
	Noise pollution	Noisy work shall be performed (such as the operation of heavy equipment) between the hours of 6:30 a.m. and 5:00 p.m. to minimize disruption to nearby community. Use of noise reduction devices; Regular inspection, maintenance and lubrication of the construction vehicle and equipment; Use of PPEs such as earplugs and earmuffs by the workers; Avoid night time activity. Construction activities will be confined in the designated areas	Noise levels measured.	Fortnightly	Execution by construction contractor Monitoring by PISSC/PMT

Activity	Environmental and Social Impacts	Mitigation Measures	Monitoring Indicators	Frequency	Responsibility
	Air pollution	Proper engine tuning of machinery equipment; Water sprinkling particularly at work sites near the communities.	Dust emission controlled; Monitoring on stack of machinery and equipment; Evidence of measurement records;	Fortnightly	Execution by contractor Monitoring by PISSC/PMT
	Land degradation; soil erosion; pooling of water and drainage problem	Excavation of borrow sites as per specifications from river bed.	Visual inspections; Photographic records.	Fortnightly	Executing agency and contractor Monitoring by PISSC/PMT
	Residual wastes; construction material waste	Remove any left-over construction material/wastes from the construction sites. Trash will be properly secured during the workday and all trash shall be removed from site at the end of each workday.	Waste material removed.	End of the rehabilitation works	Execution by contractor Monitoring by PISSC/PMT
Safety/health measures for local population	Accident risks, particularly for local population living within/near the subproject especially women, children and elderly people; Public awareness campaigns through displaying sign board at site and haulage routes; Vulnerability to accidents; Deterioration of health due to dust	Restriction on movement of machinery on the designated haulage routes for transportation of materials; Public awareness campaigns through displaying sign board at site and haulage routes; Interaction with community; Setting up speed limits (not more than 30 Km in work areas); Availability of first aid box for locals; Strict enforcement keeping non-working persons, particularly children, away from work sites; Adequate signage to manage traffic at sites, haulage and access roads; Ensure water sprinkling.	Visual observations; Record of accident; any complaint from the community.	All activities on daily basis except public consultation that will be carried out on monthly basis	Executing agency and contractor Monitoring by PISSC/PMT

Activity	Environmental and Social Impacts	Mitigation Measures	Monitoring Indicators	Frequency	Responsibility
Working near Wildlife Habitats	Damage to Wildlife, Hunting ,poaching to wildlife	Effects of light and noise on adjacent habitat shall be limited through controls on construction equipment. Orientation of project will be provided to all construction workers to increase their understanding and sensitivity to the challenges of the special environment in which they will be working. Construction activities will be confined in the designated areas Adequate education will be provided and enforcement to limit construction worker activities that are destructive to wildlife and habitats. Firing any gun or doing any other act which may disturb any animal or bird shall be prohibited which interferes with the breeding places.	Ensure that all workers have signed the code of conduct.	Fortnightly	Execution by contractor Monitoring by PISSC/PMT
Operation Phase					
Animal burrowing	Damage to the structure	Regular inspection of structures against burrowing by animals. (Rodents, porcupines, reptiles etc.). Removal of the animals from burrow and filling/ compaction of pit.	Visual observation.	Fortnightly	Executing agency Monitoring by PISSC/PMT
Care of newly planted trees	Mortality of newly planted saplings	The Contractor shall be responsible for after care of the newly planted trees for the first year, after which trees will be handed over to the client.	Survival of trees	Fortnightly	Executing agency Contractor and SID
Impacts on lower riparian	Strom water will be blocked for lower riparian / downstream users.	With the construction of proposed dams aquifer will recharge. It is expected that groundwater level will be raised. Solar operated tube well will be installed for closely monitoring of groundwater level.	Make sure that groundwater level is recharged	Monthly basis	Contractor, PMT, SID
Impacts on existing community tracks	Two kacha tracks of villages are expected to affect	All the pedestrian and vehicular tracks, which could be blocked by proposed dam reservoirs or affected by construction activities will be realigned by providing unmetalled vehicle tracks. Cost estimation has been made	Make sure that works is undertaken as per Bill of Quantities.	Start of execution of civil works	Contractor, PISSC, PMT

Annexure I: Small Dams Constructed and Proposed Under SRP & SRP-AF



Annexure II: Screening Criteria to Determine Environmental Category of Sub-Projects

Title of Sub-project: Bhata Siro			
Scope of Works: Construction of Composite Concrete weir with Earth fill Embankment			
Duration:12 Months			
Client Project: Irrigation Department, Govt: of Sindh			
Funded by: World Bank			
Section: B Assessment			
Environmental Issues			
· There are 15 number of trees located within area of Bhatta Siro Dam.			
· There are no settlement near the proposed dam site			
· There are no protected areas like, as National Parks, game reserve, wildlife sanctuaries located at or near the proposed area.			
· During construction some natural habitats might be disturbed.			
· There are also no physical cultural resources at or near the proposed dam site which may likely to be affected by construction activities.			
· No any forests observed near the dam site.			
· Ambient Air quality is clear and noise level is under SEPA standard.			
Section C: Environmental Category w.r.t Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014.			
Type of Project: Water Management, Dams, Irrigation, and Flood Protection			
Type of Project	**Category**	**Applicable (Yes/No)**	**Comments**
Dams and reservoirs with storage volume less than 25 million cubic meters	Schedule-I	Yes, the proposed dam has storage volume 0.21 (million cubic meters)	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Dams and reservoirs having surface area less than 4 sq.-km	Schedule-I	Yes, the proposed dam has surface area of 0.21 sq.-km	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Section D: World Bank Operational Policies that Might Apply			
Safeguard Policies		**Triggered (Yes/No)**	**Explanation**
Environmental Assessment OP/BP/GP 4.01		Yes	
Natural Habitats OP/BP 4.04		No	
Forest OP/BP 4.36		No	
Pest Management OP/BP/4.09		No	
Physical Cultural Resources OP/BP 4.09		No	
Involuntary resettlement OP/BP 4.12		No	
Safety of Dams OP/BP 4.37		Yes	
Project in International Waterways OP/BP 7.50		No	
Projects in Disputed Areas OP/BP 7.60		No	

Title of Sub-project: Sohrio Wah			
Scope of Works: Construction of Composite Concrete weir with Earth fill Embankment			
Duration:12 Months			
Client Project: Irrigation Department, Govt: of Sindh			
Funded by: World Bank			
Section: B Assessment			
Environmental Issues			
· There are 10 number of trees located within area of Sohrio Wah Dam.			
· There are no settlement near the proposed dam site			
· There are no protected areas like, as National Parks, game reserve, wildlife sanctuaries located at or near the proposed area.			
· During construction some natural habitats might be disturbed.			
· There are also no physical cultural resources at or near the proposed dam site which may likely to be affected by construction activities.			
· No any forests observed near the dam site.			
· Ambient Air quality is clear and noise level is under SEPA standard.			
Section C: Environmental Category w.r.t Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014.			
Type of Project: Water Management, Dams, Irrigation, and Flood Protection			
Type of Project	**Category**	**Applicable (Yes/No)**	**Comments**
Dams and reservoirs with storage volume less than 25 million cubic meters	Schedule-I	Yes, the proposed dam has storage volume 0.08 (million cubic meters)	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Dams and reservoirs having surface area less than 4 sq.-km	Schedule-I	Yes, the proposed dam has surface area of 0.09 sq.-km	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Section D: World Bank Operational Policies that Might Apply			
Safeguard Policies		**Triggered (Yes/No)**	**Explanation**
Environmental Assessment OP/BP/GP 4.01		Yes	
Natural Habitats OP/BP 4.04		No	
Forest OP/BP 4.36		No	
Pest Management OP/BP/4.09		No	
Physical Cultural Resources OP/BP 4.09		No	
Involuntary resettlement OP/BP 4.12		No	
Safety of Dams OP/BP 4.37		Yes	
Project in International Waterways OP/BP 7.50		No	
Projects in Disputed Areas OP/BP 7.60		No	

Title of Sub-project: Namaro			
Scope of Works: Construction of Composite Concrete weir with Earth fill Embankment			
Duration:12 Months			
Client Project: Irrigation Department, Govt: of Sindh			
Funded by: World Bank			
Section: B Assessment			
Environmental Issues			
· There are 06 number of trees located within area of Namaro Dam.			
· There are no settlement near the proposed dam site			
· There are no protected areas like, as National Parks, game reserve, wildlife sanctuaries located at or near the proposed area.			
· During construction some natural habitats might be disturbed.			
· There are also no physical cultural resources at or near the proposed dam site which may likely to be affected by construction activities.			
· No any forests observed near the dam site.			
· Ambient Air quality is clear and noise level is under SEPA standard.			
Section C: Environmental Category w.r.t Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014.			
Type of Project: Water Management, Dams, Irrigation, and Flood Protection			
Type of Project	**Category**	**Applicable (Yes/No)**	**Comments**
Dams and reservoirs with storage volume less than 25 million cubic meters	Schedule-I	Yes, the proposed dam has storage volume 0.36 (million cubic meters)	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Dams and reservoirs having surface area less than 4 sq.-km	Schedule-I	Yes, the proposed dam has surface area of 0.29 sq.-km	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Section D: World Bank Operational Policies that Might Apply			
Safeguard Policies	**Triggered (Yes/No)**	**Explanation**	
Environmental Assessment OP/BP/GP 4.01	Yes		
Natural Habitats OP/BP 4.04	No		
Forest OP/BP 4.36	No		
Pest Management OP/BP/4.09	No		
Physical Cultural Resources OP/BP 4.09	No		
Involuntary resettlement OP/BP 4.12	No		
Safety of Dams OP/BP 4.37	Yes		
Project in International Waterways OP/BP 7.50	No		
Projects in Disputed Areas OP/BP 7.60	No		

Title of Sub-project: Viakasor			
Scope of Works: Construction of Composite Concrete weir with Earth fill Embankment			
Duration:12 Months			
Client Project: Irrigation Department, Govt: of Sindh			
Funded by: World Bank			
Section: B Assessment			
Environmental Issues			
· There are 12 number of trees located within area of Viakasar Dam.			
· There are no settlement near the proposed dam site			
· There are no protected areas like, as National Parks, game reserve, wildlife sanctuaries located at or near the proposed area.			
· During construction some natural habitats might be disturbed.			
· There are also no physical cultural resources at or near the proposed dam site which may likely to be affected by construction activities.			
· No any forests observed near the dam site.			
· Ambient Air quality is clear and noise level is under SEPA standard.			
Section C: Environmental Category w.r.t Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014.			
Type of Project: Water Management, Dams, Irrigation, and Flood Protection			
Type of Project	**Category**	**Applicable (Yes/No)**	**Comments**
Dams and reservoirs with storage volume less than 25 million cubic meters	Schedule-I	Yes, the proposed dam has storage volume 0.30 (million cubic meters)	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Dams and reservoirs having surface area less than 4 sq.-km	Schedule-I	Yes, the proposed dam has surface area of 0.23sq-km	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Section D: World Bank Operational Policies that Might Apply			
Safeguard Policies		**Triggered (Yes/No)**	**Explanation**
Environmental Assessment OP/BP/GP 4.01		Yes	
Natural Habitats OP/BP 4.04		No	
Forest OP/BP 4.36		No	
Pest Management OP/BP/4.09		No	
Physical Cultural Resources OP/BP 4.09		No	
Involuntary resettlement OP/BP 4.12		No	
Safety of Dams OP/BP 4.37		Yes	
Project in International Waterways OP/BP 7.50		No	
Projects in Disputed Areas OP/BP 7.60		No	

Title of Sub-project: Gordhoro-2			
Scope of Works: Construction of Composite Concrete weir with Earth fill Embankment			
Duration:12 Months			
Client Project: Irrigation Department, Govt: of Sindh			
Funded by: World Bank			
Section: B Assessment			
Environmental Issues			
· There are 6 number of trees located within area of Gordhro-2			
· There are no settlement near the proposed dam site			
· There are no protected areas like, as National Parks, game reserve, wildlife sanctuaries located at or near the proposed area.			
· During construction some natural habitats might be disturbed.			
· There are also no physical cultural resources at or near the proposed dam site which may likely to be affected by construction activities.			
· No any forests observed near the dam site.			
· Ambient Air quality is clear and noise level is under SEPA standard.			
Section C: Environmental Category w.r.t Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014.			
Type of Project: Water Management, Dams, Irrigation, and Flood Protection			
Type of Project	**Category**	**Applicable (Yes/No)**	**Comments**
Dams and reservoirs with storage volume less than 25 million cubic meters	Schedule-I	Yes, the proposed dam has storage volume 0.34 (million cubic meters)	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Dams and reservoirs having surface area less than 4 sq.-km	Schedule-I	Yes, the proposed dam has surface area of 0.32 sq.-km	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Section D: World Bank Operational Policies that Might Apply			
Safeguard Policies		**Triggered (Yes/No)**	**Explanation**
Environmental Assessment OP/BP/GP 4.01		Yes	
Natural Habitats OP/BP 4.04		No	
Forest OP/BP 4.36		No	
Pest Management OP/BP/4.09		No	
Physical Cultural Resources OP/BP 4.09		No	
Involuntary resettlement OP/BP 4.12		No	
Safety of Dams OP/BP 4.37		Yes	
Project in International Waterways OP/BP 7.50		No	
Projects in Disputed Areas OP/BP 7.60		No	

Title of Sub-project: Sudran			
Scope of Works: Construction of Composite Concrete weir with Earth fill Embankment			
Duration:12 Months			
Client Project: Irrigation Department, Govt: of Sindh			
Funded by: World Bank			
Section: B Assessment			
Environmental Issues			
· There are 4 number of trees located within area of Sudran			
· There are no settlement near the proposed dam site			
· There are no protected areas like, as National Parks, game reserve, wildlife sanctuaries located at or near the proposed area.			
· During construction some natural habitats might be disturbed.			
· There are also no physical cultural resources at or near the proposed dam site which may likely to be affected by construction activities.			
· No any forests observed near the dam site.			
· Ambient Air quality is clear and noise level is under SEPA standard.			
Section C: Environmental Category w.r.t Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014.			
Type of Project: Water Management, Dams, Irrigation, and Flood Protection			
Type of Project	**Category**	**Applicable (Yes/No)**	**Comments**
Dams and reservoirs with storage volume less than 25 million cubic meters	Schedule-I	Yes, the proposed dam has storage volume 0.16 (million cubic meters)	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Dams and reservoirs having surface area less than 4 sq.-km	Schedule-I	Yes, the proposed dam has surface area of 0.11 sq.-km	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Section D: World Bank Operational Policies that Might Apply			
Safeguard Policies		**Triggered (Yes/No)**	**Explanation**
Environmental Assessment OP/BP/GP 4.01		Yes	
Natural Habitats OP/BP 4.04		No	
Forest OP/BP 4.36		No	
Pest Management OP/BP/4.09		No	
Physical Cultural Resources OP/BP 4.09		No	
Involuntary resettlement OP/BP 4.12		No	
Safety of Dams OP/BP 4.37		Yes	
Project in International Waterways OP/BP 7.50		No	
Projects in Disputed Areas OP/BP 7.60		No	

Title of Sub-project: Adhigam - Syed Alam Shah			
Scope of Works: Construction of Composite Concrete weir with Earth fill Embankment			
Duration:12 Months			
Client Project: Irrigation Department, Govt: of Sindh			
Funded by: World Bank			
Section: B Assessment			
Environmental Issues			
· There are 5 number of trees located within area of Adhigam - Syed Alam Shah			
· There are no settlement near the proposed dam site			
· There are no protected areas like, as National Parks, game reserve, wildlife sanctuaries located at or near the proposed area.			
· During construction some natural habitats might be disturbed.			
· There are also no physical cultural resources at or near the proposed dam site which may likely to be affected by construction activities.			
· No any forests observed near the dam site.			
· Ambient Air quality is clear and noise level is under SEPA standard.			
Section C: Environmental Category w.r.t Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014.			
Type of Project: Water Management, Dams, Irrigation, and Flood Protection			
Type of Project	**Category**	**Applicable (Yes/No)**	**Comments**
Dams and reservoirs with storage volume less than 25 million cubic meters	Schedule-I	Yes, the proposed dam has storage volume 0.07 (million cubic meters)	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Dams and reservoirs having surface area less than 4 sq.-km	Schedule-I	Yes, the proposed dam has surface area of 0.06 sq.-km	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Section D: World Bank Operational Policies that Might Apply			
Safeguard Policies		**Triggered (Yes/No)**	**Explanation**
Environmental Assessment OP/BP/GP 4.01		Yes	
Natural Habitats OP/BP 4.04		No	
Forest OP/BP 4.36		No	
Pest Management OP/BP/4.09		No	
Physical Cultural Resources OP/BP 4.09		No	
Involuntary resettlement OP/BP 4.12		No	
Safety of Dams OP/BP 4.37		Yes	
Project in International Waterways OP/BP 7.50		No	
Projects in Disputed Areas OP/BP 7.60		No	

Title of Sub-project: Layari-1			
Scope of Works: Construction of Composite Concrete weir with Earth fill Embankment			
Duration:12 Months			
Client Project: Irrigation Department, Govt: of Sindh			
Funded by: World Bank			
Section: B Assessment			
Environmental Issues			
· There are 11 number of trees located within area of Layari-1			
· There are no settlement near the proposed dam site			
· There are no protected areas like, as National Parks, game reserve, wildlife sanctuaries located at or near the proposed area.			
· During construction some natural habitats might be disturbed.			
· There are also no physical cultural resources at or near the proposed dam site which may likely to be affected by construction activities.			
· No any forests observed near the dam site.			
· Ambient Air quality is clear and noise level is under SEPA standard.			
Section C: Environmental Category w.r.t Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014.			
Type of Project: Water Management, Dams, Irrigation, and Flood Protection			
Type of Project	**Category**	**Applicable (Yes/No)**	**Comments**
Dams and reservoirs with storage volume less than 25 million cubic meters	Schedule-I	Yes, the proposed dam has storage volume 0.10 (million cubic meters)	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Dams and reservoirs having surface area less than 4 sq.-km	Schedule-I	Yes, the proposed dam has surface area of 0.06 sq.-km	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Section D: World Bank Operational Policies that Might Apply			
Safeguard Policies		**Triggered (Yes/No)**	**Explanation**
Environmental Assessment OP/BP/GP 4.01		Yes	
Natural Habitats OP/BP 4.04		No	
Forest OP/BP 4.36		No	
Pest Management OP/BP/4.09		No	
Physical Cultural Resources OP/BP 4.09		No	
Involuntary resettlement OP/BP 4.12		No	
Safety of Dams OP/BP 4.37		Yes	
Project in International Waterways OP/BP 7.50		No	
Projects in Disputed Areas OP/BP 7.60		No	

Title of Sub-project: Jhanjhoo			
Scope of Works: Construction of Composite Concrete weir with Earth fill Embankment			
Duration:12 Months			
Client Project: Irrigation Department, Govt: of Sindh			
Funded by: World Bank			
Section: B Assessment			
Environmental Issues			
· There are 11 number of trees located within area of Jhanjhoo			
· There are no settlement near the proposed dam site			
· There are no protected areas like, as National Parks, game reserve, wildlife sanctuaries located at or near the proposed area.			
· During construction some natural habitats might be disturbed.			
· There are also no physical cultural resources at or near the proposed dam site which may likely to be affected by construction activities.			
· No any forests observed near the dam site.			
· Ambient Air quality is clear and noise level is under SEPA standard.			
Section C: Environmental Category w.r.t Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014.			
Type of Project: Water Management, Dams, Irrigation, and Flood Protection			
Type of Project	**Category**	**Applicable (Yes/No)**	**Comments**
Dams and reservoirs with storage volume less than 25 million cubic meters	Schedule-I	Yes, the proposed dam has storage volume 0.05 (million cubic meters)	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Dams and reservoirs having surface area less than 4 sq.-km	Schedule-I	Yes, the proposed dam has surface area of 0.04 sq.-km	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Section D: World Bank Operational Policies that Might Apply			
Safeguard Policies		**Triggered (Yes/No)**	**Explanation**
Environmental Assessment OP/BP/GP 4.01		Yes	
Natural Habitats OP/BP 4.04		No	
Forest OP/BP 4.36		No	
Pest Management OP/BP/4.09		No	
Physical Cultural Resources OP/BP 4.09		No	
Involuntary resettlement OP/BP 4.12		No	
Safety of Dams OP/BP 4.37		Yes	
Project in International Waterways OP/BP 7.50		No	
Projects in Disputed Areas OP/BP 7.60		No	

Title of Sub-project: Pathar			
Scope of Works: Construction of Composite Concrete weir with Earth fill Embankment			
Duration:12 Months			
Client Project: Irrigation Department, Govt: of Sindh			
Funded by: World Bank			
Section: B Assessment			
Environmental Issues			
· There are 02 number of trees located within area of Pathar			
· There are no settlement near the proposed dam site			
· There are no protected areas like, as National Parks, game reserve, wildlife sanctuaries located at or near the proposed area.			
· During construction some natural habitats might be disturbed.			
· There are also no physical cultural resources at or near the proposed dam site which may likely to be affected by construction activities.			
· No any forests observed near the dam site.			
· Ambient Air quality is clear and noise level is under SEPA standard.			
Section C: Environmental Category w.r.t Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014.			
Type of Project: Water Management, Dams, Irrigation, and Flood Protection			
Type of Project	**Category**	**Applicable (Yes/No)**	**Comments**
Dams and reservoirs with storage volume less than 25 million cubic meters	Schedule-I	Yes, the proposed dam has storage volume 0.19 (million cubic meters)	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Dams and reservoirs having surface area less than 4 sq.-km	Schedule-I	Yes, the proposed dam has surface area of 0.16 sq.-km	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Section D: World Bank Operational Policies that Might Apply			
Safeguard Policies		**Triggered (Yes/No)**	**Explanation**
Environmental Assessment OP/BP/GP 4.01		Yes	
Natural Habitats OP/BP 4.04		No	
Forest OP/BP 4.36		No	
Pest Management OP/BP/4.09		No	
Physical Cultural Resources OP/BP 4.09		No	
Involuntary resettlement OP/BP 4.12		No	
Safety of Dams OP/BP 4.37		Yes	
Project in International Waterways OP/BP 7.50		No	
Projects in Disputed Areas OP/BP 7.60		No	

Title of Sub-project: Targam Bhodesar			
Scope of Works: Construction of Composite Concrete weir with Earth fill Embankment			
Duration:12 Months			
Client Project: Irrigation Department, Govt: of Sindh			
Funded by: World Bank			
Section: B Assessment			
Environmental Issues			
· There are 04 number of trees located within area of Targaam Bhodesar			
· There are no settlement near the proposed dam site			
· There are no protected areas like, as National Parks, game reserve, wildlife sanctuaries located at or near the proposed area.			
· During construction some natural habitats might be disturbed.			
· There are also no physical cultural resources at or near the proposed dam site which may likely to be affected by construction activities.			
· No any forests observed near the dam site.			
· Ambient Air quality is clear and noise level is under SEPA standard.			
Section C: Environmental Category w.r.t Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014.			
Type of Project: Water Management, Dams, Irrigation, and Flood Protection			
Type of Project	**Category**	**Applicable (Yes/No)**	**Comments**
Dams and reservoirs with storage volume less than 25 million cubic meters	Schedule-I	Yes, the proposed dam has storage volume 0.19 (million cubic meters)	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Dams and reservoirs having surface area less than 4 sq.-km	Schedule-I	Yes, the proposed dam has surface area of 0.16 sq.-km	Sub-project is falling in schedule-I requiring the filling of an IEE with the provincial EPA.
Section D: World Bank Operational Policies that Might Apply			
Safeguard Policies		**Triggered (Yes/No)**	**Explanation**
Environmental Assessment OP/BP/GP 4.01		Yes	
Natural Habitats OP/BP 4.04		No	
Forest OP/BP 4.36		No	
Pest Management OP/BP/4.09		No	
Physical Cultural Resources OP/BP 4.09		No	
Involuntary resettlement OP/BP 4.12		No	
Safety of Dams OP/BP 4.37		Yes	
Project in International Waterways OP/BP 7.50		No	
Projects in Disputed Areas OP/BP 7.60		No	

Annexure III: Baseline Environmental Monitoring Locations & Reports

Sr. No	Proposed Dam	Ambient Air		Drinking /Ground Water		Surface Water		Noise Sample 1		Noise Sample 2		Noise Sample 3	
		Coordinates	Remarks	**Coordinates**	Remarks	**Coordinates**	Remarks	**Coordinates**	Remarks	**Coordinates**	Remarks	**Coordinates**	Remarks
1	Bhata Siro	24°22.4310'N 71°2.4610'E	proposed Dam axis	24°23.4350'N 71°2.2290' E	from nearby Village pot	24°23.1160'N 71°2.2910'E	Pond	24°30'34.47"N 70°52'33.07"E	Dam Axis	24°31'7.64"N 70°51'22.25"E	Mosque		
2	Sohrio Wah	24°30.0470'N 70°52.9020'E		24°31.2340'N 70°51.4070'E		24°30.1300'N 70°52.8530'E	Pond	24°30'1.81"N 70°52'53.63"E	Dam Axis	24°31.1960'N 70°51.5200'E	Near Mosque		
3	Namaro			24°28.7580'N 70°53.1520'E		24°28.6610'N 70°53.1390'E	stream	24°28'41.71"N 70°53'0.35"E	Mosque	24°28'40.96"N 70°53'12.03"E	Dam Axis	24°28'29.32"N 70°53'10.64"E	Village
4	Viakasor			24°21.7600'N 70°36.2930'E		24°21.7100'N 70°36.2830'E	stream	24°21.6390'N 70°36.3640'E	Village	24°21'52.57"N 70°36'6.48"E	Dam Axis	24°21'42.61"N 70°36'16.47"E	Temple
5	Gordhro-2	24°21.6940'N 70°46.4020'E	proposed Dam axis	24°21.2060'N 70°45.9970'E				24°21'52.96"N 70°46'35.33"E	Dam Axis	24°21'25.31"N 70°46'28.02"E	Road	24°21'14.88"N 70°45'33.86"E	Main Road
6	Sudran	24°19.5140'N 70°40.2290'E		24°19.3870'N 70°39.7060'E				24°19.3750'N 70°39.7040'E	Village	24°19'31.84"N 70°40'8.01"E	Dam Axis	24°19'32.72"N 70°39'39.41"E	Bazar
7	Adhigam - Syed Alam			24°18.1790'N 70°39.5550'E				24°17'57.44"N 70°40'5.46"E	Dam Axis	24°18'8.38"N 70°39'38.95"E	Temple	24°18'4.50"N 70°39'29.15"E	School
8	Layari-1	24°18.0500'N 70°44.2470'E	proposed Dam axis	24°18.0500'N 70°44.2470'E				24°18'4.65"N 70°44'17.22"E	Dam Axis	24°17'54.74"N 70°44'11.61"E	Village		
9	Jhanjhoo			24°17'10.74"N 70°42'31.50"E		24°17'19.27"N 70°42'26.08"E	stream	24°17'20.65"N 70°42'24.21"E	Dam Axis	24°17'17.87"N 70°42'27.69"E	Mosque	24°17'10.14"N 70°42'30.06"E	Village
10	Pathar	24°15.7320'N 70°37.5750'E	proposed Dam axis	24°16.1640'N 70°38.3960'E		24°15.7700'N 70°37.7050'E	Pond	24°15'29.33"N 70°37'30.75"E	Dam Axis	24°16'8.48"N 70°38'0.82"E	School	24°16'16.39"N 70°38'6.91"E	Mosque
11	Targaam Bhodesar	24°22.4310'N 71°2.4610'E		24°23.4350'N 71°2.2290'E		24°23.1160'N 71°2.2910'E	stream	24°22'22.71"N 71° 2'29.65"E	Dam Axis	24°23'23.00"N 71° 2'14.34"E	School	24°23'13.51"N 71° 2'1.89"E	Main Track

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SURFACE WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Surface Water	Reporting Date	05-11-2020
Grab/Composite	Grab	Analysis Completion Date	05-11- 2020
Sampling Date	25-10-2020	Sample Collected by/Sent By	-
Sample ID	EGEL-SW-07/2020	Sample Receiving Date	30-10-2020
Sampling Coordinates	24°23.1160' N 71°2.2910'E	Sampling Location	Bhatta Siro 2

Surface Water Analysis Results

Sr. No.	Parameter	Analysis Method	Result	SEQS Limits
	Field Analysis			
1	Temperature	SMWW 2550 B	22.0	≤ 3°C
	Lab Analysis			
2	pH	SMWW 4500 H^+ B	6.92	6-9
3	Biochemical Oxygen Demand (BOD_5)	SMWW 5210-B	10	250
4	Chemical Oxygen Demand (COD)	SMWW 5220 B	23	400
5	Total Suspended Solids (TSS)	SMWW 2540 D	33	400
6	Total Dissolved Solids (TDS)	SMWW 2540 C	167	3500
7	Phenolic Compounds (as Phenols)	SMWW 5530 D	0.0	0.3
8	Grease and Oil	USEPA 1664 B	0.0	10
9	Chloride (Cl^-)	SMWW 4500 Cl- B	25	1000
10	Fluoride (F^-)	SMWW 4500 F- C	0.0	10
11	Cyanide (CN^-)	SMWW 4500 CN- F	0.0	1.0
12	An-ionic Detergents (as MBAs)	SMWW 5540-C	0.0	20
13	Sulfate (SO_4^{-2})	SMWW 4500 SO_4^{-2} C	27	600
14	Sulfide (S^{-2})	SMWW 4500 S^{-2} F	0.0	1.0
15	Ammonia (NH_3)	SMWW 4500-NH_3 D	0.0	40
16	Cadmium (Cd)	SMWW 3113 B	<0.006	0.1
17	Chromium (Cr)	SMWW 3113 B	0.004	1.0
18	Copper (Cu)	SMWW 3113 B	0.165	1.0
19	Lead (Pb)	SMWW 3113 B	0.006	0.5
20	Mercury (Hg)	SMWW 3112 B	0.002	0.01
21	Selenium (Se)	SMWW 3114 B	<0.01	0.5
22	Nickel (Ni)	SMWW 3113 B	0.024	1.0
23	Silver (Ag)	SMWW 3113 B	0.009	1.0
24	Total Toxic Metals	Calculated Value	0.271	2.0
25	Zinc (Zn)	SMWW 3111 B	0.062	5.0
26	Arsenic (As)	SMWW 3114 B	0.007	1.0
27	Barium (Ba)	SMWW 3113 B	0.008	1.5
28	Iron (Fe)	SMWW 3113 B	0.620	8.0
29	Manganese (Mn)	SMWW 3111 B	0.022	1.5
30	Boron (B)	SMWW 3113 B	0.03	6.0
31	Residual Chlorine (Cl_2)	SMWW 4500 Cl- B	0.0	1.0

SEQS= Sindh Environmental Quality Standards (The Gazette of Pakistan) Registered No. EPA/TECH/739/2014

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Evergreen Environments

Evergreen Environmental Laboratory

SURFACE WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Surface Water	**Reporting Date**	05-11-2020
Grab/Composite	Grab	**Analysis Completion Date**	05-11- 2020
Sampling Date	25-10-2020	**Sample Collected by/Sent By**	-
Sample ID	EGEL-SW-08/2020	**Sample Receiving Date**	30-10-2020
Sampling Coordinates	24°30.1300'N 70°52.8530'E	**Sampling Location**	Sohrio Wah

Surface Water Analysis Results

Sr. No.	Parameter	Analysis Method	Result	SEQS Limits
	Field Analysis			
1	Temperature	SMWW 2550 B	23.0	≤ 3°C
	Lab Analysis			
2	pH	SMWW 4500 H^+ B	6.98	6-9
3	Biochemical Oxygen Demand (BOD_5)	SMWW 5210-B	09	250
4	Chemical Oxygen Demand (COD)	SMWW 5220 B	22	400
5	Total Suspended Solids (TSS)	SMWW 2540 D	38	400
6	Total Dissolved Solids (TDS)	SMWW 2540 C	188	3500
7	Phenolic Compounds (as Phenols)	SMWW 5530 D	0.0	0.3
8	Grease and Oil	USEPA 1664 B	0.0	10
9	Chloride (Cl^-)	SMWW 4500 Cl- B	34	1000
10	Fluoride (F^-)	SMWW 4500 F- C	0.0	10
11	Cyanide (CN^-)	SMWW 4500 CN- F	0.0	1.0
12	An-ionic Detergents (as MBAs)	SMWW 5540-C	0.0	20
13	Sulfate (SO_4^{-2})	SMWW 4500 SO_4^{-2} C	20	600
14	Sulfide (S^{-2})	SMWW 4500 S^{-2} F	0.0	1.0
15	Ammonia (NH_3)	SMWW 4500-NH_3 D	0.0	40
16	Cadmium (Cd)	SMWW 3113 B	<0.006	0.1
17	Chromium (Cr)	SMWW 3113 B	0.004	1.0
18	Copper (Cu)	SMWW 3113 B	0.169	1.0
19	Lead (Pb)	SMWW 3113 B	0.008	0.5
20	Mercury (Hg)	SMWW 3112 B	<0.001	0.01
21	Selenium (Se)	SMWW 3114 B	<0.01	0.5
22	Nickel (Ni)	SMWW 3113 B	0.022	1.0
23	Silver (Ag)	SMWW 3113 B	0.008	1.0
24	Total Toxic Metals	Calculated Value	0.249	2.0
25	Zinc (Zn)	SMWW 3111 B	0.056	5.0
26	Arsenic (As)	SMWW 3114 B	0.009	1.0
27	Barium (Ba)	SMWW 3113 B	<0.002	1.5
28	Iron (Fe)	SMWW 3113 B	0.626	8.0
29	Manganese (Mn)	SMWW 3111 B	0.018	1.5
30	Boron (B)	SMWW 3113 B	0.01	6.0
31	Residual Chlorine (Cl_2)	SMWW 4500 Cl- B	0.0	1.0

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Evergreen Environments

Evergreen Environmental Laboratory

SURFACE WATER ANALYSIS REPORT

Sample Detail			
Nature of Sample	Surface Water	Reporting Date	05-11-2020
Grab/Composite	Grab	Analysis Completion Date	05-11- 2020
Sampling Date	26-10-2020	Sample Collected by/Sent By	-
Sample ID	EGEL-SW-10/2020	Sample Receiving Date	30-10-2020
Sampling Coordinates	24°21.7100'N 70°36.2830'E	Sampling Location	Viakasar

Surface Water Analysis Results

Sr. No.	Parameter	Analysis Method	Result	SEQS Limits
	Field Analysis			
1.	Temperature	SMWW 2550 B	24.0	≤ 3°C
	Lab Analysis			
2	pH	SMWW 4500 H^+ B	7.4	6-9
3	Biochemical Oxygen Demand (BOD_5)	SMWW 5210-B	9	250
4	Chemical Oxygen Demand (COD)	SMWW 5220 B	24	400
5	Total Suspended Solids (TSS)	SMWW 2540 D	43	400
6	Total Dissolved Solids (TDS)	SMWW 2540 C	211	3500
7	Phenolic Compounds (as Phenols)	SMWW 5530 D	0.0	0.3
8	Grease and Oil	USEPA 1664 B	0.0	10
9	Chloride (Cl^-)	SMWW 4500 Cl- B	18	1000
10	Fluoride (F^-)	SMWW 4500 F- C	0.0	10
11	Cyanide (CN^-)	SMWW 4500 CN- F	0.0	1.0
12	An-ionic Detergents (as MBAs)	SMWW 5540-C	0.0	20
13	Sulfate (SO_4^{-2})	SMWW 4500 SO_4^{-2} C	39	600
14	Sulfide (S^{-2})	SMWW 4500 S^{-2} F	0.0	1.0
15	Ammonia (NH_3)	SMWW 4500-NH_3 D	0.0	40
16	Cadmium (Cd)	SMWW 3113 B	<0.006	0.1
17	Chromium (Cr)	SMWW 3113 B	0.005	1.0
18	Copper (Cu)	SMWW 3113 B	0.171	1.0
19	Lead (Pb)	SMWW 3113 B	<0.005	0.5
20	Mercury (Hg)	SMWW 3112 B	<0.001	0.01
21	Selenium (Se)	SMWW 3114 B	<0.02	0.5
22	Nickel (Ni)	SMWW 3113 B	0.022	1.0
23	Silver (Ag)	SMWW 3113 B	0.006	1.0
24	Total Toxic Metals	Calculated Value	0.289	2.0
25	Zinc (Zn)	SMWW 3111 B	0.058	5.0
26	Arsenic (As)	SMWW 3114 B	0.008	1.0
27	Barium (Ba)	SMWW 3113 B	0.005	1.5
28	Iron (Fe)	SMWW 3113 B	0.624	8.0
29	Manganese (Mn)	SMWW 3111 B	0.021	1.5
30	Boron (B)	SMWW 3113 B	0.04	6.0
31	Residual Chlorine (Cl_2)	SMWW 4500 Cl- B	0.0	1.0

SEQS= Sindh Environmental Quality Standards (The Gazette of Pakistan) Registered No. EPA/TECH/739/2014

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SURFACE WATER ANALYSIS REPORT

Sample Detail			
Nature of Sample	Surface Water	Reporting Date	05-11-2020
Grab/Composite	Grab	Analysis Completion Date	05-11- 2020
Sampling Date	27-10-2020	Sample Collected by/Sent By	-
Sample ID	EGEL-SW-11/2020	Sample Receiving Date	30-10-2020
Sampling Coordinates	24°17'19.27"N 70°42'26.08"E	Sampling Location	Jhanjhoo Nadi

Surface Water Analysis Results

Sr. No.	Parameter	Analysis Method	Result	SEQS Limits
	Field Analysis			
1	Temperature	SMWW 2550 B	22.0	≤ 3°C
	Lab Analysis			
2	pH	SMWW 4500 H^+ B	7.5	6-9
3	Biochemical Oxygen Demand (BOD_5)	SMWW 5210-B	11	250
4	Chemical Oxygen Demand (COD)	SMWW 5220 B	20	400
5	Total Suspended Solids (TSS)	SMWW 2540 D	35	400
6	Total Dissolved Solids (TDS)	SMWW 2540 C	232	3500
7	Phenolic Compounds (as Phenols)	SMWW 5530 D	0.0	0.3
8	Grease and Oil	USEPA 1664 B	0.0	10
9	Chloride (Cl^-)	SMWW 4500 Cl- B	19	1000
10	Fluoride (F^-)	SMWW 4500 F- C	0.0	10
11	Cyanide (CN^-)	SMWW 4500 CN- F	0.0	1.0
12	An-ionic Detergents (as MBAs)	SMWW 5540-C	0.0	20
13	Sulfate (SO_4^{-2})	SMWW 4500 SO_4^{-2} C	22	600
14	Sulfide (S^{-2})	SMWW 4500 S^{-2} F	0.0	1.0
15	Ammonia (NH_3)	SMWW 4500-NH_3 D	0.0	40
16	Cadmium (Cd)	SMWW 3113 B	<0.006	0.1
17	Chromium (Cr)	SMWW 3113 B	0.006	1.0
18	Copper (Cu)	SMWW 3113 B	0.169	1.0
19	Lead (Pb)	SMWW 3113 B	<0.005	0.5
20	Mercury (Hg)	SMWW 3112 B	0.001	0.01
21	Selenium (Se)	SMWW 3114 B	<0.02	0.5
22	Nickel (Ni)	SMWW 3113 B	0.022	1.0
23	Silver (Ag)	SMWW 3113 B	0.007	1.0
24	Total Toxic Metals	Calculated Value	0.282	2.0
25	Zinc (Zn)	SMWW 3111 B	0.051	5.0
26	Arsenic (As)	SMWW 3114 B	0.008	1.0
27	Barium (Ba)	SMWW 3113 B	0.008	1.5
28	Iron (Fe)	SMWW 3113 B	0.623	8.0
29	Manganese (Mn)	SMWW 3111 B	0.022	1.5
30	Boron (B)	SMWW 3113 B	0.03	6.0
31	Residual Chlorine (Cl_2)	SMWW 4500 Cl- B	0.0	1.0

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SURFACE WATER ANALYSIS REPORT

Sample Detail			
Nature of Sample	Surface Water	Reporting Date	05-11-2020
Grab/Composite	Grab	Analysis Completion Date	05-11- 2020
Sampling Date	26-10-2020	Sample Collected by/Sent By	-
Sample ID	EGEL-SW-12/2020	Sample Receiving Date	30-10-2020
Sampling Coordinates	24°15.7700'N 70°37.7050'E	Sampling Location	Pathar

Surface Water Analysis Results

Sr. No.	Parameter	Analysis Method	Result	SEQS Limits
	Field Analysis			
1	Temperature	SMWW 2550 B	24.0	≤ 3°C
	Lab Analysis			
2	pH	SMWW 4500 H^+ B	7.3	6-9
3	Biochemical Oxygen Demand (BOD_5)	SMWW 5210-B	<5	250
4	Chemical Oxygen Demand (COD)	SMWW 5220 B	17	400
5	Total Suspended Solids (TSS)	SMWW 2540 D	32	400
6	Total Dissolved Solids (TDS)	SMWW 2540 C	176	3500
7	Phenolic Compounds (as Phenols)	SMWW 5530 D	0.0	0.3
8	Grease and Oil	USEPA 1664 B	0.0	10
9	Chloride (Cl^-)	SMWW 4500 Cl- B	27	1000
10	Fluoride (F^-)	SMWW 4500 F- C	0.0	10
11	Cyanide (CN^-)	SMWW 4500 CN- F	0.0	1.0
12	An-ionic Detergents (as MBAs)	SMWW 5540-C	0.0	20
13	Sulfate (SO_4^{-2})	SMWW 4500 SO_4^{-2} C	30	600
14	Sulfide (S^{-2})	SMWW 4500 S^{-2} F	0.0	1.0
15	Ammonia (NH_3)	SMWW 4500-NH_3 D	0.0	40
16	Cadmium (Cd)	SMWW 3113 B	<0.006	0.1
17	Chromium (Cr)	SMWW 3113 B	<0.004	1.0
18	Copper (Cu)	SMWW 3113 B	0.168	1.0
19	Lead (Pb)	SMWW 3113 B	<0.005	0.5
20	Mercury (Hg)	SMWW 3112 B	<0.001	0.01
21	Selenium (Se)	SMWW 3114 B	<0.01	0.5
22	Nickel (Ni)	SMWW 3113 B	0.024	1.0
23	Silver (Ag)	SMWW 3113 B	0.006	1.0
24	Total Toxic Metals	Calculated Value	0.248	2.0
25	Zinc (Zn)	SMWW 3111 B	0.057	5.0
26	Arsenic (As)	SMWW 3114 B	0.008	1.0
27	Barium (Ba)	SMWW 3113 B	0.006	1.5
28	Iron (Fe)	SMWW 3113 B	0.625	8.0
29	Manganese (Mn)	SMWW 3111 B	0.027	1.5
30	Boron (B)	SMWW 3113 B	0.01	6.0
31	Residual Chlorine (Cl_2)	SMWW 4500 Cl- B	0.0	1.0

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SURFACE WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Surface Water	**Reporting Date**	05-11-2020
Grab/Composite	Grab	**Analysis Completion Date**	05-11- 2020
Sampling Date	25-10-2020	**Sample Collected by/Sent By**	-
Sample ID	EGEL-SW-13/2020	**Sample Receiving Date**	30-10-2020
Sampling Coordinates	24°23.1160'N 71°2.2910'E	**Sampling Location**	Targaam Budhesar

Surface Water Analysis Results

Sr. No.	Parameter	Analysis Method	Result	SEQS Limits
	Field Analysis			
1	Temperature	SMWW 2550 B	24.0	≤ 3°C
	Lab Analysis			
2	pH	SMWW 4500 H^+ B	7.6	6-9
3	Biochemical Oxygen Demand (BOD_5)	SMWW 5210-B	<5	250
4	Chemical Oxygen Demand (COD)	SMWW 5220 B	21	400
5	Total Suspended Solids (TSS)	SMWW 2540 D	32	400
6	Total Dissolved Solids (TDS)	SMWW 2540 C	211	3500
7	Phenolic Compounds (as Phenols)	SMWW 5530 D	0.0	0.3
8	Grease and Oil	USEPA 1664 B	0.0	10
9	Chloride (Cl^-)	SMWW 4500 Cl- B	41	1000
10	Fluoride (F^-)	SMWW 4500 F- C	0.0	10
11	Cyanide (CN^-)	SMWW 4500 CN- F	0.0	1.0
12	An-ionic Detergents (as MBAs)	SMWW 5540-C	0.0	20
13	Sulfate (SO_4^{-2})	SMWW 4500 SO_4^{-2} C	34	600
14	Sulfide (S^{-2})	SMWW 4500 S^{-2} F	0.0	1.0
15	Ammonia (NH_3)	SMWW 4500-NH_3 D	0.0	40
16	Cadmium (Cd)	SMWW 3113 B	<0.006	0.1
17	Chromium (Cr)	SMWW 3113 B	0.007	1.0
18	Copper (Cu)	SMWW 3113 B	0.164	1.0
19	Lead (Pb)	SMWW 3113 B	<0.005	0.5
20	Mercury (Hg)	SMWW 3112 B	<0.001	0.01
21	Selenium (Se)	SMWW 3114 B	<0.02	0.5
22	Nickel (Ni)	SMWW 3113 B	0.025	1.0
23	Silver (Ag)	SMWW 3113 B	0.006	1.0
24	Total Toxic Metals	Calculated Value	0.276	2.0
25	Zinc (Zn)	SMWW 3111 B	0.059	5.0
26	Arsenic (As)	SMWW 3114 B	0.008	1.0
27	Barium (Ba)	SMWW 3113 B	0.004	1.5
28	Iron (Fe)	SMWW 3113 B	0.628	8.0
29	Manganese (Mn)	SMWW 3111 B	0.024	1.5
30	Boron (B)	SMWW 3113 B	0.03	6.0
31	Residual Chlorine (Cl_2)	SMWW 4500 Cl- B	0.0	1.0

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DRINKING WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Drinking Water	**Reporting Date**	05-11-2020
Grab/Composite	Grab	**Analysis Completion Date**	05-11-2020
Sampling Date	25-10-2020	**Sample Collected by/Sent By**	-
Sample ID	EGEL-DW-35/2020	**Sample Receiving Date**	30-10-2020
Sampling Coordinates	24°23.4350'N 71°2.2290' E	**Sampling Location**	Bhattasiro

Drinking Water Analysis Results

Parameter	Analysis Method	SEQS	Results
Lab Analysis			
Color	SMWW 2120 C	≤ 15 TCU	0.0
Taste	SMWW 2160 C	Non- Objectionable	Non- Objectionable
Odor	SMWW 2150 B	Non- Objectionable	Non- Objectionable
Turbidity	SMWW 2130 B	< 5 NTU	
Total Hardness (as $CaCO_3$)	SMWW 2340 C	< 500 mg/L	176
Total Dissolved Solids (TDS)	SMWW 2540 C	< 1000 mg/L	346
pH	SMWW 4500 H^+ B	6.5- 8.5	7.97
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	0.002
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	0.006
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.04
Barium (Ba)	SMWW 3113 B	0.7 mg/L	0.02
Boron (B)	SMWW 3113 B	0.3 mg/l	0.021
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	0.009
Chloride (Cl^-)	SMWW 4500 Cl^- B	< 250 mg/L	41
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	0.028
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.266
Cyanide (CN^-)	SMWW 4500 CN^- F	≤ 0.05 mg/L	0.0
Fluoride (F^-)	SMWW 4500 F^- C	≤ 1.5 mg/L	0.0
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	0.049
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.075
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	0.016
Nitrate (NO_3^-)	SMWW 4500 NO_3^- B	≤ 50 mg/L	1.62
Nitrite (NO_2^-)	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0.08
Selenium (Se)	SMWW 3114 B	0.01 mg/L	0.01
Residual Chlorine (Cl_2)	SMWW 4500 Cl^- B	0.5 mg/L	0.0
Phenolic Compounds (as Phenols)	SMWW 5530 D	NGVS	0.05
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.12
Microbiological Analysis			
Total Coliforms	SMWW 9222 B	0/ 100 mL CFU	8
Fecal Coliforms	SMWW 9222 D	0/ 100 mL CFU	0

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DRINKING WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Drinking Water	**Reporting Date**	05-11-2020
Grab/Composite	Grab	**Analysis Completion Date**	05-11-2020
Sampling Date	25-10-2020	**Sample Collected by/Sent By**	-
Sample ID	EGEL-DW-36/2020	**Sample Receiving Date**	30-10-2020
Sampling Coordinates	24°31.2340'N 70°51.4070'E	**Sampling Location**	Sohriowah

Drinking Water Analysis Results

Parameter	Analysis Method	SEQS	Results
Lab Analysis			
Color	SMWW 2120 C	≤ 15 TCU	0.0
Taste	SMWW 2160 C	Non- Objectionable	Non- Objectionable
Odor	SMWW 2150 B	Non- Objectionable	Non- Objectionable
Turbidity	SMWW 2130 B	< 5 NTU	21.5
Total Hardness (as $CaCO_3$)	SMWW 2340 C	< 500 mg/L	160
Total Dissolved Solids (TDS)	SMWW 2540 C	< 1000 mg/L	358
pH	SMWW 4500 H^+ B	6.5- 8.5	7.66
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	0.003
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	0.005
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.05
Barium (Ba)	SMWW 3113 B	0.7 mg/L	0.02
Boron (B)	SMWW 3113 B	0.3 mg/l	0.024
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	0.009
Chloride (Cl^-)	SMWW 4500 Cl^- B	< 250 mg/L l	65
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	0.023
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.215
Cyanide (CN^-)	SMWW 4500 CN^- F	≤ 0.05 mg/L	0.0
Fluoride (F^-)	SMWW 4500 F^- C	≤ 1.5 mg/L	0.0
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	0.045
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.087
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	0.014
Nitrate (NO_3^-)	SMWW 4500 NO_3^- B	≤ 50 mg/L	1.41
Nitrite (NO_2^-)	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0.07
Selenium (Se)	SMWW 3114 B	0.01 mg/L	<0.01
Residual Chlorine (Cl_2)	SMWW 4500 Cl^- B	0.5 mg/L	0.0
Phenolic Compounds (as Phenols)	SMWW 5530 D	NGVS	0.04
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.096
Microbiological Analysis			
Total Coliforms	SMWW 9222 B	0/ 100 mL CFU	10
Fecal Coliforms	SMWW 9222 D	0/ 100 mL CFU	0

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DRINKING WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Drinking Water	**Reporting Date**	05-11-2020
Grab/Composite	Grab	**Analysis Completion Date**	05-11-2020
Sampling Date	26-10-2020	**Sample Collected by/Sent By**	-
Sample ID	EGEL-DW-37/2020	**Sample Receiving Date**	30-10-2020
Sampling Coordinates	24°28.7580'N 70°53.1520'E	**Sampling Location**	Namaro

Drinking Water Analysis Results

Parameter	Analysis Method	SEQS	Results
Lab Analysis			
Color	SMWW 2120 C	≤ 15 TCU	1
Taste	SMWW 2160 C	Non- Objectionable	Non- Objectionable
Odor	SMWW 2150 B	Non- Objectionable	Non- Objectionable
Turbidity	SMWW 2130 B	< 5 NTU	56.9
Total Hardness (as $CaCO_3$)	SMWW 2340 C	< 500 mg/L	90
Total Dissolved Solids (TDS)	SMWW 2540 C	< 1000 mg/L	220
pH	SMWW 4500 H^+ B	6.5- 8.5	7.78
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	0.002
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	<0.005
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.005
Barium (Ba)	SMWW 3113 B	0.7 mg/L	0.004
Boron (B)	SMWW 3113 B	0.3 mg/l	0.023
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	0.008
Chloride (Cl^-)	SMWW 4500 Cl^- B	< 250 mg/L	25
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	0.024
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.164
Cyanide (CN^-)	SMWW 4500 CN^- F	≤ 0.05 mg/L	0.0
Fluoride (F^-)	SMWW 4500 F^- C	≤ 1.5 mg/L	0.0
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	0.049
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.095
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	0.018
Nitrate (NO_3^-)	SMWW 4500 NO_3^- B	≤ 50 mg/L	18.28
Nitrite (NO_2^-)	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	1.28
Selenium (Se)	SMWW 3114 B	0.01 mg/L	<0.01
Residual Chlorine (Cl_2)	SMWW 4500 Cl^- B	0.5 mg/L	0.0
Phenolic Compounds (as Phenols)	SMWW 5530 D	NGVS	0.13
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.25
Microbiological Analysis			
Total Coliforms	SMWW 9222 B	0/ 100 mL CFU	12
Fecal Coliforms	SMWW 9222 D	0/ 100 mL CFU	3

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DRINKING WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Drinking Water	**Reporting Date**	05-11-2020
Grab/Composite	Grab	**Analysis Completion Date**	05-11-2020
Sampling Date	26-10-2020	**Sample Collected by/Sent By**	-
Sample ID	EGEL-DW-38/2020	**Sample Receiving Date**	30-10-2020
Sampling Coordinates	24°21.7600'N 70°36.2930'E	**Sampling Location**	Viakasar

Drinking Water Analysis Results

Parameter	Analysis Method	SEQS	Results
Lab Analysis			
Color	SMWW 2120 C	≤ 15 TCU	0.0
Taste	SMWW 2160 C	Non- Objectionable	Non- Objectionable
Odor	SMWW 2150 B	Non- Objectionable	Non- Objectionable
Turbidity	SMWW 2130 B	< 5 NTU	0.00
Total Hardness (as $CaCO_3$)	SMWW 2340 C	< 500 mg/L	178
Total Dissolved Solids (TDS)	SMWW 2540 C	< 1000 mg/L	304
pH	SMWW 4500 H^+ B	6.5- 8.5	7.61
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	0.004
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	0.005
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.005
Barium (Ba)	SMWW 3113 B	0.7 mg/L	0.01
Boron (B)	SMWW 3113 B	0.3 mg/l	0.026
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	0.009
Chloride (Cl^-)	SMWW 4500 Cl^- B	< 250 mg/L	15
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	0.028
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.246
Cyanide (CN^-)	SMWW 4500 CN F	≤ 0.05 mg/L	0.0
Fluoride (F^-)	SMWW 4500 F C	≤ 1.5 mg/L	0.0
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	0.092
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.081
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	0.012
Nitrate (NO_3^-)	SMWW 4500 NO_3^- B	≤ 50 mg/L	1.05
Nitrite (NO_2^-)	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0.06
Selenium (Se)	SMWW 3114 B	0.01 mg/L	<0.01
Residual Chlorine (Cl_2)	SMWW 4500 Cl B	0.5 mg/L	0.0
Phenolic Compounds (as Phenols)	SMWW 5530 D	NGVS	0.00
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.198
Microbiological Analysis			
Total Coliforms	SMWW 9222 B	0/ 100 mL CFU	1
Fecal Coliforms	SMWW 9222 D	0/ 100 mL CFU	0

SEQS= Sindh Environmental Quality Standards (The Gazette of Pakistan) Registered No. EPA/TECH/739/2014

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DRINKING WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Drinking Water	**Reporting Date**	05-11-2020
Grab/Composite	Grab	**Analysis Completion Date**	05-11-2020
Sampling Date	26-10-2020	**Sample Collected by/Sent By**	-
Sample ID	EGEL-DW-39/2020	**Sample Receiving Date**	30-10-2020
Sampling Coordinates	24°21.2060'N 70°45.9970'E	**Sampling Location**	Gordhro-2

Drinking Water Analysis Results

Parameter	Analysis Method	SEQS	Results
Lab Analysis			
Color	SMWW 2120 C	≤ 15 TCU	0.0
Taste	SMWW 2160 C	Non- Objectionable	Non- Objectionable
Odor	SMWW 2150 B	Non- Objectionable	Non- Objectionable
Turbidity	SMWW 2130 B	< 5 NTU	0.00
Total Hardness (as $CaCO_3$)	SMWW 2340 C	< 500 mg/L	212
Total Dissolved Solids (TDS)	SMWW 2540 C	< 1000 mg/L	698
pH	SMWW 4500 H^+ B	6.5- 8.5	7.58
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	0.003
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	<0.005
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.045
Barium (Ba)	SMWW 3113 B	0.7 mg/L	0.022
Boron (B)	SMWW 3113 B	0.3 mg/l	0.021
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	0.006
Chloride (Cl^-)	SMWW 4500 Cl^- B	< 250 mg/L	100
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	0.028
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.244
Cyanide (CN^-)	SMWW 4500 CN^- F	≤ 0.05 mg/L	0.0
Fluoride (F^-)	SMWW 4500 F^- C	≤ 1.5 mg/L	0.0
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	0.046
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.074
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	0.012
Nitrate (NO_3^-)	SMWW 4500 NO_3^- B	< 50 mg/L	0.89
Nitrite (NO_2^-)	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0.05
Selenium (Se)	SMWW 3114 B	0.01 mg/L	0.02
Residual Chlorine (Cl_2)	SMWW 4500 Cl^- B	0.5 mg/L	0.0
Phenolic Compounds (as Phenols)	SMWW 5530 D	NGVS	0.00
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.255
Microbiological Analysis			
Total Coliforms	SMWW 9222 B	0/ 100 mL CFU	2
Fecal Coliforms	SMWW 9222 D	0/ 100 mL CFU	0

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DRINKING WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Drinking Water	**Reporting Date**	05-11-2020
Grab/Composite	Grab	**Analysis Completion Date**	05-11-2020
Sampling Date	26-10-2020	**Sample Collected by/Sent By**	-
Sample ID	EGEL-DW-40/2020	**Sample Receiving Date**	30-10-2020
Sampling Coordinates	24°19.3870'N 70°39.7060'E	**Sampling Location**	Sudran Nadi

Drinking Water Analysis Results

Parameter	Analysis Method	SEQS	Results
Lab Analysis			
Color	SMWW 2120 C	≤ 15 TCU	0.0
Taste	SMWW 2160 C	Non- Objectionable	Non- Objectionable
Odor	SMWW 2150 B	Non- Objectionable	Non- Objectionable
Turbidity	SMWW 2130 B	< 5 NTU	0.0
Total Hardness (as $CaCO_3$)	SMWW 2340 C	< 500 mg/L	176
Total Dissolved Solids (TDS)	SMWW 2540 C	< 1000 mg/L	414
pH	SMWW 4500 H^+ B	6.5- 8.5	7.82
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	0.005
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	<0.005
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.05
Barium (Ba)	SMWW 3113 B	0.7 mg/L	0.03
Boron (B)	SMWW 3113 B	0.3 mg/l	0.028
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	0.009
Chloride (Cl^-)	SMWW 4500 Cl^- B	< 250 mg/L	50
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	0.025
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.245
Cyanide (CN^-)	SMWW 4500 CN^- F	≤ 0.05 mg/L	0.0
Fluoride (F^-)	SMWW 4500 F^- C	≤ 1.5 mg/L	0.0
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	0.042
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.079
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	0.014
Nitrate (NO_3^-)	SMWW 4500 NO_3^- B	≤ 50 mg/L	1.58
Nitrite (NO_2^-)	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0.08
Selenium (Se)	SMWW 3114 B	0.01 mg/L	0.01
Residual Chlorine (Cl_2)	SMWW 4500 Cl^- B	0.5 mg/L	0.0
Phenolic Compounds (as Phenols)	SMWW 5530 D	NGVS	0.0
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.246
Microbiological Analysis			
Total Coliforms	SMWW 9222 B	0/ 100 mL CFU	1
Fecal Coliforms	SMWW 9222 D	0/ 100 mL CFU	0

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DRINKING WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Drinking Water	**Reporting Date**	05-11-2020
Grab/Composite	Grab	**Analysis Completion Date**	05-11-2020
Sampling Date	27-10-2020	**Sample Collected by/Sent By**	-
Sample ID	EGEL-DW-41/2020	**Sample Receiving Date**	30-10-2020
Sampling Coordinates	24°18.1790'N 70°39.5550'E	**Sampling Location**	Adhigam-Syed Ahm Shah

Drinking Water Analysis Results

Parameter	Analysis Method	SEQS	Results
Lab Analysis			
Color	SMWW 2120 C	≤ 15 TCU	0.0
Taste	SMWW 2160 C	Non- Objectionable	Non- Objectionable
Odor	SMWW 2150 B	Non- Objectionable	Non- Objectionable
Turbidity	SMWW 2130 B	< 5 NTU	0.00
Total Hardness (as $CaCO_3$)	SMWW 2340 C	< 500 mg/L	174
Total Dissolved Solids (TDS)	SMWW 2540 C	< 1000 mg/L	474
pH	SMWW 4500 H^+ B	6.5- 8.5	8.03
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	0.002
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	<0.005
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.05
Barium (Ba)	SMWW 3113 B	0.7 mg/L	0.1
Boron (B)	SMWW 3113 B	0.3 mg/l	0.021
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	0.008
Chloride (Cl^-)	SMWW 4500 Cl^- B	< 250 mg/L	50
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	0.024
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.235
Cyanide (CN^-)	SMWW 4500 CN F	≤ 0.05 mg/L	0.0
Fluoride (F^-)	SMWW 4500 F^- C	≤ 1.5 mg/L	0.0
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	0.048
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.085
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001
Nickel (Ni)	SMWW 3113 B	<0.02 mg/L	0.019
Nitrate (NO_3^-)	SMWW 4500 NO_3^- B	≤ 50 mg/L	0.82
Nitrite (NO_2^-)	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0.05
Selenium (Se)	SMWW 3114 B	0.01 mg/L	0.01
Residual Chlorine (Cl_2)	SMWW 4500 Cl^- B	0.5 mg/L	0.0
Phenolic Compounds (as Phenols)	SMWW 5530 D	NGVS	0.00
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.219
Microbiological Analysis			
Total Coliforms	SMWW 9222 B	0/ 100 mL CFU	3
Fecal Coliforms	SMWW 9222 D	0/ 100 mL CFU	0

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DRINKING WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Drinking Water	Reporting Date	05-11-2020
Grab/Composite	Grab	Analysis Completion Date	05-11-2020
Sampling Date	27-10-2020	Sample Collected by/Sent By	-
Sample ID	EGEL-DW-42/2020	Sample Receiving Date	30-10-2020
Sampling Coordinates	24°18.0500'N 70°44.2470'E	Sampling Location	Nagar-2 (Layari)

Drinking Water Analysis Results

Parameter	Analysis Method	SEQS	Results
Lab Analysis			
Color	SMWW 2120 C	≤ 15 TCU	0.0
Taste	SMWW 2160 C	Non- Objectionable	Salty
Odor	SMWW 2150 B	Non- Objectionable	Non- Objectionable
Turbidity	SMWW 2130 B	< 5 NTU	0.0
Total Hardness (as $CaCO_3$)	SMWW 2340 C	< 500 mg/L	670
Total Dissolved Solids (TDS)	SMWW 2540 C	< 1000 mg/L	1924
pH	SMWW 4500 H+ B	6.5- 8.5	7.57
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	<0.001
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	<0.005
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.07
Barium (Ba)	SMWW 3113 B	0.7 mg/L	0.03
Boron (B)	SMWW 3113 B	0.3 mg/l	0.023
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	0.007
Chloride (Cl^-)	SMWW 4500 Cl- B	< 250 mg/L	724
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	0.026
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.274
Cyanide (CN^-)	SMWW 4500 CN- F	≤ 0.05 mg/L	0.0
Fluoride (F^-)	SMWW 4500 F- C	≤ 1.5 mg/L	0.06
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	0.046
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.088
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	0.015
Nitrate (NO_3^-)	SMWW 4500 NO_3^- B	≤ 50 mg/L	0.86
Nitrite (NO_2^-)	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0.05
Selenium (Se)	SMWW 3114 B	0.01 mg/L	<0.01
Residual Chlorine (Cl_2)	SMWW 4500 Cl- B	0.5 mg/L	0.0
Phenolic Compounds (as Phenols)	SMWW 5530 D	NGVS	0.06
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.262
Microbiological Analysis			
Total Coliforms	SMWW 9222 B	0/ 100 mL CFU	11
Fecal Coliforms	SMWW 9222 D	0/ 100 mL CFU	2

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DRINKING WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Drinking Water	**Reporting Date**	05-11-2020
Grab/Composite	Grab	**Analysis Completion Date**	05-11-2020
Sampling Date	27-10-2020	**Sample Collected by/Sent By**	-
Sample ID	EGEL-DW-43/2020	**Sample Receiving Date**	30-10-2020
Sampling Coordinates	24°17'10.74"N 70°42'31.50"E	**Sampling Location**	Jhanjhoo Nadi

Drinking Water Analysis Results

Parameter	Analysis Method	SEQS	Results
Lab Analysis			
Color	SMWW 2120 C	≤ 15 TCU	0.0
Taste	SMWW 2160 C	Non- Objectionable	Salty
Odor	SMWW 2150 B	Non- Objectionable	Non- Objectionable
Turbidity	SMWW 2130 B	< 5 NTU	9.77
Total Hardness (as $CaCO_3$)	SMWW 2340 C	< 500 mg/L	680
Total Dissolved Solids (TDS)	SMWW 2540 C	< 1000 mg/L	1982
pH	SMWW 4500 H^+ B	6.5- 8.5	7.66
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	0.004
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	<0.005
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.05
Barium (Ba)	SMWW 3113 B	0.7 mg/L	0.02
Boron (B)	SMWW 3113 B	0.3 mg/l	0.03
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	0.009
Chloride (Cl^-)	SMWW 4500 Cl^- B	< 250 mg/L	734
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	0.028
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.246
Cyanide (CN^-)	SMWW 4500 CN^- F	≤ 0.05 mg/L	0.042
Fluoride (F^-)	SMWW 4500 F^- C	≤ 1.5 mg/L	0.083
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	<0.001
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.018
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	0.02
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	0.254
Nitrate (NO_3)	SMWW 4500 NO_3^- B	≤ 50 mg/L	0.78
Nitrite (NO_2)	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0.04
Selenium (Se)	SMWW 3114 B	0.01 mg/L	0.02
Residual Chlorine (Cl_2)	SMWW 4500 Cl^- B	0.5 mg/L	0.0
Phenolic Compounds (as Phenols)	SMWW 5530 D	NGVS	0.0
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.254
Microbiological Analysis			
Total Coliforms	SMWW 9222 B	0/ 100 mL CFU	13
Fecal Coliforms	SMWW 9222 D	0/ 100 mL CFU	4

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DRINKING WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Drinking Water	**Reporting Date**	05-11-2020
Grab/Composite	Grab	**Analysis Completion Date**	05-11-2020
Sampling Date	26-10-2020	**Sample Collected by/Sent By**	-
Sample ID	EGEL-DW-44/2020	**Sample Receiving Date**	30-10-2020
Sampling Coordinates	24°16.1640'N 70°38.3960'E	**Sampling Location**	Pathar

Drinking Water Analysis Results

Parameter	Analysis Method	SEQS	Results
Lab Analysis			
Color	SMWW 2120 C	≤ 15 TCU	0.0
Taste	SMWW 2160 C	Non- Objectionable	Non- Objectionable
Odor	SMWW 2150 B	Non- Objectionable	Non- Objectionable
Turbidity	SMWW 2130 B	< 5 NTU	15.59
Total Hardness (as $CaCO_3$)	SMWW 2340 C	< 500 mg/L	120
Total Dissolved Solids (TDS)	SMWW 2540 C	< 1000 mg/L	172
pH	SMWW 4500 H^+ B	6.5- 8.5	8.31
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	0.003
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	<0.005
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.04
Barium (Ba)	SMWW 3113 B	0.7 mg/L	0.01
Boron (B)	SMWW 3113 B	0.3 mg/l	0.022
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	0.008
Chloride (Cl^-)	SMWW 4500 Cl^- B	< 250 mg/L	8.4
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	0.026
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.275
Cyanide (CN^-)	SMWW 4500 CN^- F	≤ 0.05 mg/L	0.0
Fluoride (F^-)	SMWW 4500 F^- C	≤ 1.5 mg/L	0.0
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	0.044
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.095
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	0.012
Nitrate (NO_3^-)	SMWW 4500 NO_3^- B	≤ 50 mg/L	0.02
Nitrite (NO_2^-)	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0.00
Selenium (Se)	SMWW 3114 B	0.01 mg/L	0.01
Residual Chlorine (Cl_2)	SMWW 4500 Cl^- B	0.5 mg/L	0.0
Phenolic Compounds (as Phenols)	SMWW 5530 D	NGVS	0.01
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.259
Microbiological Analysis			
Total Coliforms	SMWW 9222 B	0/ 100 mL CFU	12
Fecal Coliforms	SMWW 9222 D	0/ 100 mL CFU	3

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DRINKING WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Drinking Water	**Reporting Date**	05-11-2020
Grab/Composite	Grab	**Analysis Completion Date**	05-11-2020
Sampling Date	25-10-2020	**Sample Collected by/Sent By**	-
Sample ID	EGEL-DW-45/2020	**Sample Receiving Date**	30-10-2020
Sampling Coordinates	24°23.4350'N 71°2.2290'E	**Sampling Location**	Targaam Budhesar

Drinking Water Analysis Results

Parameter	Analysis Method	SEQS	Results
Lab Analysis			
Color	SMWW 2120 C	≤ 15 TCU	0.0
Taste	SMWW 2160 C	Non- Objectionable	Non- Objectionable
Odor	SMWW 2150 B	Non- Objectionable	Non- Objectionable
Turbidity	SMWW 2130 B	< 5 NTU	0.00
Total Hardness (as $CaCO_3$)	SMWW 2340 C	< 500 mg/L	290
Total Dissolved Solids (TDS)	SMWW 2540 C	< 1000 mg/L	507
pH	SMWW 4500 H^+ B	6.5- 8.5	7.92
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	0.004
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	<0.005
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.005
Barium (Ba)	SMWW 3113 B	0.7 mg/L	0.021
Boron (B)	SMWW 3113 B	0.3 mg/l	0.03
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	0.008
Chloride (Cl^-)	SMWW 4500 Cl^- B	< 250 mg/L	124
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	0.023
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.262
Cyanide (CN^-)	SMWW 4500 CN F	≤ 0.05 mg/L	0.0
Fluoride (F^-)	SMWW 4500 F^- C	≤ 1.5 mg/L	0.0
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	0.049
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.069
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	0.019
Nitrate (NO_3^-)	SMWW 4500 NO_3^- B	≤ 50 mg/L	0.04
Nitrite (NO_2^-)	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0.01
Selenium (Se)	SMWW 3114 B	0.01 mg/L	0.03
Residual Chlorine (Cl_2)	SMWW 4500 Cl^- B	0.5 mg/L	0.0
Phenolic Compounds (as Phenols)	SMWW 5530 D	NGVS	0.00
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.252
Microbiological Analysis			
Total Coliforms	SMWW 9222 B	0/ 100 mL CFU	2
Fecal Coliforms	SMWW 9222 D	0/ 100 mL CFU	0

SEQS= Sindh Environmental Quality Standards (The Gazette of Pakistan) Registered No. EPA/TECH/739/2014

Note:

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- The left over samples (if so available) shall be retained for fifteen days after the issuance of the report unless otherwise negotiated between the client and the laboratory.

Analyzed By

Reviewed By
(TM)

Approved By
(QM)

Evergreen Environmental Laboratory Karachi

24°23.4350'N, 71°2.2290'E
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SURFACE WATER ANALYSIS REPORT

Sample Detail

Nature of Sample	Surface Water	**Reporting Date**	05-11-2020
Grab/Composite	Grab	**Analysis Completion Date**	05-11- 2020
Sampling Date	25-10-2020	**Sample Collected by/Sent By**	-
Sample ID	EGEL-SW-14/2020	**Sample Receiving Date**	30-10-2020
Sampling Coordinates	24°28.6610' N 70°53.1390'E	**Sampling Location**	Namaro

Surface Water Analysis Results

Sr. No.	Parameter	Analysis Method	Result	SEQS Limits
	Field Analysis			
1	Temperature	SMWW 2550 B	22.0	≤ 3°C
	Lab Analysis			
2	pH	SMWW 4500 H+ B	6.92	6-9
3	Biochemical Oxygen Demand (BOD_5)	SMWW 5210-B	07	250
4	Chemical Oxygen Demand (COD)	SMWW 5220 B	18	400
5	Total Suspended Solids (TSS)	SMWW 2540 D	27	400
6	Total Dissolved Solids (TDS)	SMWW 2540 C	153	3500
7	Phenolic Compounds (as Phenols)	SMWW 5530 D	0.0	0.3
8	Grease and Oil	USEPA 1664 B	0.0	10
9	Chloride (Cl^-)	SMWW 4500 Cl- B	21	1000
10	Fluoride (F^-)	SMWW 4500 F- C	0.0	10
11	Cyanide (CN^-)	SMWW 4500 CN- F	0.0	1.0
12	An-ionic Detergents (as MBAs)	SMWW 5540-C	0.0	20
13	Sulfate (SO_4^{-2})	SMWW 4500 SO_4^{-2} C	21	600
14	Sulfide (S^{-2})	SMWW 4500 S^{-2} F	0.0	1.0
15	Ammonia (NH_3)	SMWW 4500-NH_3 D	0.0	40
16	Cadmium (Cd)	SMWW 3113 B	<0.006	0.1
17	Chromium (Cr)	SMWW 3113 B	0.004	1.0
18	Copper (Cu)	SMWW 3113 B	<0.164	1.0
19	Lead (Pb)	SMWW 3113 B	0.006	0.5
20	Mercury (Hg)	SMWW 3112 B	0.002	0.01
21	Selenium (Se)	SMWW 3114 B	<0.01	0.5
22	Nickel (Ni)	SMWW 3113 B	0.022	1.0
23	Silver (Ag)	SMWW 3113 B	0.011	1.0
24	Total Toxic Metals	Calculated Value	0.271	2.0
25	Zinc (Zn)	SMWW 3111 B	0.058	5.0
26	Arsenic (As)	SMWW 3114 B	0.005	1.0
27	Barium (Ba)	SMWW 3113 B	0.008	1.5
28	Iron (Fe)	SMWW 3113 B	0.562	8.0
29	Manganese (Mn)	SMWW 3111 B	0.024	1.5
30	Boron (B)	SMWW 3113 B	0.03	6.0
31	Residual Chlorine (Cl_2)	SMWW 4500 Cl- B	0.0	1.0

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Evergreen Environmental Laboratory

Customer's Ref: 10452/ACE/SRP/AW-002R **Date: 14-11-2020**

Report to: **M/s ACE (Pvt) Ltd**
Project Office Bungalow # D-37,
Miran Mohammad Shah Road,
Mohammad Ali Society,
KDA-Scheme-1, Karachi, Sindh, Pakistan. .

Project ID: **SRP- Sindh Resilience Project.**
Site ID: Gordhro-2 Sr # 39
Sampling Coordinates: **24°22.4310'N**
71°2.4610'E
Lab. Rpt. Rf. No.: **28371/EGEL/ACE/AE/2020/48**

Sampling Date: ***24-11-2020***
Sample type: ***Ambient air***

ANALYTICAL TEST REPORT

Sr. No.	Parameters	Units	Min	Max	Average	SEQS Limits
1	Carbon Monoxide (CO)	mg/Nm^3	0.96	1.2	1.08	5
2	Sulfur Dioxide (SO_2)	µg/Nm3	8.6	9.3	8.95	120
3	Nitrogen Monoxide (NO)		2.9	3.5	3.2	40
4	Nitrogen Dioxide (NO_2)		9.1	10.2	9.65	80
5	Particulate Matter (PM_{10})		115	128	121.5	150
6	Particulate Matter ($PM_{2.5}$)		28	35	31.5	75

❖ *SEQS – Sindh Environmental Quality Standards (The Gazette of Pakistan) Registered No. EPA/TECH/739/2016*

Note:

- Selected measurement units were µg/m^3 otherwise stated.
- Quality was assured through self-calibration of the instrument.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
- The report is not valid for any negotiations.

Remarks: The Ambient Air & Noise Sampling results are well within guideline values set by SEQS.

Prepared By	Section In charge (EGEL)

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Customer's Ref: 10452/ACE/SRP/AW-002R **Date: 14-11-2020**

Report to: **M/s ACE (Pvt) Ltd**
Project Office Bungalow # D-37,
Miran Mohammad Shah Road,
Mohammad Ali Society,
KDA-Scheme-1, Karachi, Sindh, Pakistan. .

Project ID: **SRP- Sindh Resilience Project.**
Site ID: Sohrio Wah Sr # 36
Sampling Coordinates: **24°30.0470'N**
70°52.9020'E
Lab. Rpt. Rf. No.: **28371/EGEL/ACE/AE/2020/49**

Sampling Date: ***24-11-2020***
Sample type: ***Ambient air***

ANALYTICAL TEST REPORT

Sr. No.	Parameters	Units	Min	Max	Average	SEQS Limits
1	Carbon Monoxide (CO)	mg/Nm^3	0.74	0.85	0.795	5
2	Sulfur Dioxide (SO_2)	µg/Nm3	8.4	8.9	8.65	120
3	Nitrogen Monoxide (NO)		2.6	2.9	2.75	40
4	Nitrogen Dioxide (NO_2)		8.2	9.4	8.8	80
5	Particulate Matter (PM_{10})		124	132	128	150
6	Particulate Matter ($PM_{2.5}$)		25	29	27	75

❖ *SEQS– Sindh Environmental Quality Standards (The Gazette of Pakistan) Registered No. EPA/TECH/739/2016.*

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Date: 14-11-2020

Customer's Ref: 10452/ACE/SRP/AW-002R

Report to: **M/s ACE (Pvt) Ltd**
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Mohammad Ali Society,
KDA-Scheme-1, Karachi, Sindh, Pakistan.

Project ID: **SRP- Sindh Resilience Project.**
Site ID: Targaam Budhesar Sr # 45
Sampling Coordinates: **24°22.4310'N**
71°2.4610'E
Lab. Rpt. Rf. No.: **28371/EGEL/ACE/AE/2020/50**

Sampling Date: ***24-11-2020***
Sample type: ***Ambient air***

ANALYTICAL TEST REPORT

Sr. No.	Parameters	Units	Min	Max	Average	SEQS Limits
1	Carbon Monoxide (CO)	mg/Nm³	0.91	0.99	0.95	5
2	Sulfur Dioxide (SO_2)	µg/Nm3	8.8	9.5	9.15	120
3	Nitrogen Monoxide (NO)		2.4	2.8	2.6	40
4	Nitrogen Dioxide (NO_2)		9.7	10.8	10.25	80
5	Particulate Matter (PM_{10})		128	137	132.5	150
6	Particulate Matter ($PM_{2.5}$)		26	31	28.5	75

❖ *SEQS- Sindh Environmental Quality Standards (The Gazette of Pakistan) Registered No. EPA/TECH/739/2016*

Note:

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Report to: **M/s ACE (Pvt) Ltd**
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Miran Mohammad Shah Road,
Mohammad Ali Society,
KDA-Scheme-1, Karachi, Sindh, Pakistan. .

Project ID: **SRP- Sindh Resilience Project.**
Site ID: Sudran Nadi Sr # 40
Sampling Coordinates: **24°19.5140'N**
70°40.2290'E
Lab. Rpt. Rf. No.: **28371/EGEL/ACE/AE/2020/51**

Sampling Date: 25-11-2020
*Sample type: **Ambient air***

ANALYTICAL TEST REPORT

Sr. No.	Parameters	Units	Min	Max	Average	SEQS Limits
1	Carbon Monoxide (CO)	mg/Nm^3	0.94	1.1	1.02	5
2	Sulfur Dioxide (SO_2)	µg/Nm3	7.3	8.5	7.9	120
3	Nitrogen Monoxide (NO)		2.4	2.9	2.65	40
4	Nitrogen Dioxide (NO_2)		10.2	11.1	10.65	80
5	Particulate Matter (PM_{10})		105	112	108.5	150
6	Particulate Matter ($PM_{2.5}$)		29	33	31	75

❖ *SEQS– Sindh Environmental Quality Standards (The Gazette of Pakistan) Registered No. EPA/TECH/739/2016.*

Note:

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Customer's Ref: 10452/ACE/SRP/AW-002R

Date: 14-11-2020

Report to: **M/s ACE (Pvt) Ltd**
Project Office Bungalow # D-37,
Miran Mohammad Shah Road,
Mohammad Ali Society,
KDA-Scheme-1, Karachi, Sindh, Pakistan.

Project ID: **SRP- Sindh Resilience Project.**
Site ID: Pathar Sr # 44
Sampling Coordinates: **24°15.7320'N**
70°37.5750'E
Lab. Rpt. Rf. No.: **28371/EGEL/ACE/AE/2020/52**

*Sampling Date: **25-11-2020***
*Sample type: **Ambient air***

ANALYTICAL TEST REPORT

Sr. No.	Parameters	Units	Min	Max	Average	SEQS Limits
1	Carbon Monoxide (CO)	mg/Nm^3	0.79	0.93	0.86	5
2	Sulfur Dioxide (SO_2)	µg/Nm3	8.9	9.3	9.1	120
3	Nitrogen Monoxide (NO)		3.5	3.9	3.7	40
4	Nitrogen Dioxide (NO_2)		9.9	10.5	10.2	80
5	Particulate Matter (PM_{10})		125	129	127	150
6	Particulate Matter ($PM_{2.5}$)		30	33	31.5	75

❖ *SEQS- Sindh Environmental Quality Standards (The Gazette of Pakistan) Registered No. EPA/TECH/739/2016.*

Note:

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Prepared By

Section In Charge (EGEL)

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Customer's Ref: 10452/ACE/SRP/AW-002R **Date: 14-11-2020**

Report to: **M/s ACE (Pvt) Ltd**
Project Office Bungalow # D-37,
Miran Mohammad Shah Road,
Mohammad Ali Society,
KDA-Scheme-1, Karachi, Sindh, Pakistan. .

Project ID: **SRP- Sindh Resilience Project.**
Site ID: Nagar - 2 (Layari) Sr # 42
Sampling Coordinates: **24°18.0500'N**
70°44.2470'E
Lab. Rpt. Rf. No.: **28371/EGEL/ACE/AE/2020/53**

*Sampling Date: **25-11-2020***
*Sample type: **Ambient air***

ANALYTICAL TEST REPORT

Sr. No.	Parameters	Units	Min	Max	Average	SEQS Limits
1	Carbon Monoxide (CO)	mg/Nm^3	0.69	0.77	0.73	5
2	Sulfur Dioxide (SO_2)	µg/Nm3	6.8	7.6	7.2	120
3	Nitrogen Monoxide (NO)		3.3	3.9	3.6	40
4	Nitrogen Dioxide (NO_2)		7.9	8.7	8.3	80
5	Particulate Matter (PM_{10})		88	93	90.5	150
6	Particulate Matter ($PM_{2.5}$)		25	29	27	75

❖ *SEQS – Sindh Environmental Quality Standards (The Gazette of Pakistan) Registered No. EPA/TECH/739/2016.*

Note:

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Evergreen Environmental Laboratory

Customer's Ref: 10452/ACE/SRP/AW-002R **Date: 14-11-2020**

Report to: **M/s ACE (Pvt) Ltd**
Project Office Bungalow # D-37,
Miran Mohammad Shah Road,
Mohammad Ali Society,
KDA-Scheme-1, Karachi, Sindh, Pakistan.

Project ID: **SRP- Sindh Resilience Project.**
Site ID: Jharando-2 Sr # 30
Sampling Coordinates: **24°22.4310'N**
71°2.4610'E
Lab Rpt Rf. No.: **28371/EGEL/ACE/AE/2020/54**

*Sampling Date: **26-11-2020***
*Sample type: **Ambient air***

ANALYTICAL TEST REPORT

Sr. No.	Parameters	Units	Min	Max	Average	SEQS Limits
1	**Carbon Monoxide (CO)**	**mg/Nm^3**	**0.66**	**0.74**	**0.7**	**5**
2	**Sulfur Dioxide (SO_2)**	**µg/Nm3**	**8.5**	**9.9**	**9.2**	**120**
3	**Nitrogen Monoxide (NO)**		**2.1**	**2.9**	**2.5**	**40**
4	**Nitrogen Dioxide (NO_2)**		**11.3**	**13.8**	**12.55**	**80**
5	**Particulate Matter (PM_{10})**		**125**	**138**	**131.5**	**150**
6	**Particulate Matter ($PM_{2.5}$)**		**30**	**35**	**32.5**	**75**

❖ *SEQS- Sindh Environmental Quality Standards (The Gazette of Pakistan) Registered No. EPA/TECH/739/2016.*

Note:

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Customer's Ref: 10452/ACE/SRP/AW-002R **Date: 14-11-2020**

Report to: **M/s ACE (Pvt) Ltd**
Project Office Bungalow # D-37,
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KDA-Scheme-1, Karachi, Sindh, Pakistan.

Project ID: **SRP- Sindh Resilience Project.**
Site ID: Bhatta Siro-2 Sr # 30
Sampling Coordinates: **24°22.4310'N**
71°2.4610'E
Lab. Rpt. Rf. No.: **28371/EGEL/ACE/AE/2020/54**

Sampling Date: ***26-11-2020***
Sample type: ***Ambient air***

ANALYTICAL TEST REPORT

Sr. No.	Parameters	Units	Min	Max	Average	SEQS Limits
1	Carbon Monoxide (CO)	mg/Nm^3	0.66	0.74	0.7	5
2	Sulfur Dioxide (SO_2)	µg/Nm3	8.5	9.9	9.2	120
3	Nitrogen Monoxide (NO)		2.1	2.9	2.5	40
4	Nitrogen Dioxide (NO_2)		11.3	13.8	12.55	80
5	Particulate Matter (PM_{10})		125	138	131.5	150
6	Particulate Matter ($PM_{2.5}$)		30	35	32.5	75

✣ *SEQS= Sindh Environmental Quality Standards (The Gazette of Pakistan) Registered No. EPA/TECH/739/2016*

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Noise Level Monitoring Report

Monitoring Detail

Reference No. 10452/ACE/SRP/N-002R **Reporting Date** 17-11-2020
Monitoring Date 23 to 27 Oct, 2020 **Instrument** BSWA Noise Meter

Sr. No.	Proposed Dam Site	Location of Noise Monitoring	Coordinates	Results			SEQS Levels
				Min	Max	Average	
1	Bhatta Siro 2	Dam Axis	24°30'34.47"N 70°52'33.07"E	30.5	32.9	31.7	
		Mosque	24°31'7.64"N 70°51'22.25"E	36.3	37.8	37.1	
2	Sohrio Wah	Dam Axis	24°30'1.81"N 70°52'53.63"E	34.9	38.6	36.8	
		Near Mosque	24°31.1960'N 70°51.5200'E	31.5	33.9	32.7	
		School	24°29'54.36"N 70°52'41.49"E	40.7	42.3	41.5	
3	Namaro	Mosque	24°28'41.71"N 70°53'0.35"E	32.3	36.8	34.6	
		Dam Axis	24°28'40.96"N 70°53'12.03"E	48.2	50.2	49.2	
		Village	24°28'29.32"N 70°53'10.64"E	45.5	49.7	47.6	
4	Viakasar	Dam Axis	24°21'52.57"N 70°36'6.48"E	31.5	33.9	32.7	
		Village	24°21.6390'N 70°36.3640'E	43.2	46.2	44.7	
		Temple	24°21'42.61"N 70°36'16.47"E	38.3	40.8	39.6	
5	Gordhro-2	Dam Axis	24°21'52.96"N 70°46'35.33"E	32.5	36.4	34.5	
		Road	24°21'25.31"N 70°46'28.02"E	35.3	36.8	36.1	
6	Sudran Nadi	Main Road	24°21'14.88"N 70°45'33.86"E	40.8	43.9	42.4	
		Dam Axis	24°19'31.84"N 70°40'8.01"E	41.3	43.6	42.5	55 dB (A)
		Village	24°19.3750'N 70°39.7040'E	43.5	45.9	44.7	
		Bazar	24°19'32.72"N 70°39'39.41"E	42.1	43.7	42.9	
7	Adhigam - Syed Alam Shah	Dam Axis	24°17'57.44"N 70°40'5.46"E	37.6	41.5	39.6	
		Temple	24°18'8.38"N 70°39'38.95"E	39.5	43.5	41.5	
		School	24°18'4.50"N 70°39'29.15"E	35.3	36.8	36.1	
8	Nagar - 2 (Layari)	Dam Axis	24°18'4.65"N 70°44'17.22"E	31.5	33.9	32.7	
		Village	24°17'54.74"N 70°44'11.61"E	44.2	46.2	45.2	
9	Jhanjhoo Nadi	Dam Axis	24°17'20.65"N 70°42'24.21"E	48.7	53.4	51.1	
		Mosque	24°17'17.87"N 70°42'27.69"E	31.5	35.4	33.5	
		Village	24°17'10.14"N 70°42'30.06"E	45.9	55.9	50.9	
10	Pathar	Dam Axis	24°15'29.33"N 70°37'30.75"E	43.9	55.3	49.6	
		School	24°16'8.48"N 70°38'0.82"E	37.6	41.5	39.6	
		Mosque	24°16'16.39"N 70°38'6.91"E	41.5	43.7	42.6	
	Targaam Budhesar	Dam Axis	24°22'22.71"N 71° 2'29.65"E	39.5	43.5	41.5	
		School	24°23'23.00"N 71° 2'14.34"E	38.4	42.3	40.4	
		Main Track	24°23'13.51"N 71° 2'1.89"E	42.9	45.9	44.4	

❖ *SEQS - Sindh Environmental Quality Standards (The Gazette of Pakistan) Registered No. EPA/TECH/739/2016*

Note:

- Quality was assured through self-calibration of the instrument.
- The measurements were carried out on client request.
- The client is responsible lawful usage of reported data in future.
- The report is not valid for any negotiations.

Remarks: The Ambient Air & Noise Sampling results are well within guideline values set by SEQS.

Prepared By

Section In charge (EGEL)

Evergreen Environmental Laboratory S.E.P.A. Certified Karachi

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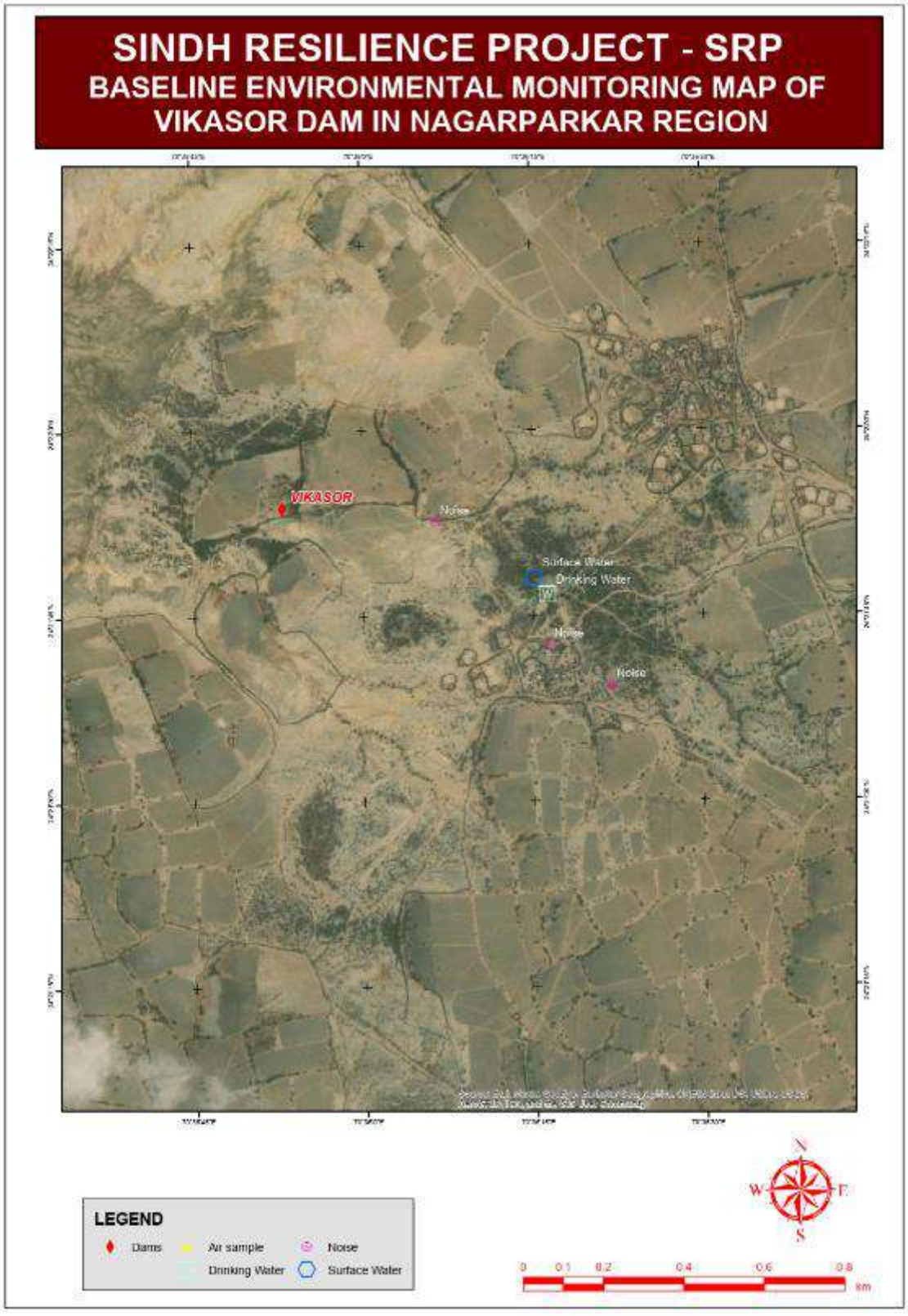
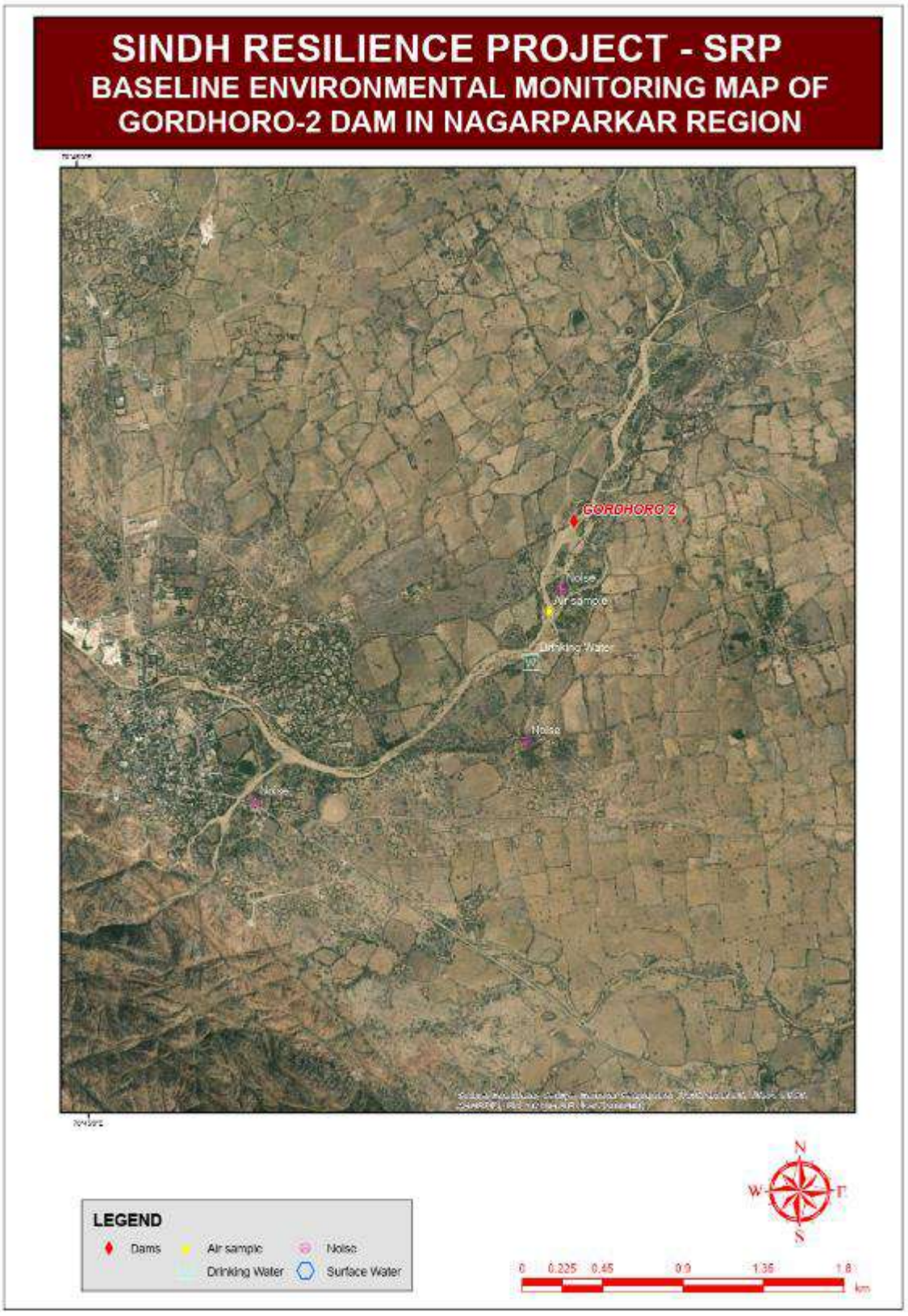
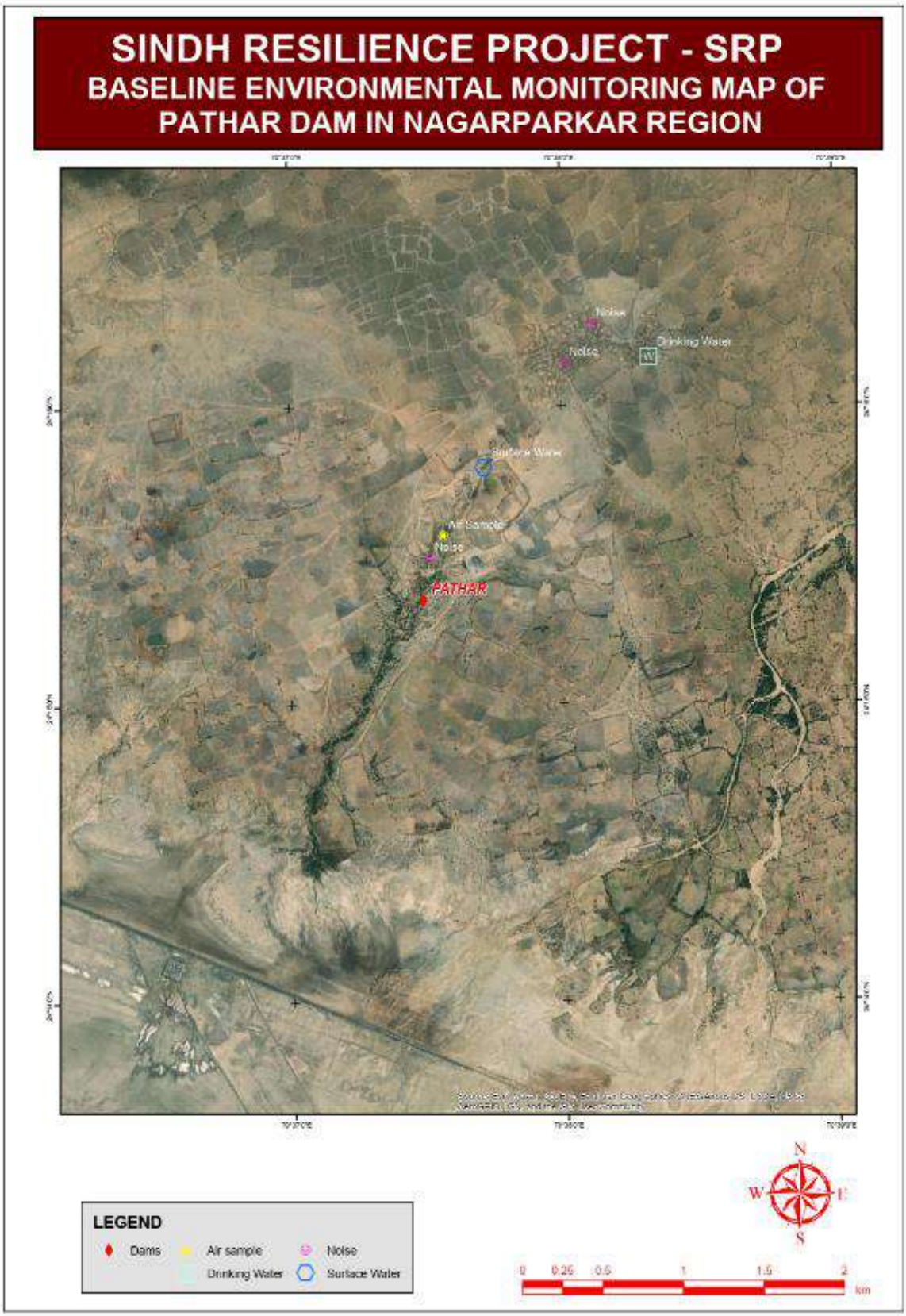
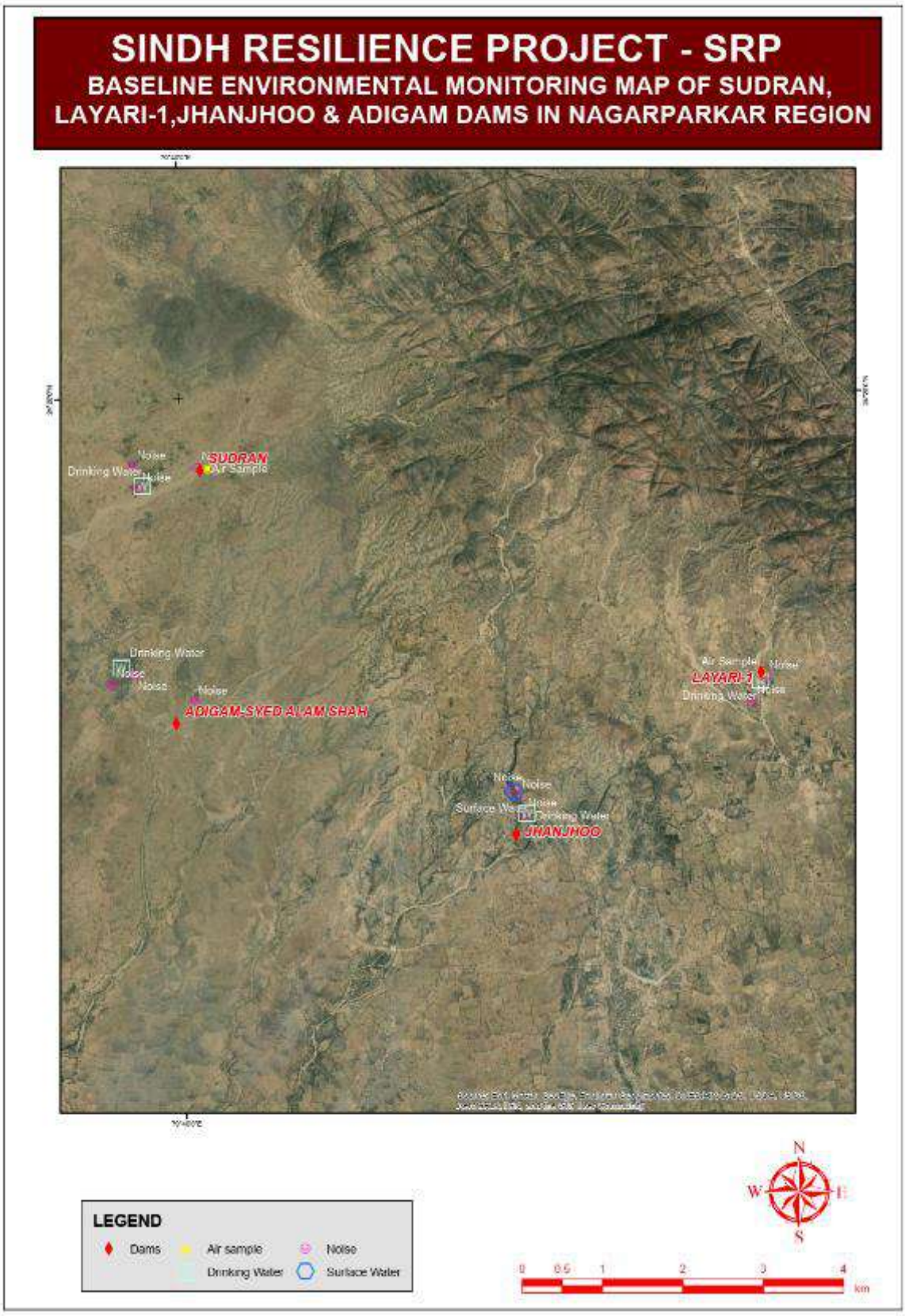
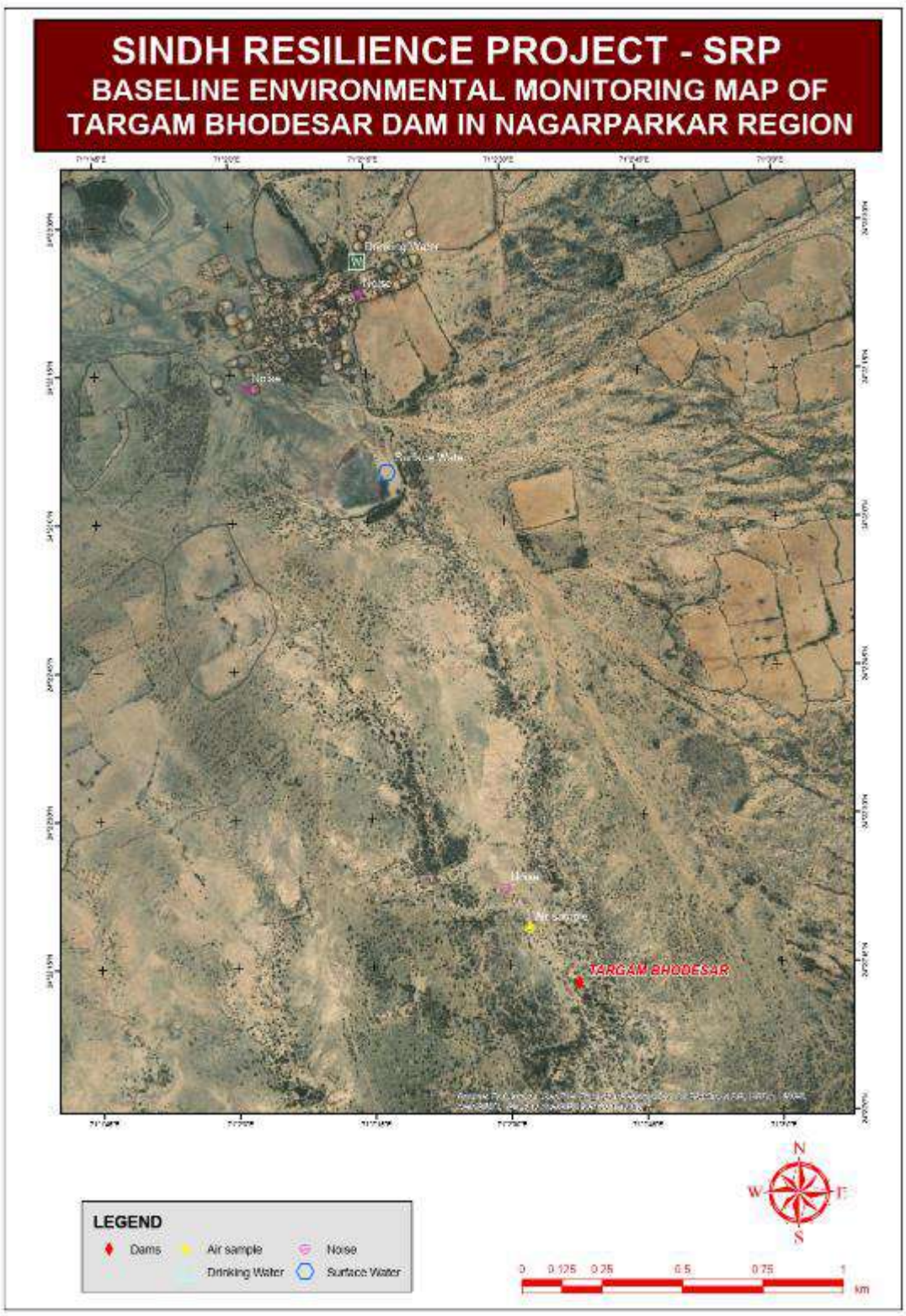

SINDH RESILIENCE PROJECT - SRP
BASELINE ENVIRONMENTAL MONITORING MAP OF VIKASOR DAM IN NAGARPARKAR REGION
VIKASOR
Noise
Surface Water
Drinking Water
Noise
Noise
LEGEND
Dams
Air sample
Noise
Drinking Water
Surface Water
N
W
E
S
0
0.1
0.2
0.4
0.6
0.8
km

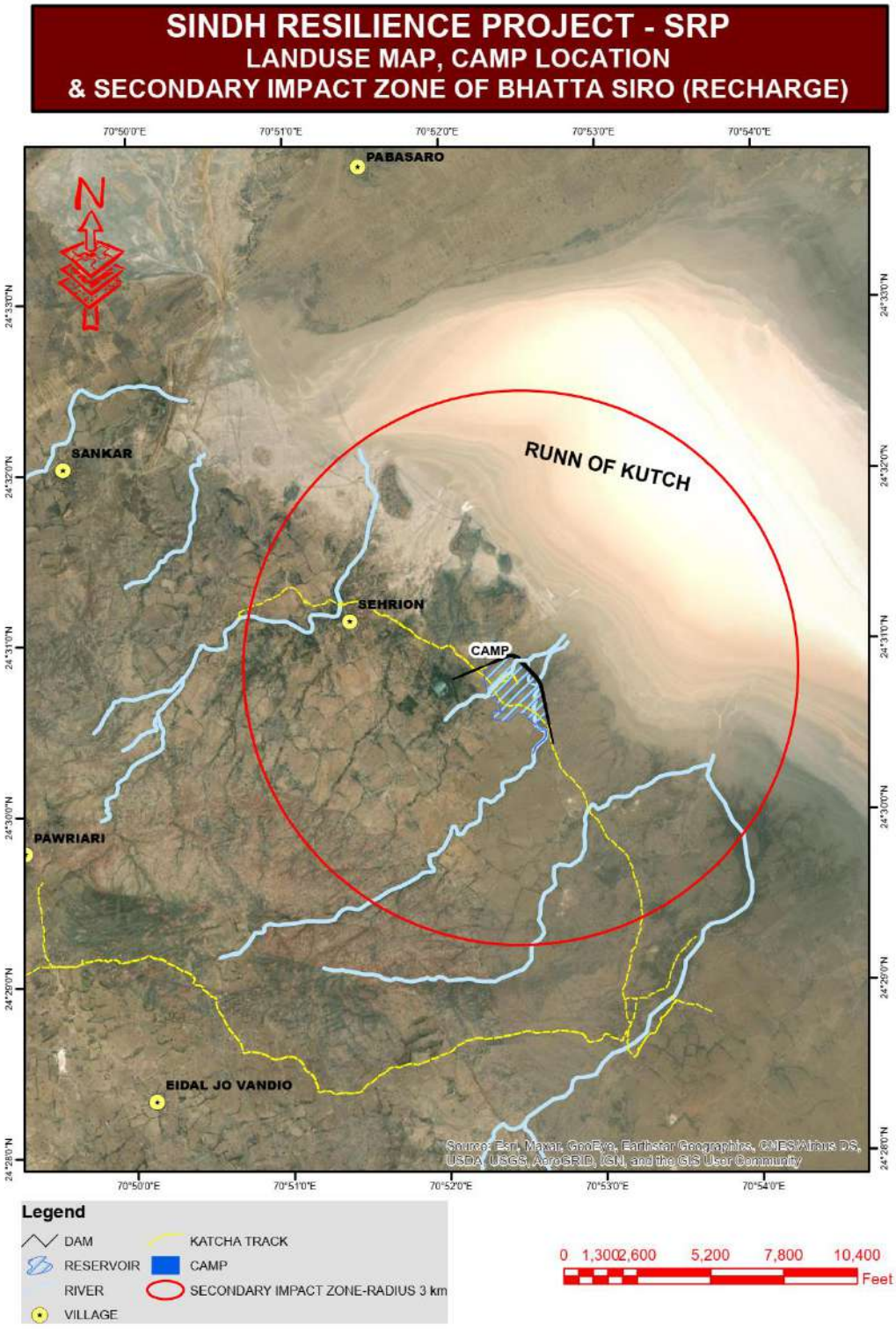

SINDH RESILIENCE PROJECT - SRP
BASELINE ENVIRONMENTAL MONITORING MAP OF GORDHORO-2 DAM IN NAGARPARKAR REGION
GORDHORO 2
Noise
Air sample
Drinking Water
Noise
Noise
LEGEND
Dams
Air sample
Noise
Drinking Water
Surface Water
N
W
E
S
0
0.225
0.45
0.9
1.35
1.8
km

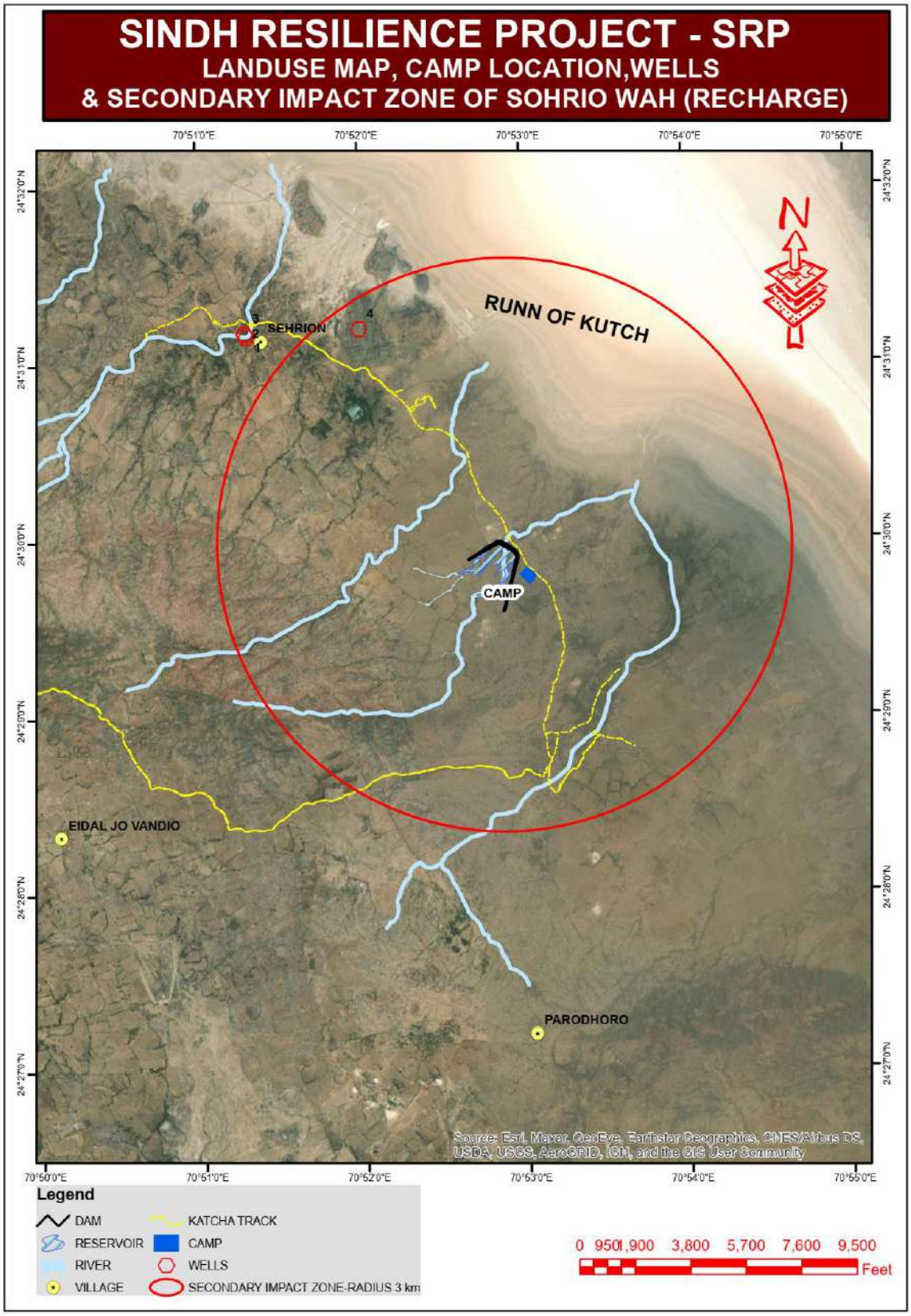

SINDH RESILIENCE PROJECT - SRP
BASELINE ENVIRONMENTAL MONITORING MAP OF PATHAR DAM IN NAGARPARKAR REGION
Noise
Noise
Drinking Water
Surface Water
Air Sample
Noise
PATHAR
LEGEND
Dams
Air sample
Noise
Drinking Water
Surface Water
N
W
E
S
0
0.25
0.5
1
1.5
2
km

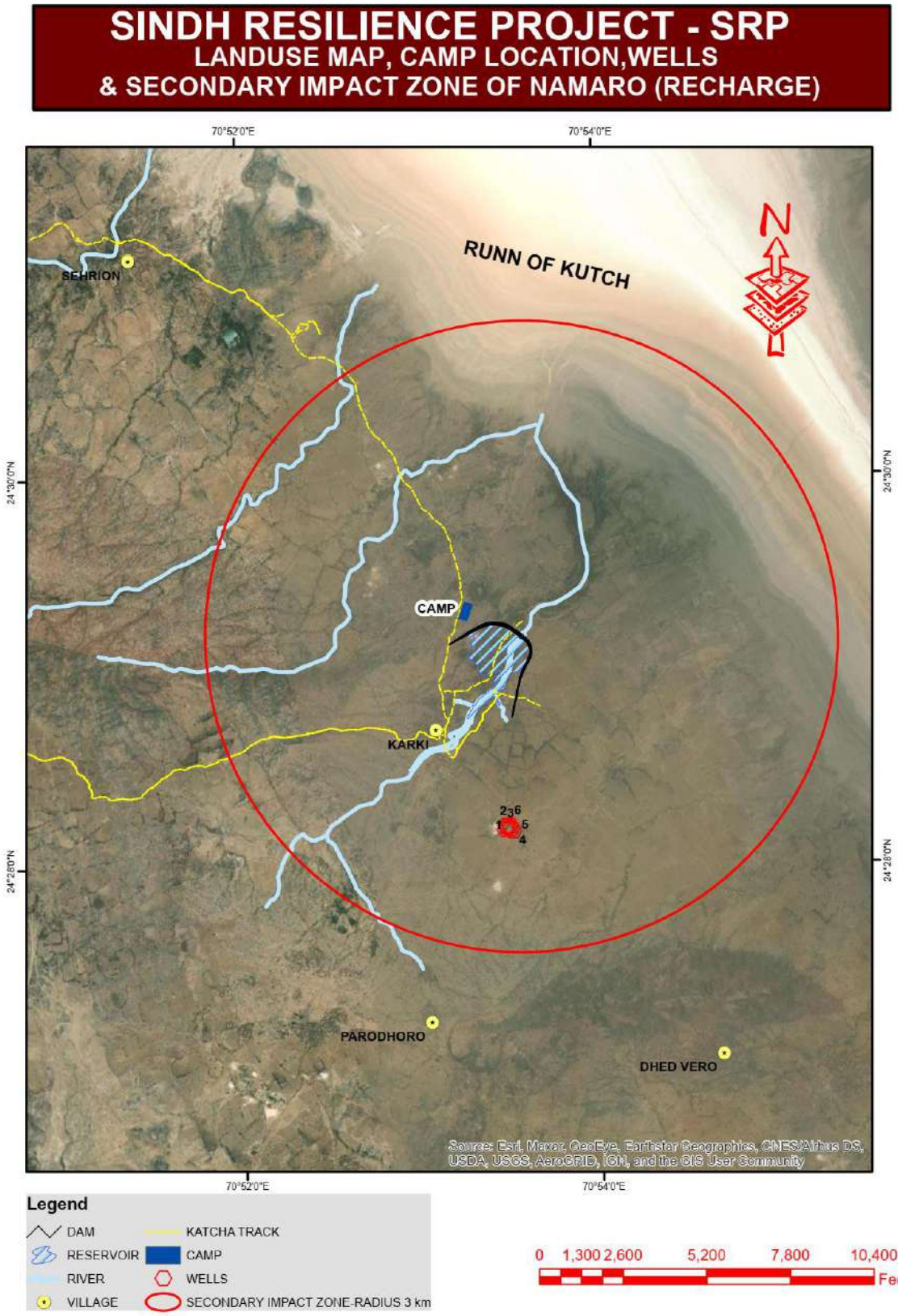

SINDH RESILIENCE PROJECT - SRP
BASELINE ENVIRONMENTAL MONITORING MAP OF SUDRAN, LAYARI-1,JHANJHOO & ADIGAM DAMS IN NAGARPARKAR REGION
SUDRAN
Air Sample
Noise
Drinking Water
ADIGAM-SYED ALAM SHAH
LAYARI-1
JHANJHOO
Surface Water
LEGEND
Dams
Air sample
Noise
Drinking Water
Surface Water
N
S
E
W
0
0.5
1
2
3
4
km

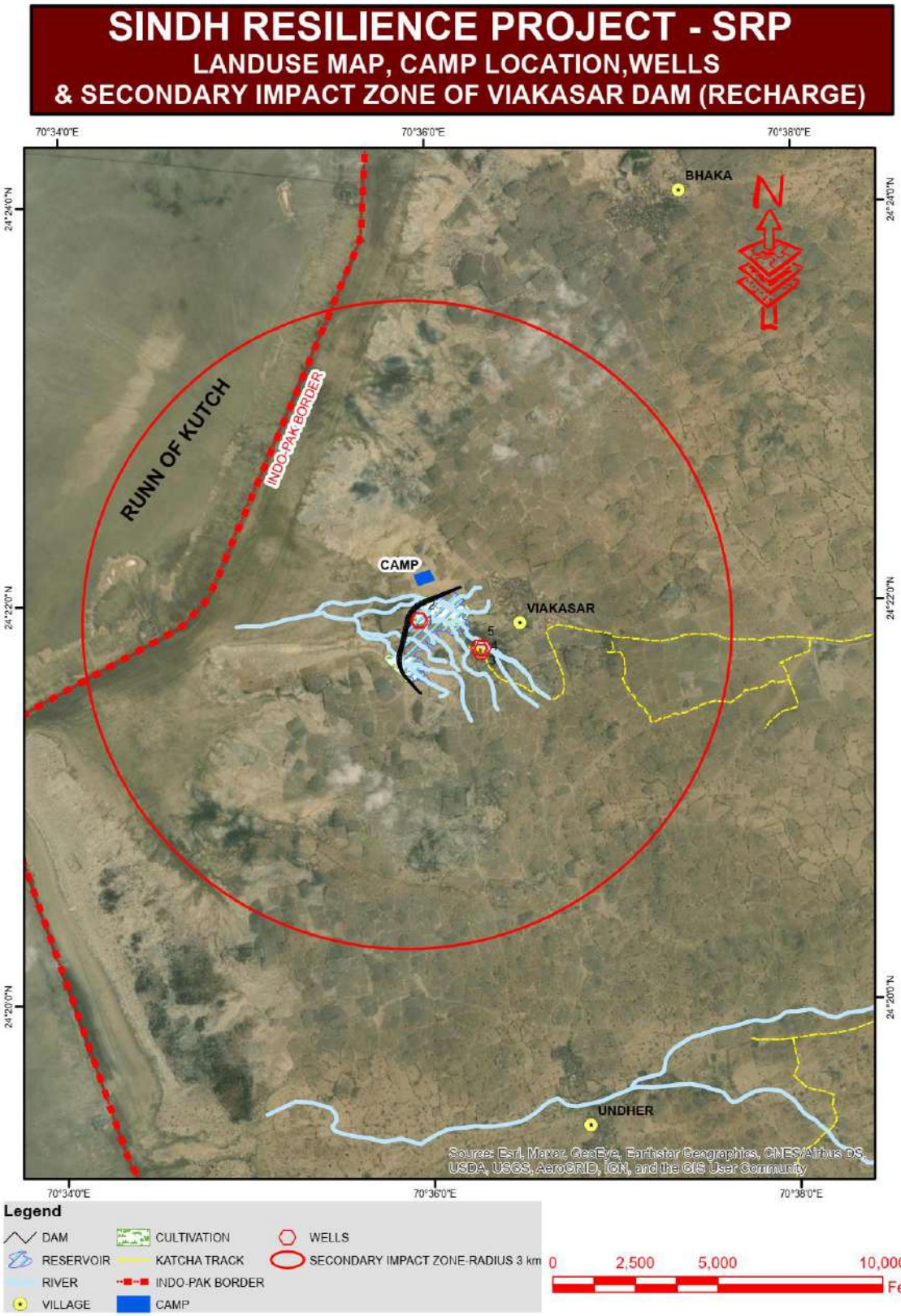

SINDH RESILIENCE PROJECT - SRP
BASELINE ENVIRONMENTAL MONITORING MAP OF
TARGAM BHODESAR DAM IN NAGARPARKAR REGION
Drinking Water
Noise
Noise
Surface Water
Noise
Air sample
TARGAM BHODESAR
LEGEND
Dams
Air sample
Noise
Drinking Water
Surface Water
N
W
E
S
0
0.125
0.25
0.5
0.75
1
km

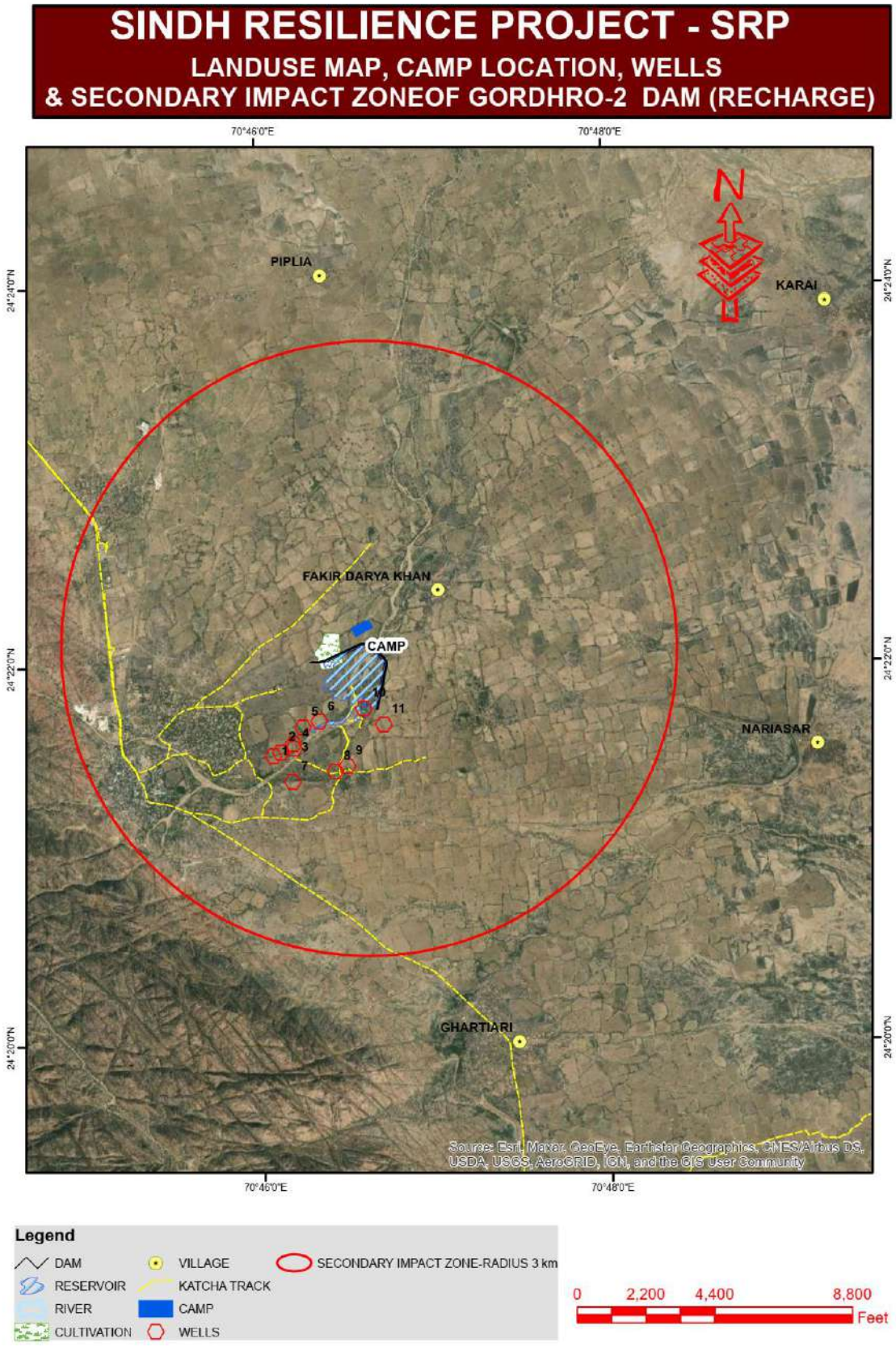
Annexure IV: Land Use, Proposed Camp Area and Secondary Impact Zone Maps

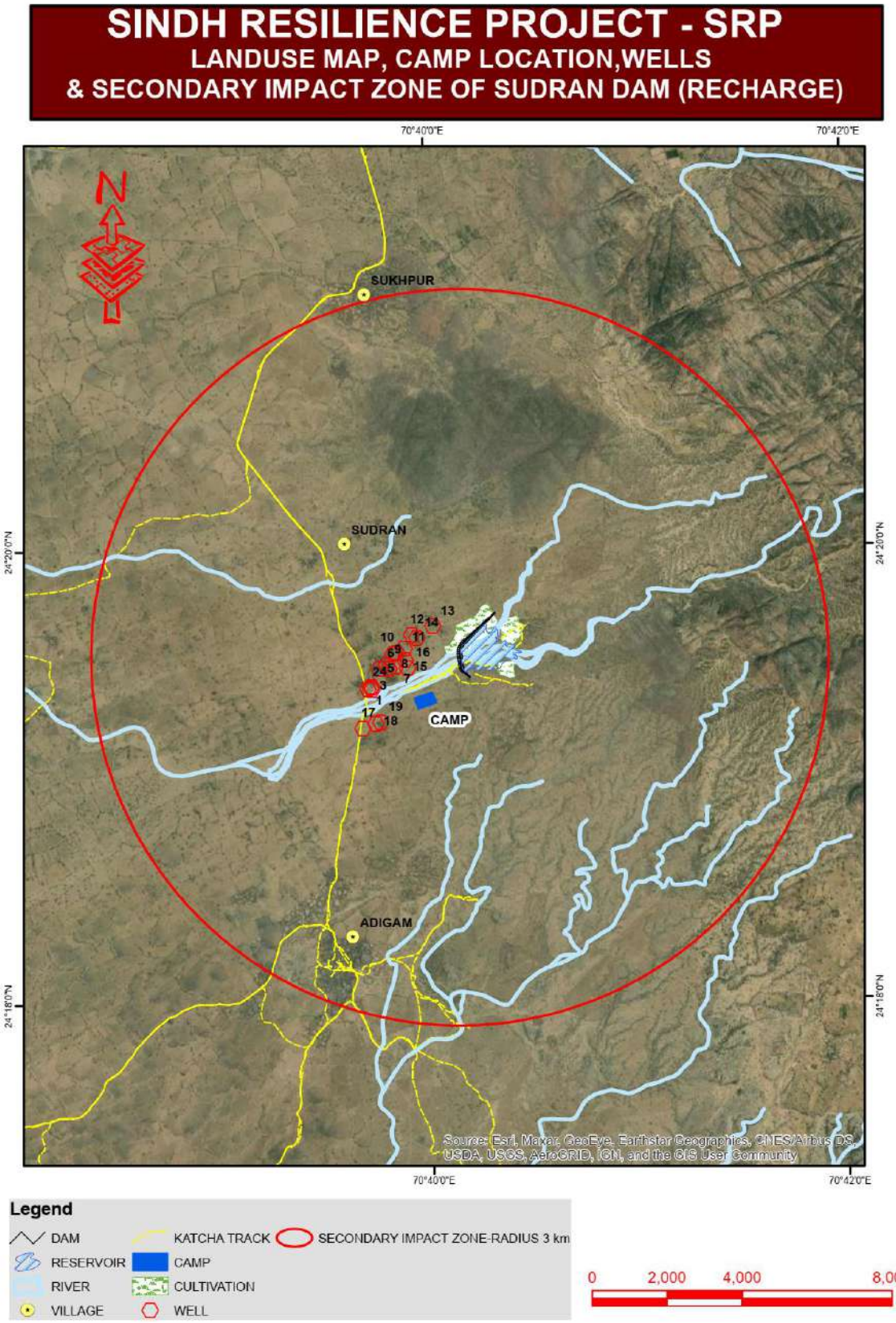


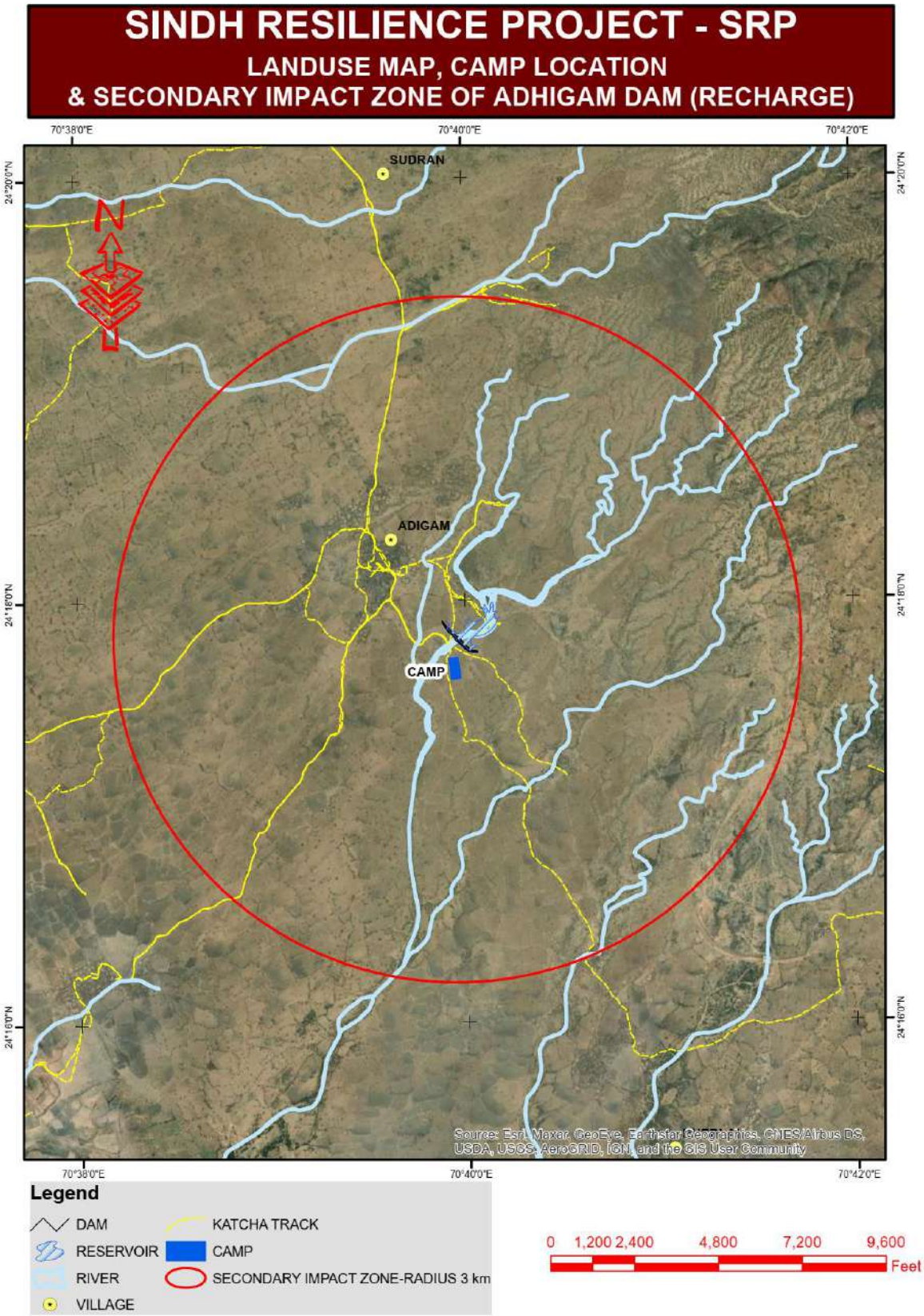

SINDH RESILIENCE PROJECT - SRP
LANDUSE MAP, CAMP LOCATION,WELLS
& SECONDARY IMPACT ZONE OF SOHRIO WAH (RECHARGE)
70°51'0"E
70°52'0"E
70°53'0"E
70°54'0"E
70°55'0"E
24°32'0"N
24°31'0"N
24°30'0"N
24°29'0"N
24°28'0"N
24°27'0"N
N
RUNN OF KUTCH
SEHRION
1
2
3
4
CAMP
EIDAL JO VANDIO
PARODHORO
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
70°50'0"E
70°51'0"E
70°52'0"E
70°53'0"E
70°54'0"E
70°55'0"E
Legend
DAM
KATCHA TRACK
RESERVOIR
CAMP
RIVER
WELLS
VILLAGE
SECONDARY IMPACT ZONE-RADIUS 3 km
0 950 1,900 3,800 5,700 7,600 9,500
Feet

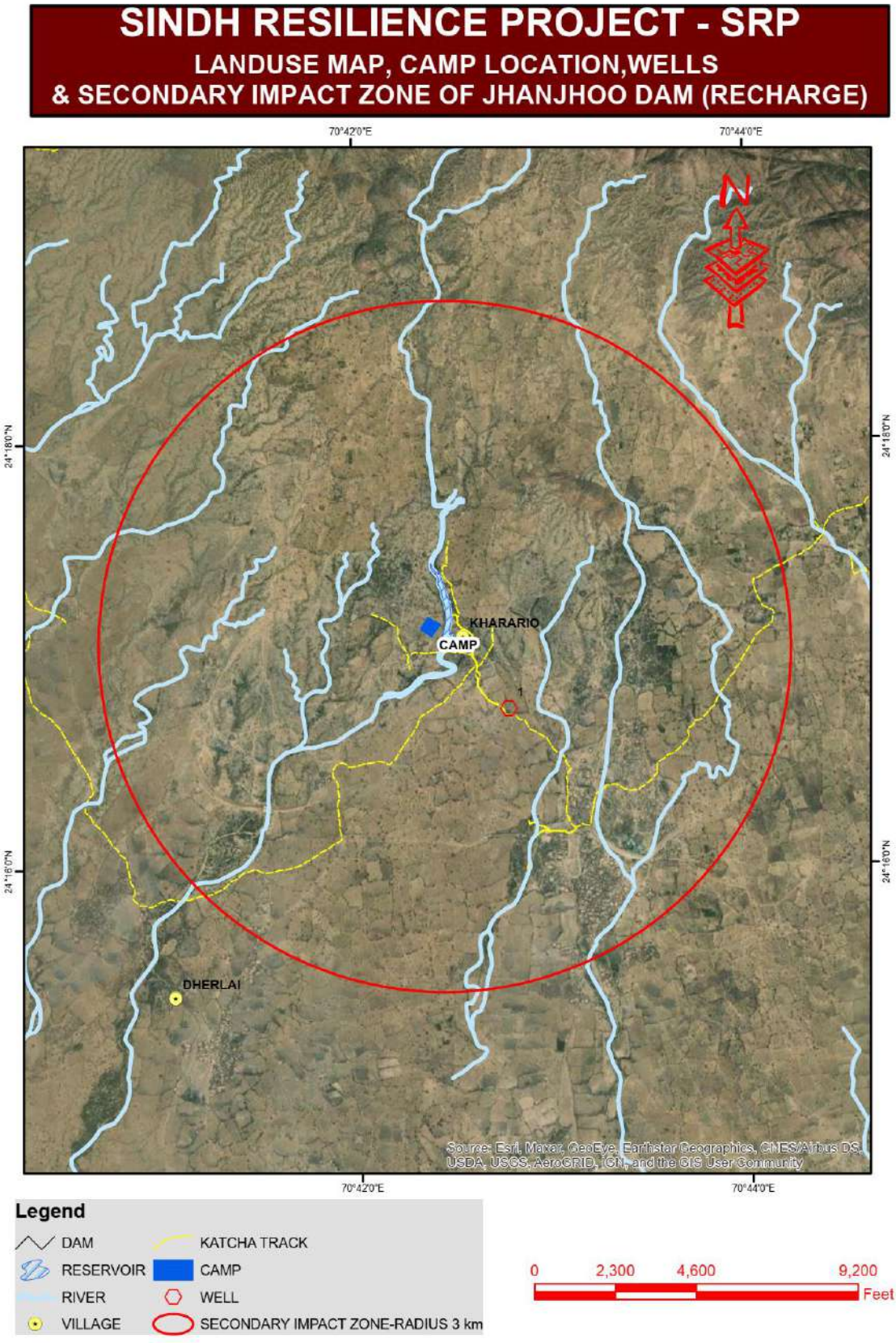

SINDH RESILIENCE PROJECT - SRP
LANDUSE MAP, CAMP LOCATION,WELLS
& SECONDARY IMPACT ZONE OF NAMARO (RECHARGE)
70°52'0"E
70°54'0"E
24°30'0"N
24°28'0"N
N
RUNN OF KUTCH
SEHRION
CAMP
KARKI
PARODHORO
DHED VERO
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Legend
DAM
KATCHA TRACK
RESERVOIR
CAMP
RIVER
WELLS
VILLAGE
SECONDARY IMPACT ZONE-RADIUS 3 km
0 1,300 2,600 5,200 7,800 10,400
Feet

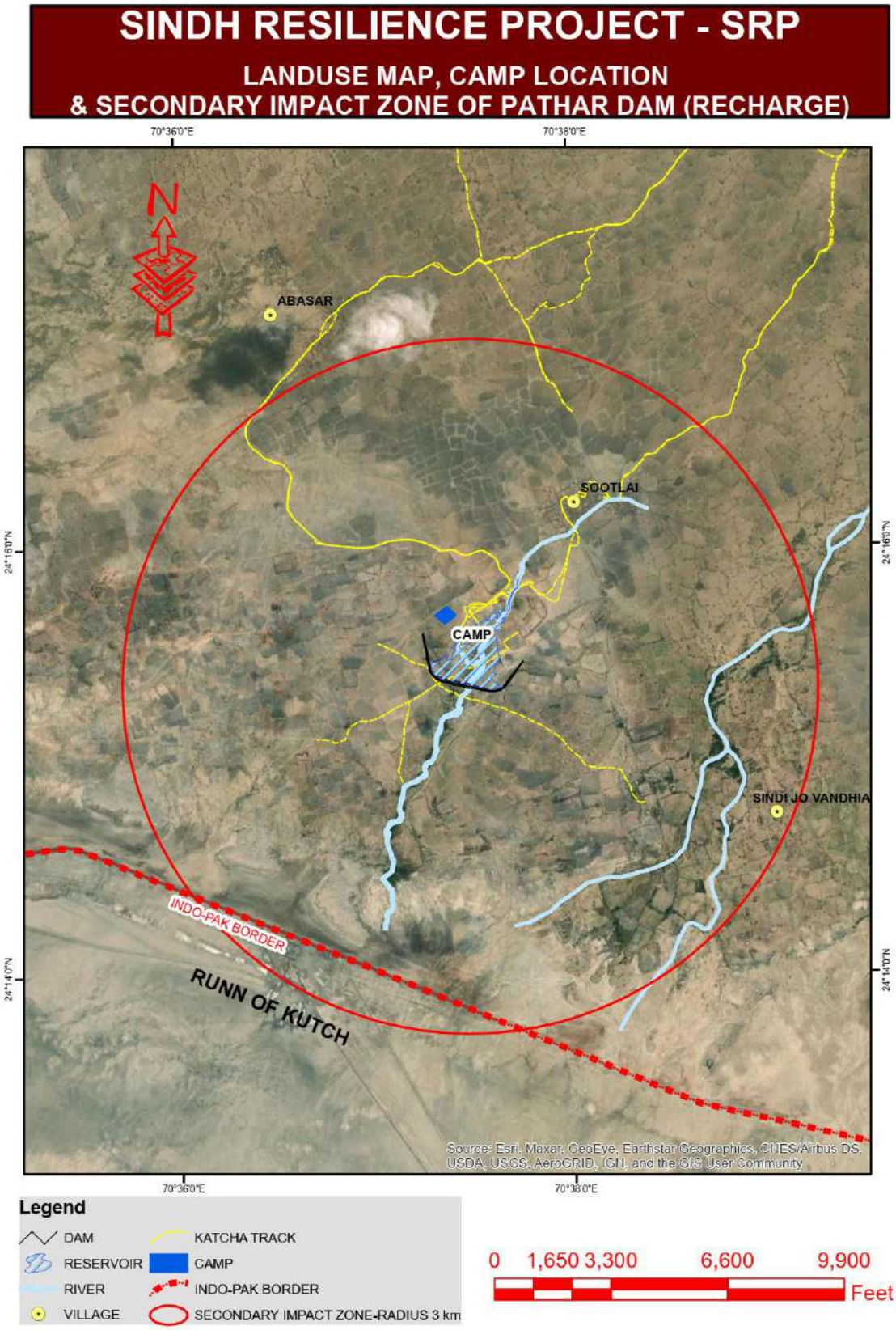

SINDH RESILIENCE PROJECT - SRP
LANDUSE MAP, CAMP LOCATION,WELLS
& SECONDARY IMPACT ZONE OF VIAKASAR DAM (RECHARGE)
70°34'0"E
70°36'0"E
70°38'0"E
24°24'0"N
24°22'0"N
24°20'0"N
BHAKA
N
RUNN OF KUTCH
INDO-PAK BORDER
CAMP
VIAKASAR
UNDHER
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Legend
DAM
RESERVOIR
RIVER
VILLAGE
CULTIVATION
KATCHA TRACK
INDO-PAK BORDER
CAMP
WELLS
SECONDARY IMPACT ZONE-RADIUS 3 km
0
2,500
5,000
10,000
Feet

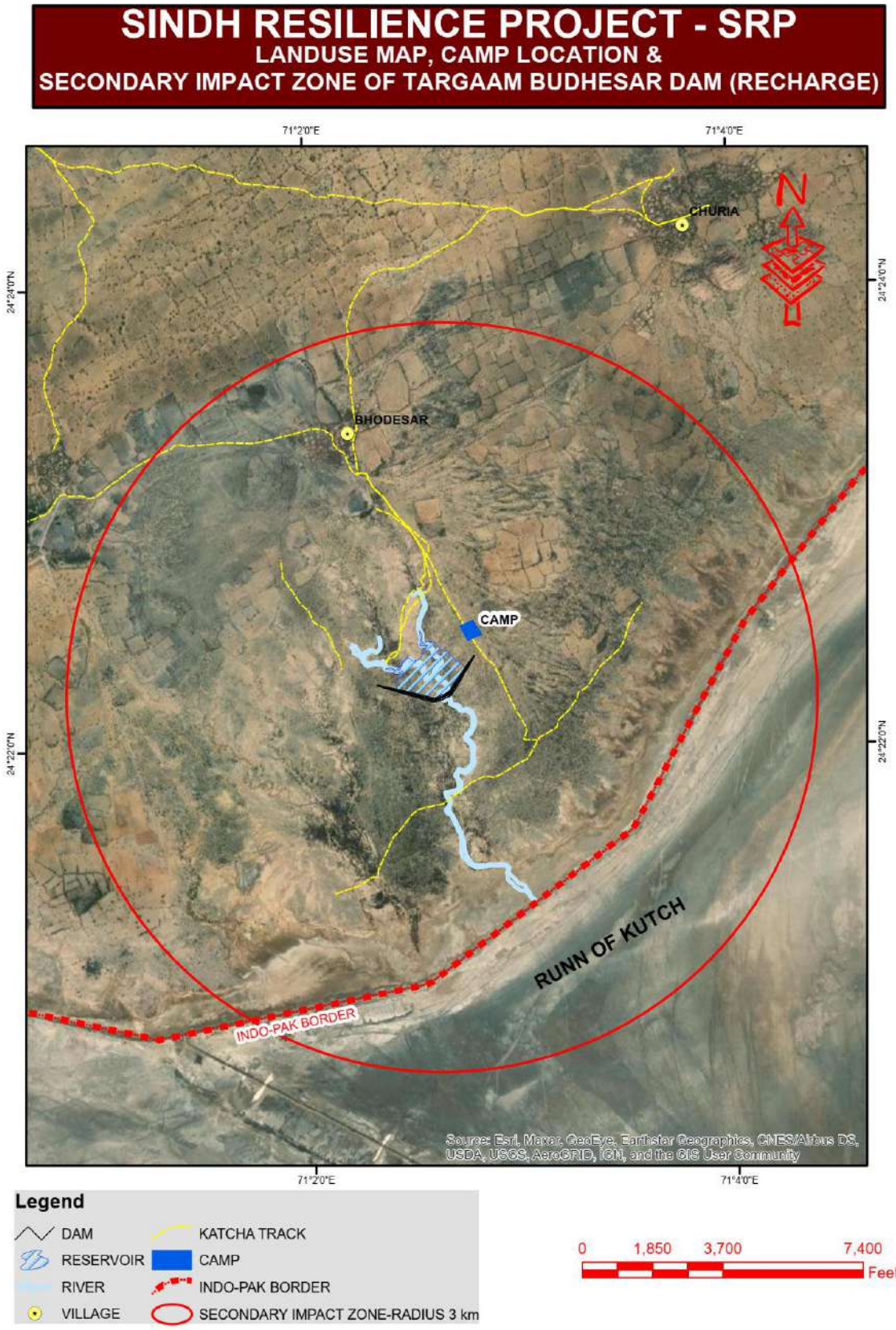

SINDH RESILIENCE PROJECT - SRP
LANDUSE MAP, CAMP LOCATION, WELLS
& SECONDARY IMPACT ZONEOF GORDHRO-2 DAM (RECHARGE)
70°46'0"E
70°48'0"E
24°24'0"N
24°22'0"N
24°20'0"N
N
PIPLIA
KARAI
FAKIR DARYA KHAN
CAMP
NARIASAR
GHARTIARI
1
2
3
4
5
6
7
8
9
10
11
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Legend
DAM
RESERVOIR
RIVER
CULTIVATION
VILLAGE
KATCHA TRACK
CAMP
WELLS
SECONDARY IMPACT ZONE-RADIUS 3 km
0
2,200
4,400
8,800
Feet


SINDH RESILIENCE PROJECT - SRP
LANDUSE MAP, CAMP LOCATION,WELLS
& SECONDARY IMPACT ZONE OF SUDRAN DAM (RECHARGE)
70°40'0"E
70°42'0"E
24°20'0"N
24°18'0"N
N
SUKHPUR
SUDRAN
ADIGAM
CAMP
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Legend
DAM
RESERVOIR
RIVER
VILLAGE
KATCHA TRACK
CAMP
CULTIVATION
WELL
SECONDARY IMPACT ZONE-RADIUS 3 km
0
2,000
4,000
8,000
Feet


SINDH RESILIENCE PROJECT - SRP
LANDUSE MAP, CAMP LOCATION
& SECONDARY IMPACT ZONE OF ADHIGAM DAM (RECHARGE)
70°38'0"E
70°40'0"E
70°42'0"E
24°20'0"N
24°18'0"N
24°16'0"N
SUDRAN
ADIGAM
CAMP
N
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Legend
DAM
RESERVOIR
RIVER
VILLAGE
KATCHA TRACK
CAMP
SECONDARY IMPACT ZONE-RADIUS 3 km
0 1,200 2,400 4,800 7,200 9,600
Feet


SINDH RESILIENCE PROJECT - SRP
LANDUSE MAP, CAMP LOCATION,WELLS
& SECONDARY IMPACT ZONE OF JHANJHOO DAM (RECHARGE)
70°42'0"E
70°44'0"E
24°18'0"N
24°16'0"N
N
KHARARIO
CAMP
1
DHERLAI
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Legend
DAM
RESERVOIR
RIVER
VILLAGE
KATCHA TRACK
CAMP
WELL
SECONDARY IMPACT ZONE-RADIUS 3 km
0
2,300
4,600
9,200
Feet


SINDH RESILIENCE PROJECT - SRP
LANDUSE MAP, CAMP LOCATION
& SECONDARY IMPACT ZONE OF PATHAR DAM (RECHARGE)
70°36'0"E
70°38'0"E
24°16'0"N
24°14'0"N
N
ABASAR
SOOTLAI
CAMP
SINDI JO VANDHIA
INDO-PAK BORDER
RUNN OF KUTCH
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Legend
DAM
RESERVOIR
RIVER
VILLAGE
KATCHA TRACK
CAMP
INDO-PAK BORDER
SECONDARY IMPACT ZONE-RADIUS 3 km
0 1,650 3,300 6,600 9,900
Feet


SINDH RESILIENCE PROJECT - SRP
LANDUSE MAP, CAMP LOCATION &
SECONDARY IMPACT ZONE OF TARGAAM BUDHESAR DAM (RECHARGE)
71°2'0"E
71°4'0"E
24°24'0"N
24°22'0"N
CHURIA
BHODESAR
CAMP
RUNN OF KUTCH
INDO-PAK BORDER
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Legend
DAM
RESERVOIR
RIVER
VILLAGE
KATCHA TRACK
CAMP
INDO-PAK BORDER
SECONDARY IMPACT ZONE-RADIUS 3 km
0
1,850
3,700
7,400
Feet

Annexure V: Environmental & Social Questionnaires

SINDH RESILIENCE PROJECT (SRP) IRRIGATION COMPONENT
FEASIBILITY STUDY OF 30 NOS SMALL DAMS IN WATER SCARCE AREAS OF SINDH PROVINCE

Scope of Guidelines

These guidelines are applicable to all dams and reservoirs with a storage volume of less than 25 million cubic meters or surface area of less than 4 square kilometers.

How to use these Guidelines?

The following steps are to be taken in this regard:

Step 1: Provide information on project [use Section I]

Step 2: Determine Applicability (Are you sure that IEE or EIA is not required?) [use Section II]

Step 3: Describe the physical, biological and social environment [use Section III]

Step 4: Assess potential impacts and applicable mitigation measures [use Section IV]

Section I: Project Description

File No _____ Date _____

1. General Information

1.1 Project Name or Title_____

1.2 Name of the person who conducted this assessment _____

1.3 Designation _____

2. Project Information

2.1 Project location _____

2.2 Cost of the project _____ 2.3 Purpose of the reservoir _____

2.4 Name of the river or stream_____2.5 Is the stream seasonal or perennial ____

2.6 Total area of the reservoir _____ m^2 2.7 Total storage capacity _____ m^3

2.8 Total volume of the embankment _____ m³

2.9 Brief Project Description

Please attach a map of the proposed project site showing the location of the key structures, access, etc.

3. Construction

3.1 Who owns the proposed land for the project? _____

3.2 What is the present use of the land? _____

3.3 Are there any structures on the proposed site now? ___Yes ___ No

If yes, will any structure be demolished? ___ Yes ___ No

If yes, where the demolition waste will be disposed? _____

3.4 Are there any trees on the proposed site? ___ Yes ___ No

3.5 Will any tree be removed? ___ Yes ___ No

If yes, how many? _____

3.6 Period of construction (start and end dates) _____

3.7 What major construction equipment (dozer, grader, crane, etc.) will be used? _____

3.8 Will any land be acquired? _____

If yes, please specify the total area: _____ Present ownership of land _____

What is the present use of the land? _____

How the land will be acquired (Through Land Acquisition Act or Direct Purchase)? _____

When the compensation will be paid? _____

3.9 In case of state land, are there any squatter settlements on the land? ____

If yes, please specify Number of settlements _____Will any compensation be paid? _____ When the compensation will be paid? _____

Section II: Screening

Is the proposed project or part of the project in an ecologically sensitive area?

Is the total storage capacity more than 25 million cubic meter? ___ Yes ___ No

Is the total area of the reservoir more than 4 square kilometers? ___ Yes __ No

If the answer to any of the above questions is yes, then the project would require an initial environmental examination or an environment impact assessment. Refer to the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environment Impact Assessment Regulations, 2000 for appropriate category.

Section III: Environmental Profile

1. Describe the terrain of the project area:

Flat or Level (Slope < 3%) Level to moderately steep (Slope 3%-30%)

Moderately steep to mountainous (Slope > 30%)

2. Are there signs of soil erosion or landslide anywhere within 2,000 m of the proposed site? Yes No

If yes, please describe (where, nature) _____

3. Please describe the hydrological conditions of the stream or river, run-off characteristics, rainfall, rainfall variability, groundwater, and drought patterns.

_____

_____

4. Is the stream polluted? Is domestic or other wastewater discharged to it?

_____

5. What are the present uses of the stream, e.g., agriculture, domestic, industrial, washing, fishery. _____

6. Is there any groundwater well on the proposed site or within 500 m of the proposed site? Yes No

If yes, describe each well:

Type (Dug well, tube well, hand pump)	Location (Village, road, mohalla, etc. and distance from the site)	Depth and Yield	Uses (Drinking, agriculture, domestic, industrial, washing, livestock)

7. Based on the interview of the surrounding population or a wildlife expert, is any form of wildlife found on, or around the proposed site of the project? ___Yes ___No

If yes, please describe _____

_____

8. Are there any existing trees or vegetation on the proposed site? ___ Yes ___ No

If yes, how many? _____

9. Are there any community forest, reserved forest or protected area within 2,000 m of the proposed site? _____ Yes _____ No

If yes, please describe? _____

10. What is the present land use of the proposed dam site and its vicinity (roughly a radius of 500 m) of the proposed site?

	Residential (Thick, Moderate, Sparse)	Commercial (Office, Shops, Fuel Stations)	Open Land (Parks, Farmlands, unutilized plots, barren land	Industrial	Other
Description					

11. For any agricultural farmland on the proposed site and a radius of 500 m around it, provide the following information: Main crop(s) and average yield _____
Source of irrigation water_____
Area affected by salinity or water logging _____

12. Please describe all the sensitive receptors within 500 m of the proposed site:

Type (schools, colleges, hospitals, and clinics)	**Name**	**Size** (Number of students or number of beds)	**Location** (Village, road, mohalla, etc.)	**Distance from Site**

13. What is the total population of the area? _____

14. What proportion of the houses in the area are *pukka, semi-pukka, and* kutcha?

_____

15. How are the general hygienic conditions of the project area?

_____ Generally clean _____Fair ____Poor

16. Is there any bad odor in the project area? ____Yes _____ No
What is the source of the odor? _____

17. What are the main sources of income of the surrounding community? _____

_____

18. Is there any site of cultural importance (graveyard, shrine, mosque, archeological site) within 1,000 m of the proposed scheme? _____Yes _____No
If yes, please describe? _____

_____

19. Will the reservoir submerge any:
Village or house_____ Wetland _____Forest _____
Sensitive vegetation _____ Wildlife habitat_____
Tomb or graveyard _____ Archeologically important site _____

Section IV: Impact Assessment

Potential Negative Environmental Impacts	*Tick, if relevant*	*Mitigation Measures*	*Tick, if proposed*	*Monitoring Plan*
Socioeconomic Impact	☐	To the extent possible, local labor will be used for unskilled, semi skilled and skilled jobs	☐	
		A formal resettlement plan will be prepared	☐	
Water-related diseases	☐	Sanitation and health-care programs will be initiated for the population around the reservoir	☐	
		As far as possible, the reservoir water level will be fluctuated to discourage growth of disease carrying insects.	☐	
Wildlife and vegetation	☐	Minimum flow required to maintain vegetation will be determined and it will be ensured that the flow is maintained	☐	
		Operational rules will be defined for regulating downstream flows at critical times to protect habitat for reproduction or migratory routes.	☐	
		Provisions for the migration of fish and other aquatic organisms will be provided, if needed	☐	
Safety Concerns	☐	The surrounding communities will be informed about the construction schedule and will be briefed about the safety procedures	☐	
		A comprehensive plan for operation, maintenance and rehabilitation will be prepared. This should include inspections, evaluations, modifications and upgrades of the dams to ensure that they meet safety standards.	☐	
		Emergency action plans will be prepared. Training will be provided to dam operators.	☐	
		Safety exercises will also involve the local government officials and community.	☐	
		A periodic and thorough review of the rainfall and runoff characteristics as well as the identification of other changes in the hydrology of the basin will be undertaken to monitor the changes in the hydrologic characteristics of the stream basin	☐	
Risk of erosion and landslide	☐	Stabilization measures will be undertaken	☐	
Construction	☐	Construction waste (excess rock and soil, demolition waste, etc.) will be disposed at _____ (location)	☐	
		All properties, utility lines and other structures damaged during the construction will be restored	☐	

SINDH RESILIENCE PROJECT (SRP)

SOCIO-ECONOMIC BASELINE CONDITIONS

Household Profile (Sample Survey)

District		Tehsil	
UC Name			
Village			
Urban		Rural	

Interviewer's Name _____

Name of the Respondent _____

Father's Name of the Respondent _____

NIC No. of the Respondent _____

Name of the Head of Household _____

CNIC No. of Head of Household _____

Date of Interview | | | - | | | - | | | | |
DD/MM/YYYY

Section 1: Basic Information of the Household

Sr. No.	Details	Answers
1.	Gender of Respondent	1. Male 2. Female
2.	What is your approximate age? (Write in figures only)	
3.	Relation with Head of Household	1. Self 2. Father 3. Brother 4. Son Others (Please specify)_____
4.	Gender of the Head of Household	1. Male 2. Female
5.	Tribe	
6.	What is the highest level of education you have reached or completed?	1. No education 2. Primary (up to 5 Years) 3. Secondary (up to 10 years) 4. High School (up to 12 Years) 5. University Other (Please specify)_____
7.	What is your Religion?	
8.	Settlement Status	1. Local 2. Migrated Settler Others (Please specify)_____
9.	If Migrated/Settler, Years of Settlement?	
10.	Reasons of Migration	

Section 2: Awareness Regarding the Project

Sr. No.	Details	Answers
1.	Are you aware of the upcoming Water Resources Management and Development Project? (if respondent is not aware of the project, brief him about the project)	1. Yes 2. No
2.	If "Yes" to question 1, do you know when the project will be implemented? (if respondent is not aware of the project, brief him about the project implementation)	1. Yes 2. No

Section 3: Demographic Details

Sr. No.	Name of Head of Household	No. of Family Members	Gender		CNIC No.	Education Level	Occu -pation	Any Special Person (Yes/No)
			M	F				
1.					- -			
2.					- -			
3.					- -			
4.					- -			
5.					- -			
6.					- -			
7.					- -			
8.					- -			
9.					- -			
10.					- -			

Gender: a. Male b. Female

Education Level: a. Literate, b. Upto Primary, c. Upto Matric, d. Graduate, e. Higher Education/Masters

Occupation: a. Farming, b. Business, c. Handicraft, d. Artisan, e. Skilled Works, f. Govt. Service, g. Private Service, h. Agriculture Labor, i. Livestock Grazing, j. Labor, k. Others (Specify)

Section 4 Available Facilities in the House

Sr. No.	Details	Answers
1.	Do you have Telephone Connection (landline)?	1. Yes 2. No
2.	If "Yes" to question 1, when connected?	
3.	Is your house electrified?	1. Yes 2. No
4.	When connected: (Give dates as mm/dd/yyyyy)	
5.	Do you have sewerage System?	1. Yes 2. No

Section 5: Fuel Consumption in the House for illumination, cooking & heating

Type	Units	Average Quantity Consumed (unit/ month)		Price per Unit (Rs)	Monthly Expenditure (Rs.)	Source (e.g. forest, market)
		Winter	Summer			
1. Fuel wood						
2. Electricity						
3. LPG						
4. Kerosene						
Other (Please specify)---------- ----------						

Section 6: Social Issues

Sr. No.	Details	Answers
1.	Do married family members live with you in the same house?	1. Yes 2. No
2.	Do you marry children outside your tribe?	1. Yes 2. No
3.	Number of child births in your family during last year	
4.	Were there any illnesses during the past 12 months?	
5.	For how long treatment continued (Months)	
6.	Place of treatment	

7.	Distance from village/hamlet (km)	
8.	Expenses Incurred (Rs.)	
9.	Number of deaths in the family during last year	
10.	Cause/s of Death	1. _____ 2. _____ 3. _____ 4. _____

11. Did you borrow money during the last year? 1. Yes ☐ 2. No ☐

12. If "Yes" to question 11, provide details as below:

Sr. No.	Source	Amount Borrowed (Rs.)	Purpose	Amount Yet to Return (Rs.)	Sources 1. Relative/friends 2. NGO 3. Bank 4. Others (specify) Purpose 1. Marriage 2. Purchase of land 3. Purchase of built-up prpoerty 4. Establishment of business 5. Others (Please specify) _____
1.					
2.					
3.					

13.	Do you have to go to the city for fulfillment of various needs?	1. Yes 2. No
14.	If "Yes" to question 13, then how offenly?	1. Daily 2. Weekly 3. Monthly 4. Occasionally 5. Others (Specify) _____
16.	Social issues of the community	_____ _____ _____ _____ _____

Section 7: Livestock (Domestic Animals)

1. Number of Livestock heads of each type owned by you?

Type	Buffalo	Cow	Goat	Sheep	Oxen	Calve	Donkey	Horse	Chicken	Others (Please specify)
Number										
Value Rs./ Unit										

2. From where do you get fodder for livestock? _____

3. Estimated cost for purchasing feed / fodder for your animals (Rs./Month) ? _____

Section 8: Livelihood

1.	What is your occupation?	1. Primary 2. Secondary
2.	What is your place of work?	1. Same village 2. Nearby Town 3. Nearby city 4. Others (Please specify) _____

4. Involvement of household members in income earning activities.

Sr. No.	Activity	Number of Persons Involved					
		Men (between 16-65)	Women (between 16-65)	Old Men (65 years and above)	Old Women (65 years and above)	Children (below 16 years)	Average Monthly Income (Rs.)
1.	Farming						
2.	Small Business						
3.	Handicraft						
4.	Artisan Services*						
5.	Skilled Works**						
6.	Govt. Service						
7.	Pvt.Service						
8.	Agri. Labor Permanent						
9.	Fisherman						
10.	Livestock Rearing						

11.	Labour						
12.	Other (Pls. specify)----------						
Total							

*Artisans: Carpenter, Black-Smith, Barber, Potter, Shoe Menders/Maker, etc.
**Skilled Workers: Tailor, Carpet Weaver, Stone Masonry, Plumber, Mechanic, Driver, Electrician, Furnisher, etc.

5. Average monthly expenditures?

Sr. No.	Detail	Expenditures (Rs./Month)
1.	Food Items	
2.	Firewood/ Energy Source	
3.	Education	
4.	Health	
5.	Social/Recreation Activities	
6.	Others (Please specify)	

Section 9: Housing

1.	Type of the ownership	1. Owned 2. Rented 3. Free 4. Others _____
2.	Nature of the construction of the house	1. Pucca (Bricks/blocks/stones) 2. Semi Pucca 3. Katcha 4. Wood/Bamboo 5. Others (Pls. specify)_____
3.	Number of rooms in the house	
4.	Availability of bathroom in the house?	1. Yes 2. No
5.	Aproximate Plot size of the house	Marla _____
6.	Covered area (sq.ft)	_____
7.	Year of construction of the house	_____
8.	Do you have separate room/rooms for animals in your house?	1. Yes 2. No
9.	If "Yes" to question 8, then number of rooms	_____

10.	Construction Type	1. Pucca (Bricks/blocks/stones) 2. Semi Pucca 3. Katcha 4. Wood/Bamboo 5. Others (Pls. specify)_____
11.	Is your house being affected by the project?	1. Yes 2. No
12.	If "Yes" to question 11, then do you have any other place of residence to move	1. Yes 2. No
13.	If "Yes" to question 12 please specify	

Section 10: Land holding and land use by the household

1. Size of land holding with its approximate price?

Sr. No.	Land Use	Overall Land (Kanals)	Approximate Size of Land Perceived to be Affected (Kanals)	Perceived Approx. Unit Price (Rs./Kanal)
1.	Cultivated			
2.	Un-cultivated			
3.	Banjar jaded			
4.	Banjar qadeem			
5.	Ghair mumkin/pahar			
6.	Fruit orchard area			
7.	Other (Please specify) _____			
	Total			

8.	Nature of farming	1. Owner 2. Contract 3. Owner cum tenant 4. Tenant 5. Share cropping 6. Others (Pls. specify)_____
11.	Which of the following agricultural implements do you have	1. Plough for oxen 2. Plough for tractor

		3. Tractor 4. Spray machine 5. Trolley for tractor 6. Thresher 7. Other (Please specify)_____

12. What do you grow mostly in your agricultural land?

Sr. No.	Crop	Area under Cultivation (Kanals)	Yield / Kanal
1.	Wheat		
2.	Maize		
3.	Vegetables		
4.	Fodder		
5.	Other (Pls. specify) _____		

13. What are the expenditures to grow crops in your agricultural land?

Sr. No.	Inputs	Unit	Unit Price (Rs.)	Quantity/ Season	Seasonal Cost
1.	Seeds	Kgs/Kanal			
2.	Fertilizers	Kgs/Kanal			
3.	Pesticides	Liter/Kanal			
4.	Plowing	No.			
5.	Harvesting	days			
6.	Other (Please specify)				
Total					

14. What is your average seasonal earning(Rs./Season)?

a. Rabi [ ] b. Kharif [ ]

1. If your agricultural land /commercial asset are to be acquired for Project, do you have any other sources of income?

   a. Yes ☐ b. No ☐

1.1 If "Yes" specify the source. _____

2. In case of relocation, where will you prefer to resettle?

   a. Shifting to other village/UC ☐ b. Project developed resettlement site ☐

   c. Within the tehsil ☐ d. Within the district ☐

   e. Out of province ☐ f. Don't know ☐

   g. Any other place (Please specify) _____

3. What mode of compensation for land will be your choice?

   a. Cash ☐ b. Alternate Land ☐ c. Other (Please specify) _____

4. If cash payments are made, then expected utilization of the money?

   a. Business ☐ b. Property ☐

   c. Agricultural Land ☐ d. Others (Please specify) ☐

15. What do you suggest for livelihood restoration?

_____

_____

_____

Signature:	_____	Signature:	_____
Name:	_____	Name:	_____
CNIC No.	_____	CNIC No.	_____
	(Respondent)		**(Community Representative)**
Signature:	_____	Signature:	_____
Name:	_____	Name:	_____
CNIC No.	_____	CNIC No.	_____
	(Interviewer)		**(SID Representative)**

Dated: _____

Annexure VI: Photo Log

Bhatta Siro

Sohrio Wah

Namaro

Viakasar

Gordhro-2

Sudran Nadi

Adhigam

Nagar - 2 (Layari)

Pathar

Targaam Budhesar

Bhatta Siro

Viakasar

Gordhro-2

Sudran Nadi

Pathar

Nagar - 2 (Layari)

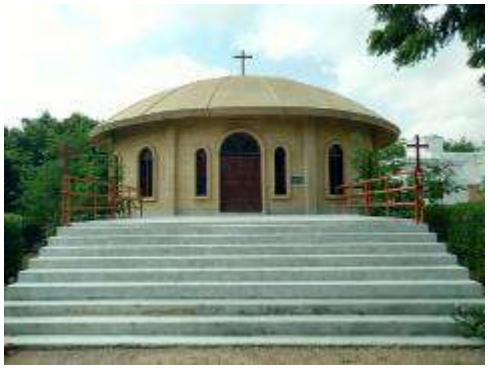
Adhigam

Adhigam

Gordhro-2

Targaam Budhesar

Type of Construction



Church at Nagarparkar

Shrine at Adigam

Churio Temple

Dug Well at Sub Project Area

Livestocke of the area

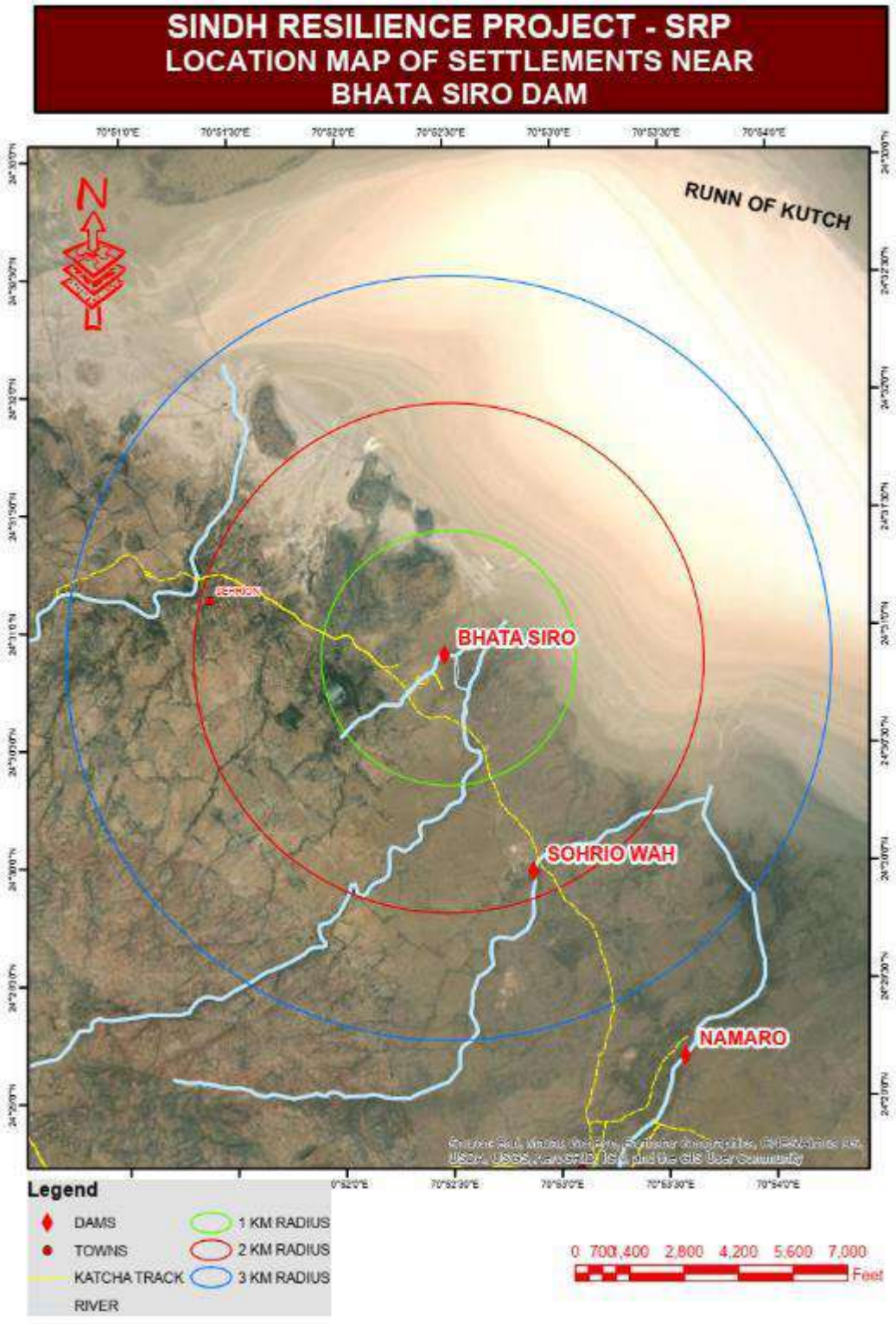
Pond a sub project area

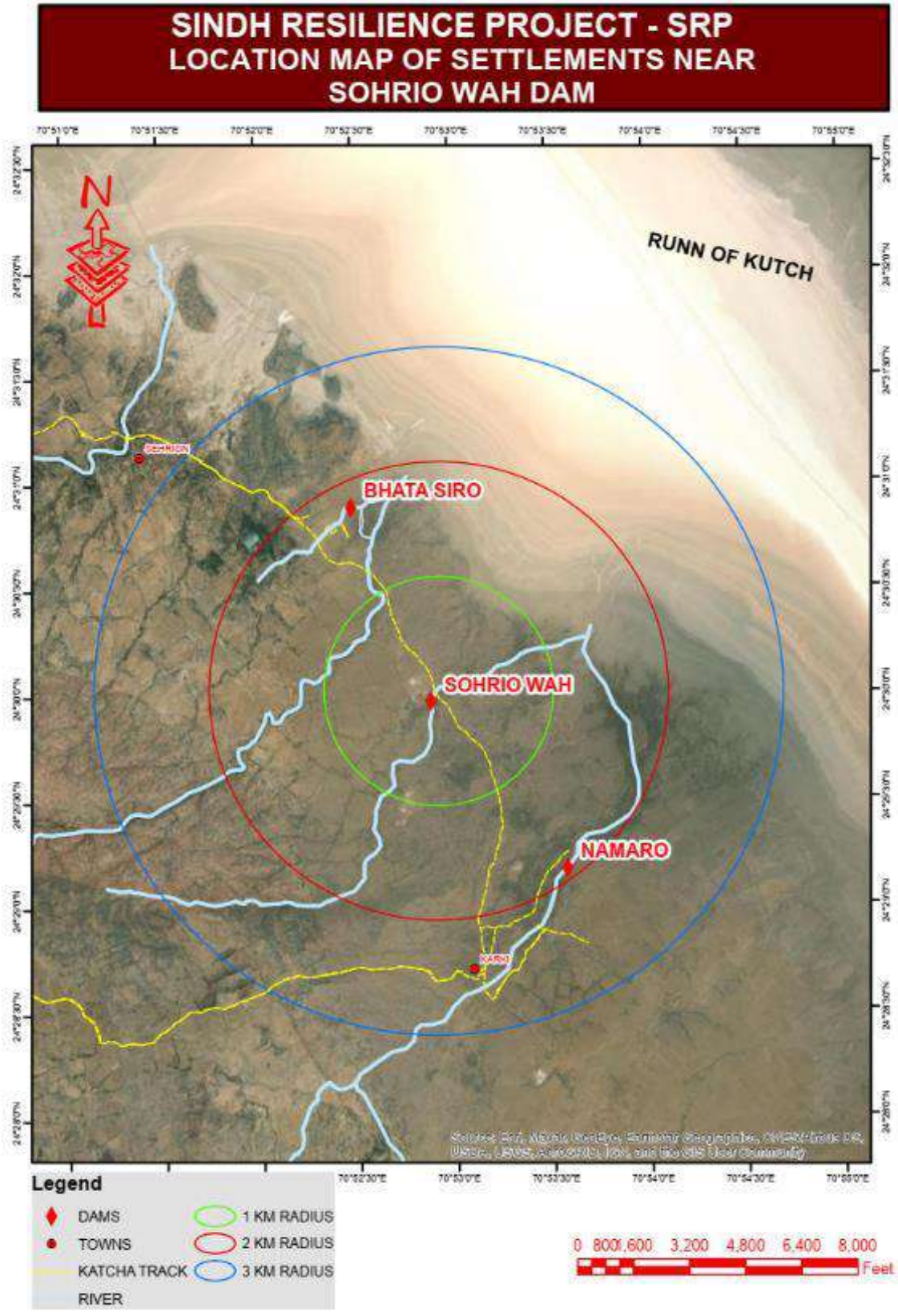
Agriculture Field at Sub Project Area

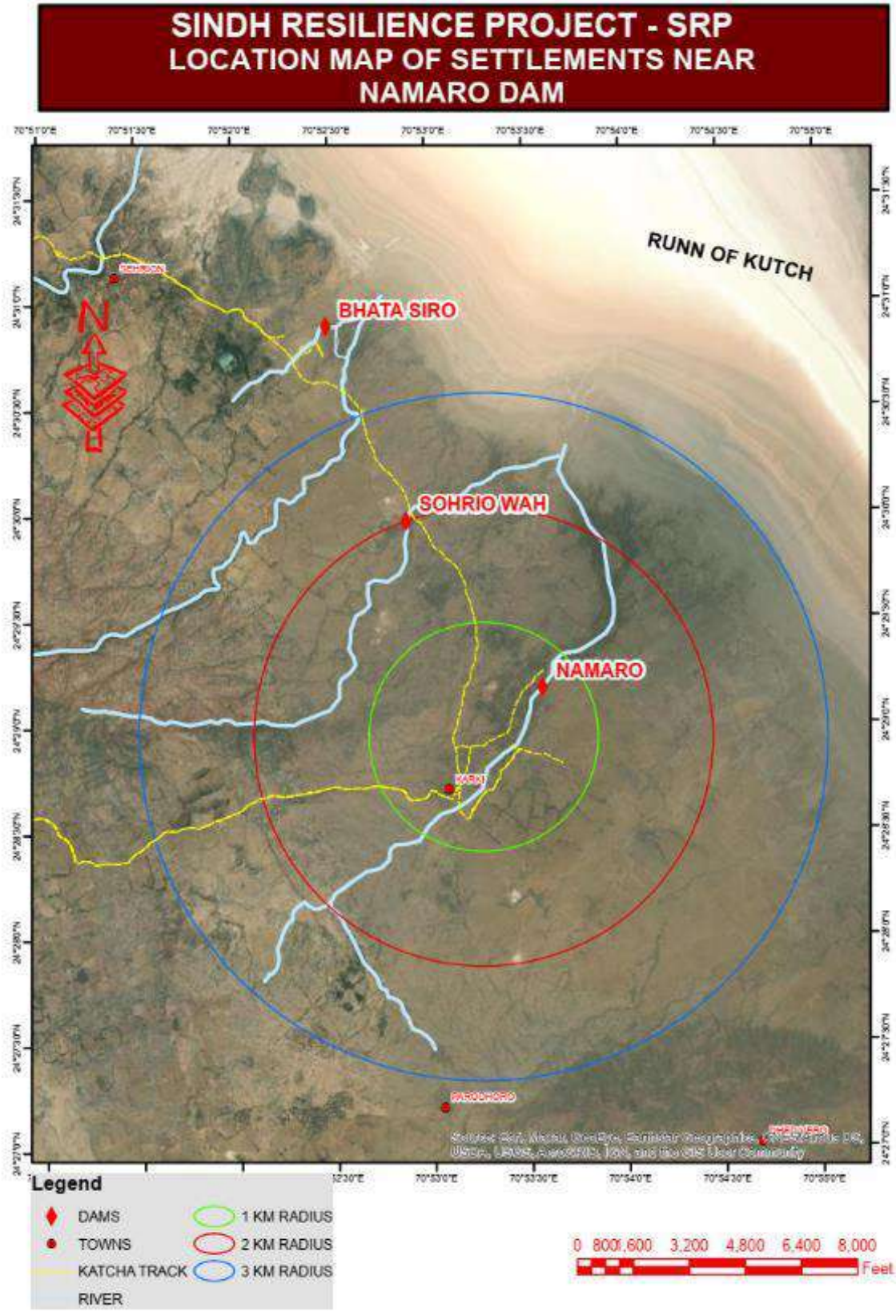
Vegetation Cover at Sub project Area

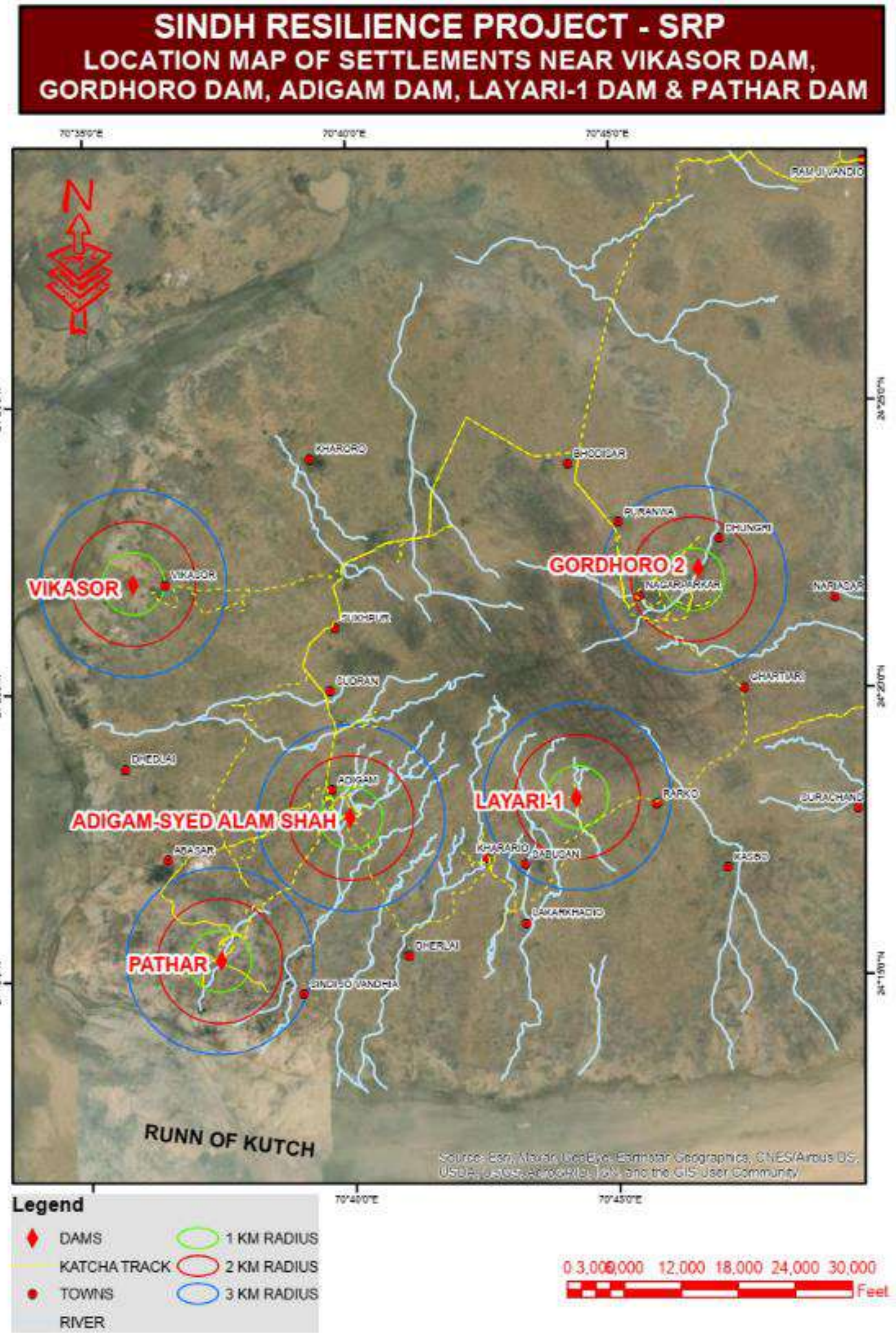
Livestock in Sub project area

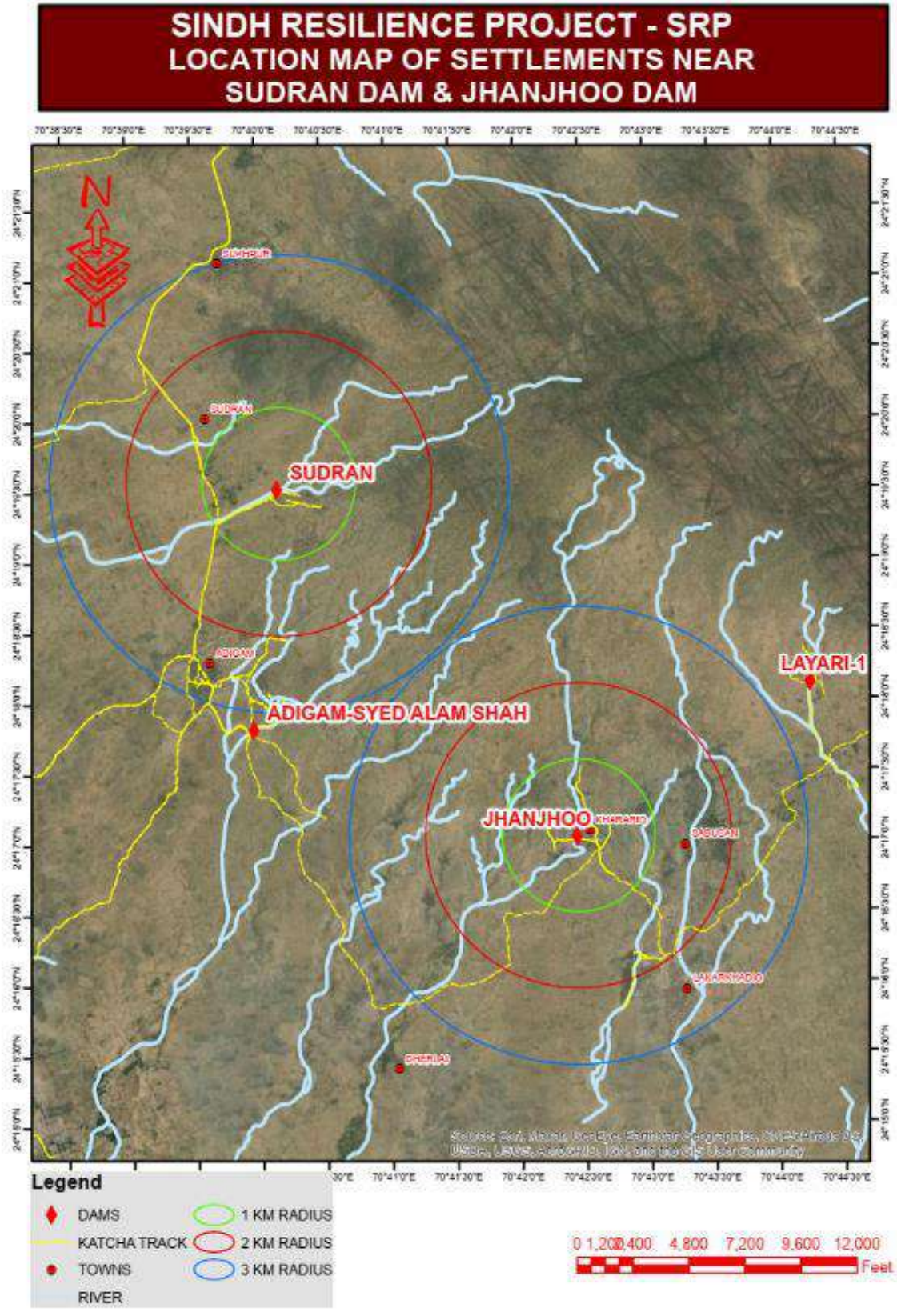
Annexure VII: Location Map of Settlements near Proposed Dam Sites

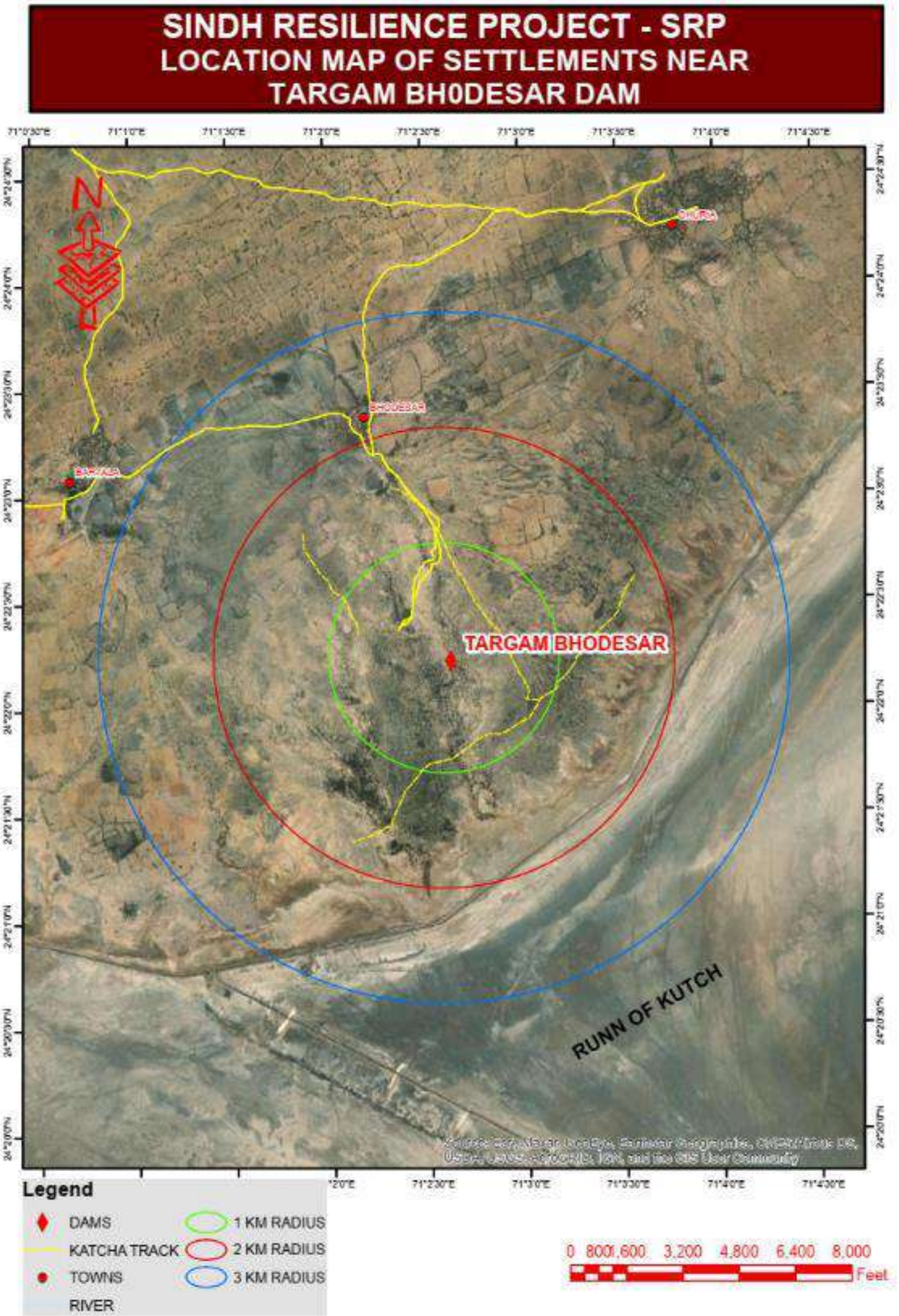



SINDH RESILIENCE PROJECT - SRP
LOCATION MAP OF SETTLEMENTS NEAR
SOHRIO WAH DAM
N
RUNN OF KUTCH
BHATA SIRO
SOHRIO WAH
NAMARO
Legend
DAMS
TOWNS
KATCHA TRACK
RIVER
1 KM RADIUS
2 KM RADIUS
3 KM RADIUS
0 800 1,600 3,200 4,800 6,400 8,000
Feet


SINDH RESILIENCE PROJECT - SRP
LOCATION MAP OF SETTLEMENTS NEAR
NAMARO DAM
RUNN OF KUTCH
BHATA SIRO
SOHRIO WAH
NAMARO
KARN
N
Legend
DAMS
TOWNS
KATCHA TRACK
RIVER
1 KM RADIUS
2 KM RADIUS
3 KM RADIUS
0 800 1,600 3,200 4,800 6,400 8,000
Feet


SINDH RESILIENCE PROJECT - SRP
LOCATION MAP OF SETTLEMENTS NEAR VIKASOR DAM, GORDHORO DAM, ADIGAM DAM, LAYARI-1 DAM & PATHAR DAM
VIKASOR
GORDHORO 2
ADIGAM-SYED ALAM SHAH
LAYARI-1
PATHAR
RUNN OF KUTCH
Legend
DAMS
KATCHA TRACK
TOWNS
RIVER
1 KM RADIUS
2 KM RADIUS
3 KM RADIUS
Feet


SINDH RESILIENCE PROJECT - SRP
LOCATION MAP OF SETTLEMENTS NEAR
SUDRAN DAM & JHANJHOO DAM
N
SUDRAN
ADIGAM-SYED ALAM SHAH
JHANJHOO
LAYARI-1
Legend
DAMS
KATCHA TRACK
TOWNS
RIVER
1 KM RADIUS
2 KM RADIUS
3 KM RADIUS
0 1,200 2,400 4,800 7,200 9,600 12,000
Feet


SINDH RESILIENCE PROJECT - SRP
LOCATION MAP OF SETTLEMENTS NEAR
TARGAM BH0DESAR DAM
BHODESAR
TARGAM BHODESAR
RUNN OF KUTCH
Legend
DAMS
KATCHA TRACK
TOWNS
RIVER
1 KM RADIUS
2 KM RADIUS
3 KM RADIUS
0 800 1,600 3,200 4,800 6,400 8,000
Feet

Annexure VIII: Environmental Code of Practices (ECoPS)

Introduction

The objective of preparation of the Environmental Code of Practices (ECoPs) is to address less significant environmental impacts and all general construction related impacts for the proposed SRP-AF project implementation. The ECoPs will provide guidelines for best operating practices and environmental management guidelines to be followed by the contractors for sustainable management of all environmental issues. This ECoPs will be annexed in the general conditions of all the contracts to be carried out under the SRP project. The list of ECoPs prepared for the SRP-AF is given below:

ECoP 1: Waste Management
ECoP 2: Fuels and Hazardous Substances Management
ECoP 3: Water Resources Management
ECoP 4: Borrow Areas Development and Operation
ECoP 5: Air Quality Management
ECoP 6: Noise and Vibration Management
ECoP 7: Protection of Flora
ECoP 8: Protection of Fauna
ECoP 9: Road Transport and Road Traffic Management
ECoP 10: Construction Camp Management
ECoP 11: Cultural and Religious Issues
ECoP 12: Workers Health and Safety

The Contractor shall prepare a 'Contractor's Environmental and Social Management Plan' (CESMP) demonstrating the manner in which the Contractor will comply with the requirements of ECoPs and the mitigation measures proposed in the ESMP of the ESIA Report. The CESMP shall be submitted to the ESU of PISSC and ESMU of PMT for review and finally shall be approved by the ESU of PISSC. The CESMP will form the part of the contract documents and will be used as monitoring tool for compliance. Violation of the compliance requirements will be treated as non-compliance leading to the corrections or otherwise imposing penalty on the contractors.

ECOP 1: WASTE MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
General Waste	Soil and water pollution from the improper management of wastes and excess materials from the construction sites.	The Contractor shall: o Develop waste management plan for various specific waste streams (e.g., reusable waste, flammable waste, construction debris, food waste.) prior to commencing of construction and submit to ESMU PMT and PISSC for approval. o Organize disposal of all wastes generated during construction in an environmentally acceptable manner. This will include consideration of the nature and location of disposal site, so as to cause less environmental impact. o Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach. o Segregate and reuse or recycle all the wastes, wherever practical. o Collect and transport non-hazardous wastes to all the approved disposal sites. o Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process. o Provide refuse containers at each worksite. o Request suppliers to minimize packaging where practicable. o Place a high emphasis on good housekeeping practices. o Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal.
Hazardous Waste	Health hazards and environmental impacts due to improper waste management practices	The Contractor shall: o Collect chemical wastes in 200 liter drums (or similar sealed container), appropriately labelled for safe transport to an approved chemical waste depot. o Store, transport and handle all chemicals avoiding potential environmental pollution. o Store all hazardous wastes appropriately in bonded areas away from water courses. o Make available Material Safety Data Sheets (MSDS) for hazardous materials on-site during construction. o Collect hydrocarbon wastes, including lube oils, for safe transport off-site for reuse, recycling, treatment or disposal at approved locations. o Construct concrete or other impermeable flooring to prevent seepage in case of spills

ECOP 2: FUELS AND HAZARDOUS SUBSTANCE MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Fuels, oil, lubricants, paints and other hazardous substance.	Materials used in construction have a potential to be a source of contamination. Improper storage and handling of fuels, lubricants, chemicals and hazardous substance on-site, and potential spills from these goods may harm the environment or health of construction workers.	The Contractor shall: ○ Prepare spill control procedures and submit the plan for PISSC and SID for approval. ○ Train the relevant construction personnel in handling of fuels and spill control procedures. ○ Store dangerous goods in bonded areas on a top of a sealed plastic sheet away from water course. Refueling should occur only within bonded areas. ○ Make available MSDS for chemicals and dangerous goods on-site. ○ Transport waste of dangerous goods, which cannot be recycled, to a designated disposal site approved by Sindh EPA. ○ Provide absorbent and containment material (e.g., absorbent matting) where hazardous material are used and stored and personnel trained in the correct use. ○ Provide protective clothing, safety boots, helmets, masks, gloves, goggles, to the construction personnel, appropriate to materials in use. ○ Make sure all containers, drums, and tanks that are used for storage are in good condition and are labelled with expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. ○ Store hazardous materials above flood plain level. ○ Put containers and drums in temporary storages in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area should preferably slope or drain to a safe collection area in the event of a spill. ○ Put containers and drums in permanent storage areas on an impermeable floor that slopes to a safe collection area in the event of a spill or leak. ○ Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution. ○ Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials.

ECOP 3: WATER RESOURCES MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Hazardous Material and Waste	Water pollution from the storage, handling and disposal of hazardous materials and general construction waste, and accidental spillage	The Contractor shall: ○ Follow the management guidelines proposed in ECoPs 1 and 2. ○ Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways, storm water systems or underground water tables
Discharge from construction sites	During construction both surface and groundwater quality may be deteriorated due to construction activities in the river, sewerages from construction sites and work camps. The construction works will modify groundcover and topography changing the surface water drainage patterns, including infiltration and storage of storm water. The change in hydrological regime leads to increased rate of runoff and in sediment and contaminant loading, increased flooding and groundwater contamination.	The Contractor shall: ○ Divert runoff from undisturbed areas around the construction site ○ Stockpile materials away from drainage lines ○ Prevent all solid and liquid wastes entering waterways by collecting solid waste, oils, chemicals, bitumen spray waste and wastewaters from brick, concrete and asphalt cutting where possible and transport to an approved waste disposal site or recycling depot ○ Wash out transit mixture and concrete handling equipment at washing facilities off site or into approved bunded areas on site. Ensure that tires of construction vehicles are cleaned in the washing bay (constructed at the entrance of the construction site) to remove the mud from the wheels. This should be done in every exit of each construction vehicle to ensure the local roads are kept clean.
Soil Erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	The Contractor shall: ○ Stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatments as soon as practicable following earthwork to minimize erosion ○ Ensure that roads used by construction vehicles are swept regularly to remove sediment. ○ Water the material stockpiles, access roads and bare soils on an as required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds)

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities in water bodies	Construction works in the water bodies will increase sediment and contaminant loading, and effect habitat of fish and other aquatic biology.	The Contractor shall: • Monitor the water quality in the runoff from the site or areas affected by dredge plumes, and improve work practices as necessary • Protect water bodies from sediment loads by silt screen or bubble curtains or other barriers • Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways, storm water systems or underground water tables. • Reduce infiltration of contaminated drainage through storm water management design • Do not discharge cement and water curing used for cement concrete directly into water courses and drainage inlets.
Drinking water	Groundwater at shallow depths might be contaminated and hence not suitable for drinking purposes.	The Contractor shall: • Control the quality of groundwater to be used for drinking water on the bases of NEQS and World Bank standards for drinking water. Safe and sustainable discharges are to be ascertained prior to selection of pumps. • Tube wells will be installed with due regard for the surface environment, protection of groundwater from surface contaminants, and protection of aquifer cross contamination
	Depletion and pollution of groundwater resources	• Install monitoring wells both upstream and downstream areas near construction yards and construction camps to regularly monitor and report on the water quality and water levels. • Protect groundwater supplies of adjacent lands

ECOP 4: SOIL QUALITY MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Storage of fuel and toxic chemicals	Spillage of fuel and toxic chemicals will contaminate the soils	The Contractor shall: • Strictly manage the wastes management plans proposed in ECoP1 and storage of materials in ECoP2 • Construct appropriate spill contaminant facilities for all fuel storage areas. • Establish and maintain a hazardous materials register detailing the location and quantities of hazardous substances including the storage, use of disposals • Train personnel and implement safe work practices for minimizing the risk of spillage • Identify the cause of contamination, if it is reported, and contain the area of contamination. The impact may be contained by isolating the source or implementing controls around the affected site • Remediate the contaminated land using the most appropriate available method to achieve required commercial/industrial guideline validation results.
Construction material stock piles	Erosion from construction material stockpiles may contaminate the soils	The Contractor shall: • Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds

ECOP 5: BORROW AREAS DEVELOPMENT AND OPERATION/RESTORATION

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Development and operation of borrow areas	In case, the borrow pits developed by the Contractor, there will be impacts on local topography, landscaping and natural drainage.	The Contractor shall: • Reuse excavated or disposed material available in the project area to the maximum extent possible • Identify borrow pits in consultation with the local governments and PISSC as well as PMT. • Obtain the borrow material from: • barren land or land without tree cover outside the road reserve; • Do not dug the borrow pits within 5m of the toe of the final section of the road embankment. • Dig the borrow pits continuously. Ridges of not less than 8 m widths shall be left at intervals not exceeding 300 m and small drains should be cut through the ridges to facilitate drainage • Borrow areas should not exceed 0.6 m (2ft.) in depth. • Slope the bed level of the borrow pits, as far as possible, down progressively towards the nearest cross drain, if any, and do not lower it than the bed of the cross-drain, to ensure efficient drainage. Follow the below for restoration of borrow areas are: • Return stockpiled topsoil to the borrow pit if is used for agriculture; • Return stockpiled topsoil to the borrow pit and all worked areas to be stabilized through re-vegetation using local plants. • Control at each site by ensuring that base of the borrow pit drains into a sediment trap prior to discharging from the site.

ECOP 6: AIR QUALITY MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Air quality can be adversely affected by vehicle exhaust emissions and combustion of fuels.	The Contractor shall: • Operate the vehicles in a fuel efficient manner • Cover haul vehicles carrying dusty materials moving outside the construction site • Impose speed limits on all vehicle movement at the worksite to reduce dust emissions • Control the movement of construction traffic • Water construction materials prior to loading and transport • Service all vehicles regularly to minimize emissions • Limit the idling time of vehicles not more than 2 minutes
Construction machinery	Air quality can be adversely affected by emissions from machinery and combustion of fuels.	The Contractor shall: • Fit machinery with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. • Focus special attention on containing the emissions from generators • Machinery causing excess pollution (e.g. visible smoke) will be banned from construction sites • Carryout effects monitoring on monthly basis to control the emissions from construction machinery. • Service all equipment regularly to minimize emissions • Engage all vehicles that are physical fit for the work. • Obtain fitness certificate of vehicles/equipment from third party certification.
Construction activities	Dust generation from construction sites, material stockpiles and access roads is a nuisance in the environment and can be a health hazard.	• Water the material stockpiles, access roads and bare soils on an as required basis to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (e.g. high winds) • Minimize the extent and period of exposure of the bare surfaces • Reschedule earthwork activities or vegetation clearing activities, where practical, if necessary to avoid during periods of high wind and if visible dust is blowing off-site • Restore disturbed areas as soon as practicable by vegetation/grass-turfing • Store the cement in silos and minimize the emissions from silos by equipping them with filters.

ECoP 7: Noise and Vibration Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Noise quality will be deteriorated due to vehicular traffic	The Contractor shall: • Maintain all vehicles in order to keep it in good working order in accordance with manufactures maintenance procedures • Make sure all drivers will comply with the traffic codes concerning maximum speed limit, driving hours. • Make sure that all operator are trained and are having third party operator certificates.
Construction machinery	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall: • Appropriately site all noise generating activities to avoid noise pollution to local residents • Use the quietest available plant and equipment • Modify equipment to reduce noise (for example, noise control kits, lining of truck trays or pipelines) • Maintain all equipment in order to keep it in good working order in accordance with manufactures maintenance procedures • Install acoustic enclosures around generators to reduce noise levels. • Fit high efficiency mufflers to appropriate construction equipment.
Construction activity	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall: • Notify adjacent residents prior to any Typical noise event outside of daylight hours • Educate the operators of construction equipment on potential noise problems and the techniques to minimize noise emissions • Employ best available work practices on-site to minimize occupational noise levels • Install temporary noise control barriers where appropriate • Notify affected people if noisy activities will be undertaken, e.g. blasting • Plan activities on site and deliveries to and from site to minimize impact • Monitor and analyse noise and vibration results and adjust construction practices as required. • Avoid undertaking the noisiest activities, where possible, when working at night near the residential areas.

ECOP 8: PROTECTION OF FLORA

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Local flora are important to provide shelters for the birds, offer fruits and/or timber/fire wood, protect soil erosion and overall keep the environment very friendly to human-living. As such damage to flora has wide range of adverse environmental impacts.	The Contractor shall: • Use appropriate type and minimum size of machine to avoid disturbance to adjacent vegetation. • Make selective and careful pruning of trees where possible to reduce need of tree removal. • Clear only the vegetation that needs to be cleared in accordance with the plans. These measures are applicable to both the construction areas as well as to any associated activities such as sites for stockpiles, disposal of fill and construction of diversion roads. • Do not burn off cleared vegetation – where feasible, chip or mulch and reuse it for the rehabilitation of affected areas, temporary access tracks or landscaping. Mulch provides a seed source, can limit embankment erosion, retains soil moisture and nutrients, and encourages re-growth and protection from weeds. • Return topsoil and mulched vegetation (in areas of native vegetation) to approximately the same area of the roadside it came from. • Minimize the length of time the ground is exposed or excavation left open by clearing and re-vegetate the area at the earliest practically possible. • Ensure excavation works occur progressively and re-vegetation done at the earliest • Provide adequate knowledge to the workers regarding nature protection and the need of avoid felling trees during construction • Supply appropriate fuel in the work caps to prevent fuel wood collection

ECOP 9: PROTECTION OF FAUNA

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction Activities	The location of construction activities can result in the loss of wild life habitat and habitat quality,	The Contractor shall: • Limit the construction works within the designated sites allocated to the contractors • check the site for animals trapped in, or in danger from site works and use a qualified person to relocate the animal
	Impact on migratory birds, its habitat and its active nests	The Contractor shall: • Not be permitted to destruct active nests or eggs of migratory birds • Minimize the tree removal during the bird breeding season. If works must be continued during the bird breeding season, a nest survey will be conducted by a qualified biologist prior to commence of works to identify and located active nests • Minimize the release of oil, oil wastes or any other substances harmful to migratory birds to any waters or any areas frequented by migratory birds.
Vegetation Clearance	Clearance of vegetation may impact shelter, feeding and/or breeding and/or physical destruction and severing of habitat areas	The Contractor shall: • Restrict the tree removal to the minimum required. • Retain tree hollows on site, or relocate hollows, where appropriate • Leave dead trees where possible as habitat for fauna • Fell the hollow bearing trees in a manner which reduces the potential for fauna mortality. Felled trees will be inspected after felling for fauna and if identified and readily accessible will be removed and relocated or rendered assistance if injured. After felling, hollow bearing trees will remain unmoved overnight to allow animals to move of their own volition.
Construction Camps	Illegal poaching	• Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching.

ECOP 10: CONSTRUCTION CAMP MANAGEMENT

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Siting and Location of Construction Camps	Campsites for construction workers are the important locations that have significant impacts such as health and safety hazards on local resources and infrastructure of nearby communities.	The Contractor shall: • Locate the construction camps at areas which are acceptable from environmental, cultural or social point of view. • Consider the location of construction camps away from communities in order to avoid social conflict in using the natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities. • Submit to the PMT for approval a detailed layout plan for the development of the construction camp showing the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the construction camps. • Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social and security matters. • Code of Conduct to be prepared by the Contractor, signed by his workers and approved by the PMT of SRP.
Construction Camp Facilities	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	Contractor shall provide the following facilities in the campsites: • Adequate housing for all workers • Safe and reliable water supply. Water supply from tube wells that meets the national standards • Drinking water should be checked on monthly basis through monthly effects monitoring. • Hygienic sanitary facilities and sewerage system. The toilets and domestic waste water will be collected through a common sewerage. Provide separate latrines and bathing places for males and females with total isolation by wall or by location. Female toilets should be clearly marked in language understood by the persons using them to avoid miscommunication. The minimum number of toilet facilities required is one toilet for every ten persons. • Treatment facilities for sewerage of toilet and domestic wastes • Storm water drainage facilities. Both sides of roads are to be provided with shallow v drains to drain off storm water to a silt retention pond which shall be sized to provide a minimum of 20 minutes retention of storm water flow from the whole site. Channel all discharge from the silt retention pond to natural drainage via a grassed swale at least 20 meters in length with suitable longitudinal gradient.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Disposal of waste	Management of wastes is crucial to minimize impacts on the environment	The Contractor shall: • Ensure proper collection and disposal of solid wastes within the construction camps • Insist waste separation by source; organic wastes in one pot and inorganic wastes in another pot at household level. • Store inorganic wastes in a safe place within the household and clear organic wastes on daily basis to waste collector. Establish waste collection, transportation and disposal systems with the manpower and equipment's/vehicles needed. • Dispose organic wastes in a designated safe place on daily basis. At the end of the day cover the organic wastes with a thin layer of sand so that flies, mosquitoes, dogs, cats, rats, are not attracted. One may dig a large hole to put organic wastes in it; take care to protect groundwater from contamination by leachate formed due to decomposition. Cover the bed of the pit with impervious layer of materials (clayey, thin concrete) to protect groundwater from contamination. • Locate the garbage pit/waste disposal site min 500 m away from the residence so that peoples are not disturbed with the odour likely to be produced from anaerobic decomposition of wastes at the waste dumping places. Encompass the waste dumping place by fencing and tree plantation to prevent children to enter and play with. • Do not establish site specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approval waste disposal sites. • Contractor should made an agreement / got a NOC from near union council for disposal of solid waste in municipal facility.
Fuel supplies for cooking purposes	Illegal sourcing of fuel wood by construction workers will impact the natural flora and fauna	The Contractor shall: • Provide fuel to the construction camps for their domestic purpose, in order to discourage them to use fuel wood or other biomass. • Make available alternative fuels like natural gas or kerosene on ration to the workforce to prevent them using biomass for cooking. • Conduct awareness campaigns to educate workers on preserving the protecting of biodiversity in the project area, and relevant government regulations and punishments on wildlife protection.
Health and Hygiene	There will be a potential for diseases to be transmitted including malaria, exacerbated by inadequate health and safety practices.	The Contractor shall: • Provide adequate health care facilities within construction sites. • Provide first aid facility round the clock. Maintain stock of medicines in the facility and appoint fulltime designated first aider or nurse. • Provide anti-venom injection at site dispensary to cope any emergency in case of snake bite.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	There will be an increased risk of work crews spreading sexually transmitted infections and HIV/AIDS.	• Provide ambulance facility for the labourers during emergency to be transported to nearest hospitals. • Initial health screening of the labourers coming from outside areas • Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work • Provide HIV awareness programming, including STI (sexually transmitted infections) and HIV information, education and communication for all workers on regular basis • Complement educational interventions with easy access to condoms at campsites as well as voluntary counselling and testing • Provide adequate drainage facilities throughout camps to ensure that disease vectors habitats (stagnant water bodies, puddles) do not form. Regular mosquito repellent sprays in monsoon. • Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers. Place display boards at strategic locations within the camps containing messages on best hygienic practices
Safety	In adequate safety facilities to the construction camps may create security problems and fire hazards	• The Contractor shall: • Provide appropriate security personnel (police / home guard or private security guards) and enclosures to prevent unauthorized entry in to the camp area. • Maintain register to keep track on a head count of persons present in the camp at any given time. • Encourage use of flameproof material for the construction of labour housing/site office. Ensure that these houses/rooms are of sound construction and capable of withstanding storms/cyclones. • Provide appropriate type of firefighting equipment suitable for the construction camps • Display emergency contact numbers clearly and prominently at strategic places in camps. • Communicate the roles and responsibilities of labourers in case of emergency in the monthly meetings with contractors.
Site Restoration	Restoration of the construction camps to original condition requires demolition of construction camps.	The Contractor shall: • Dismantle and remove from the site all facilities established within the construction camp including the perimeter fence and lockable gates at the completion of the construction work. • Dismantle camps in phases as the work decreases (do not wait for completion of the entire work. • Give prior notice to the labourers before demolishing their camps/units • Maintain the noise levels within the national standards during demolition activities • Different contractors should be hired to demolish different structures to promote recycling or reuse of demolished material.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Reuse the demolition debris to a maximum extent. Dispose remaining debris at the designated waste disposal site by PMT. • Handover the construction camps with all built facilities as it is if agreement between both parties (contactor and land-owner) has been made so. • Restore the site to its original condition or to an agreed condition with the landowner defined prior to the commencement of the works (in writing). • Not make false promises to the labourers for future employment in O&M of the project.

ECOP 11: CULTURAL AND RELIGIOUS ISSUES

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction Activities near Religious and Cultural sites	Disturbance from construction works to the cultural and religious sites, and contractors lack of knowledge on cultural issues cause social disturbances.	The Contractor shall: • Communicate to the public through community consultation and newspaper announcements regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restriction. • Do not block access to cultural and religious sites, wherever possible • Restrict all construction activities within the foot prints of the construction sites. • Stop construction works that produce noise (particularly during prayer time) should there be any mosque/religious/educational institutions close to the construction sites and users make objections. • Take special care and use appropriate equipment when working next to a cultural/religious institution. • Stop work immediately and notify the site manager if, during construction, an archaeological or burial site is discovered. It is an offence to recommence work in the vicinity of the site until approval to continue is given by the PMT. • Provide separate prayer facilities to the construction workers. • Show appropriate behavior with all construction workers especially women and elderly people • Allow the workers to participate in praying during construction time • Resolve cultural issues in consultation with local leaders and supervision consultants • Establish a mechanism that allows local people to raise grievances arising from the construction process. • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works so as to maintain effective surveillance over public health, social and security matters
Best Practices	Construction works may pose health and safety risks to the construction workers and site visitors leading to severe injuries and deaths. The population in the proximity of the construction site and the construction	The Contractor shall: • An Occupational, Health and Safety Plan shall be prepared by the Contractor and submitted to ESU of PISSC and ESMU of PMT for review and approval. The plan shall be approved by the ESU of PISSC. The OHS shall include a job hazard analysis and safety precautions (like PPEs, barriers, change to design) and make ensure use of the PPEs and other measures during construction time.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	workers will be exposed to a number of (i) biophysical health risk factors, (e.g. noise, dust, chemicals, construction material, solid waste, waste water, vector transmitted diseases), (ii) risk factors resulting from human behavior (e.g. STD and HIV) and (iii) road accidents from construction traffic.	• The contractor will train his workers and project management staff in (not limited to) first aid and basic infection control at work, transportation and handling of hazardous wastes, use of PPEs, fire safety etc. • Implement suitable safety standards for all workers and site visitors which should not be less than those laid down on the international standards (e.g. International Labour Office guideline on 'Safety and Health in Construction; World Bank Group's 'Environmental Health and Safety Guidelines') and contractor's own national standards or statutory regulations, in addition to complying with the national acts and rules of the Government of Sindh • Provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular construction activity and specific classes of hazards in the work areas, • Provide personal protection equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles, full-face eye shields, and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing them with the damaged ones. • Safety procedures include provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job • Appoint an environment, health and safety manager to look after the health and safety of the workers • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works and establishment of construction camps so as to maintain effective surveillance over public health, social and security matters.
	Child and pregnant labour	The Contractor shall: • Not hire children of less than 14 years of age and pregnant women or women who delivered a child within 8 preceding weeks, in accordance with the Pakistani Labour Laws and Employment of Child Act (1977).
Accidents	Lack of first aid facilities and health care facilities in the immediate vicinity will aggravate the health conditions of the victims	• The contractor will arrange first aid facilities at the site. A trained first-aider should be present at the site and arrangements made with a local doctor to be available on call. Appropriately equipped first-aid stations should be easily accessible throughout the place of work • Contact numbers and location of the nearest healthcare/emergency centre should be displayed at the worksite. • Document and report occupational accidents, diseases, and incidents.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice. • Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures. • Provide awareness to the construction drivers to strictly follow the driving rules • Provide adequate lighting in the construction area and along the roads
Construction Camps	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	The Contractor shall provide the following facilities in the campsites to improve health and hygienic conditions as mentioned in ECoP 14 Construction Camp Management: • Adequate ventilation facilities • Safe and reliable water supply. Water supply from deep tube wells that meets the national standards • Hygienic sanitary facilities and sewerage system. The toilets and domestic waste water will be collected through a common sewerage. • Treatment facilities for sewerage of toilet and domestic wastes • Storm water drainage facilities. • Recreational and social facilities • Safe storage facilities for petroleum and other chemicals in accordance with ECoP:2 • Solid waste collection and disposal system in accordance with ECoP1. • Arrangement for trainings • Security fence at least two m height. • Sick bay and first aid facilities
Water and Sanitation Facilities at the Construction Sites	Lack of Water sanitation facilities at construction sites cause inconvenience to the construction workers and affect their personal hygiene.	• The contractor shall provide toilets at the construction sites. • Location of toilet facilities should be at least six meters away from storm drain system and surface waters. These toilets should be cleaned once a day and all the sewerage should be pumped from the collection tank once a day and should be brought to the common septic tank for further treatment. Alternatively, each toilet facility should have septic tank and soaking pit. • Contractor should provide clean drinking water facilities to the construction workers at all the construction sites.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Trainings	Lack of awareness and basic knowledge in health care among the construction workforce, make them susceptible to potential diseases.	The Contractor shall: • Train all construction workers in basic sanitation and health care issues (e.g., how to avoid malaria and transmission of sexually transmitted infections (STI) HIV/AIDS. • Train all construction workers in general health and safety matters, and on the specific hazards of their work Training should consist of basic hazard awareness, site specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. • Commence the malaria, HIV/AIDS and STI education campaign before the start of the construction phase and complement it with by a strong condom marketing, increased access to condoms in the area as well as to voluntary counselling and testing. • Implement malaria, HIV/AIDS and STI education campaign targeting all workers hired, international and national, female and male, skilled, semi- and unskilled occupations, at the time of recruitment and thereafter pursued throughout the construction phase on on-going and regular basis. This should be complemented by easy access to condoms at the workplace as well as to voluntary counselling and testing.

ECOP 12: WORKER HEALTH AND SAFETY

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Best Practices	Construction works may pose health and safety risks to the construction workers and site visitors leading to severe injuries and deaths. The population in the proximity of the construction site and the construction workers will be exposed to a number of (i) biophysical health risk factors, (e.g. noise, dust, chemicals, construction material, solid waste, waste water, vector transmitted diseases), (ii) risk factors resulting from human behavior (e.g. STD and HIV) and (iii) road accidents from construction traffic.	The Contractor shall: • An Occupational, Health and Safety Plan shall be prepared by the Contractor and submitted to ESU of PIC and ESMU of PMU for review and approval. The plan shall be approved by the ESU of PIC. The OHS shall include a job hazard analysis and safety precautions (like PPEs, barriers, change to design) and make ensure use of the PPEs and other measures during construction time. • The contractor will train his workers and project management staff in (not limited to) first aid and basic infection control at work, transportation and handling of hazardous wastes, use of PPEs, fire safety etc. • Implement suitable safety standards for all workers and site visitors which should not be less than those laid down on the international standards (e.g. International Labour Office guideline on 'Safety and Health in Construction; World Bank Group's 'Environmental Health and Safety Guidelines') and contractor's own national standards or statutory regulations, in addition to complying with the national acts and rules of the Government of Sindh • Provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular construction activity and specific classes of hazards in the work areas, • Provide personal protection equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles, full-face eye shields, and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing them with the damaged ones. • Safety procedures include provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job • Appoint an environment, health and safety manager to look after the health and safety of the workers • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works and establishment of construction camps so as to maintain effective surveillance over public health, social and security matters.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	Child Labor	The Contractor shall: • Not hire children of less than 14 years of age in accordance with the Pakistani Labour Laws and Employment of Child Act (1977).
	Gender Based Violence	• The contractor shall: • Train the workers regarding (Gender Based Violence GBV) and also train workers about sexual harassment, child abuse, human trafficking for reducing the risk of GBV. • The contractor will also raise awareness among workers regarding coordination with local law enforcement and code of conduct.
Accidents	Lack of first aid facilities and health care facilities in the immediate vicinity will aggravate the health conditions of the victims	• The contractor will arrange first aid facilities at the site. A trained first-aider should be present at the site and arrangements made with a local doctor to be available on call. Appropriately equipped first-aid stations should be easily accessible throughout the place of work • Contact numbers and location of the nearest healthcare/emergency centre should be displayed at the worksite. • Document and report occupational accidents, diseases, and incidents. • Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice. • Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures. • Provide awareness to the construction drivers to strictly follow the driving rules • Provide adequate lighting in the construction area and along the roads
Construction Camps	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	The Contractor shall provide the following facilities in the campsites to improve health and hygienic conditions as mentioned in ECoP: Construction Camp Management: • Adequate ventilation facilities • Safe and reliable water supply. Water supply from deep tube wells that meets the national standards • Hygienic sanitary facilities and sewerage system. The toilets and domestic waste water will be collected through a common sewerage. • Treatment facilities for sewerage of toilet and domestic wastes • Storm water drainage facilities. • Recreational and social facilities • Safe storage facilities for petroleum and other chemicals in accordance with ECoP 2

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Solid waste collection and disposal system in accordance with ECoP1. • Arrangement for trainings • Security fence at least two m height. • Sick bay and first aid facilities
Water and Sanitation Facilities at the Construction Sites	Lack of Water sanitation facilities at construction sites cause inconvenience to the construction workers and affect their personal hygiene.	• The contractor shall provide toilets at the construction sites. • Location of toilet facilities should be at least six meters away from storm drain system and surface waters. These toilets should be cleaned once a day and all the sewerage should be pumped from the collection tank once a day and should be brought to the common septic tank for further treatment. Alternatively, each toilet facility should have septic tank and soaking pit. • Contractor should provide clean drinking water facilities to the construction workers at all the construction sites.
Other ECoPs	Potential risks on health and hygiene of construction workers and general public	The Contractor shall follow the following ECoPs to reduce health risks to the construction workers and nearby community: • ECoP : Fuels and Hazardous Substance Management • ECoP : Air Quality Management • ECoP : Noise and Vibration Management • ECoP : Road Transport and Road Traffic Management
Trainings	Lack of awareness and basic knowledge in health care among the construction workforce, make them susceptible to potential diseases.	The Contractor shall: • Train all construction workers in basic sanitation and health care issues (e.g., how to avoid malaria and transmission of sexually transmitted infections (STI) HIV/AIDS. • Train all construction workers in general health and safety matters, and on the specific hazards of their work Training should consist of basic hazard awareness, site specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. • Commence the malaria, HIV/AIDS and STI education campaign before the start of the construction phase and complement it with by a strong condom marketing, increased access to condoms in the area as well as to voluntary counselling and testing. • Implement malaria, HIV/AIDS and STI education campaign targeting all workers hired, international and national, female and male, skilled, semi- and unskilled occupations, at the time of recruitment and thereafter pursued throughout the construction phase on on-going and regular basis. This should be complemented by easy access to condoms at the workplace as well as to voluntary counselling and testing.

Annexure IX: SRP SOPS for Management of COVID-19

Standard Operating Procedure for Management of COVID-19

Abstract

This document has been prepared in-line with World Bank Interim Guidance Note on COVID-19. This document provides general guideline for the Contractors to mobilize the team and construction material.

Sindh Resilience Project
Irrigation Department
Government of Sindh

DOCUMENT ISSUE AND REVISION RECORD

This document and its contents have been prepared and are intended solely for the information and use of the Government of Sindh, Irrigation Department concerning the **SINDH RESILIENCE PROJECT (SRP).**

Document History

Project	Sindh Resilience Project (SRP)
Proponent	Irrigation Department, Government of Sindh
Document Ref	SRP-ESMP-COVID-19
Document Title	Standard Operating Procedure for Management of COVID-19 for Bhatta Siro 2, Sohrio Wah, Namaro Viakasar, Gordhro-2, Sudran Nadi, Adhigam - Syed Alam Shah, Nagar - 2 (Layari), Jhanjhoo Nadi, Pathar and Targaam Budhesar) Tehsil Small Dams in Nagarparkar

Revision	Description	Prepared	Checked	Review	Authorized	Date
0	Draft for World Bank Review	Arshad Hussain Memon Nasir Ali Panhwar/	Mohammad Ibrahim Daudpota	Zahid Hussain Shaikh	Jawed Ahmed Memon	18-11-2020

Hadith of the Prophet (PBUH) that addresses disease outbreaks and how Muslims should deal with it.

The Hadith says:

"If you hear of an outbreak of plague in a land, do not enter it, but if the plague breaks out in a place while you are in it, do not leave that place" (Sahih Bukhari and Muslim)

I. Introduction:

Sindh Resilience Project (SRP) received an ESF/safeguards interim note: COVID-19 considerations in construction/civil works projects on 9 April 2020 from the World Bank. In continuation to this ESMU-SRP team has developed this document. The COVID-19 pandemic has created unprecedented challenges for everyone. Addressing COVID-19 related issues at the construction site starts with recognizing that this is not business as usual and that circumstances require a highly adaptive responsive management design to avoid, minimize and manage what may be a rapidly evolving situation. To use reasonable efforts in the circumstances, recognizing that what may be possible today may be different next week (both positively, because more supplies and guidance may be available, and negatively, because the spread of the virus may have accelerated).

II. Purpose:

This SOP shall provide guidelines to deal with the current situation created due to the epidemic of COVID-19 and to provide preventive measures for prevention from the COVID-19 rampant.

III. Scope:

The scope of this Standard Operating Procedure (SOP) applies to all active work-sites of Sindh Resilience Project (SRP) mentioned below; This is general Standard operating procedure, however, as per guidance note issued on 7th April 2020 by World Bank Section 5, each contractor HSE staff should prepare site-specific COVID Management plan, which needs to be approved by PISSC and PMT team.

IV. Focal Person and their Roles for Management of COVID

Addressing COVID-19 at a project site goes beyond occupational health and safety, and is a broader project issue which requires the involvement of different members of a project management team. Given the project context, a designated team would be established to address COVID-19 issues, at PMT level, PISSC level, and at the contractor level.

Following would be the composition of designated teams at three levels; which are Client.

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a) SRP-PMT

Name	Designation	Cell number/ WhatsApp number	Email
Muhammad Ibrahim Daudpota	Deputy Director (EHS)	0335-3865861 0300-3317550	mibrahim.daudpota@yahoo.com
Arshad Hussain Memon	Environment Safeguard Consultant	0333-7045597	arshad.memon@hotmail.com
Nasir Ali Panwhar	Social Safeguard Consultant	0300-3079491	napanhwar@gmail.com

b) SRP-PISSC

Name	Designation	Cell number/ WhatsApp number	Email
TBN	Team Leader		
TBN	Chief Resident Engineer		
TBN	Resident Engineer		
TBN	Environment Specialist		
TBN	Social Safeguard Specialist		

c) Contractor Level

S.NO	Name of Sub-project	Name of Focal Person	Contact Person
1.	Bhatta Siro 2	TBN	
2.	Sohrio Wah	TBN	
3.	Namaro	TBN	
4.	Viakasar	TBN	
5.	Gordhro-2	TBN	
6.	Sudran Nadi	TBN	
7.	Adhigam - Syed Alam Shah	TBN	
8.	Nagar - 2 (Layari)	TBN	
9.	Jhanjhoo Nadi	TBN	
10	Pathar	TBN	
11	Targaam Budhesar	TBN	

The overall obligation of the Contractor will be:

- to take all necessary precautions to maintain the health and safety of the Contractor's Personnel
- to appoint a health and safety officer at site, who will have the authority to issue directives to maintain the health and safety of all personnel authorized to enter and or work on the site and to take protective measures to prevent accidents

- to ensure, in collaboration with local health authorities, that medical staff, first aid facilities, sickbay, ambulance services and any other medical services specified are available at all times at the site and at any accommodation
- to ensure suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics

V. Procedures for Working at Camps located at all sub-projects

Following is the general standard operating procedure (SOP) and shall be followed by all Contractors, however, each contractor shall prepare site-specific plans according to local conditions and site-specific needs.

i. Before resuming the work, the contractor should ensure the disinfection of camp premises and this should be done on regular basis subsequently.
ii. Contractor representative (Project Manager) in consultation with HSE Staff and PISSC -HSE team shall arrange sufficient stock of PPE like coverall, face mask N-95, face shield, surgical mask, hand sanitizer, gloves, temperature Guns shall be arranged before the arrival of the workforce on site.
iii. Other items like tissues and hand sanitizer for all office workers. Surgical masks are made available to offer anyone, who develops respiratory symptoms.
iv. The contractor should develop hand-washing areas for all the workers, with the facility of clean water and soap.
v. Wastewater tank should be developed for the disposal of contaminated water.
vi. Minimize face to face meetings, on-site maximize telephonic, video, and conference calls as a replacement of physical meetings (where available).
vii. Maintain physical distance at least 6 feet distance with each other during the meeting.
viii. Use a face mask and latex gloves while maintaining physical distance
ix. Use a digital thermometer to screen all the personnel entering site office, site and camp areas and maintain a logbook for record-keeping of temperature readings of all the workers entering office area/building.
x. DO NOT use a traditional mercury thermometer.
xi. Promote communication with staff to inform if anyone in their contact (such as within their residential area, community, market area, place of visit for work/ meeting/ religious gathering) has developed any symptoms of COVID-19 and restrict their entry to workplace or meeting with staff.
xii. If an individual's temperature is on the higher side and exhibits symptoms of high fever, he should be investigated by a medical doctor for further symptoms of COVID-19.
xiii. If an individual after examination exhibits all the symptoms of COVID-19 immediate attention should be given and contact Pak Corno Helpline (03001111166) for further guidance on an immediate basis.
xiv. Have details of contact numbers of concerned District Health Officer (DHO), Taluka Hospital and local administration i.e Deputy Commissioner and Assistant Commissioner
xv. Install sanitizer dispensers at the workplace in each room. Make sure these dispensers are regularly refilled.
xvi. Ensure that face masks and / or paper tissues are available at workplaces, for those who develop a runny nose or cough at work, along with closed bins for hygienically disposing of them.

xvii. Signages in local language promoting regular handwashing should be displayed at prominent locations, occupational health and safety officer and Social Officer shall make sure this.

xviii. All persons including officers, laborers, etc. should frequently wash hands for more than 20 seconds regularly with soap or hand sanitizer.

xix. All benchtops, door handles, working tables, chairs, etc. should be sanitized by using alcohol-based cleaning liquids or hypochlorite-based chemicals (twice a day).

xx. COVID-19 waste should not dispose in an open area, and it must be contained properly and disposed of properly, through incineration only.

xxi. All staff members should be trained for the COVID-19 waste management.

xxii. All the waste such as face masks, gloves, and other items generated at office and campsites should be stored in a labelled marked container (Hazardous Waste) and should be stored separately in isolation after disinfection. The waste once accumulated should be disposed of via EPA, a certified contractor for Incineration.

xxiii. In case of any worker/staff member develops the symptoms of COVID-19 he should be referred to the nearest Government facility for the testing.

xxiv. In case if any of the worker develops symptoms of COVID-19 he should be thoroughly explained about WHO's guidelines of "Home Care for Patients with COVID-19 presenting with mild symptoms and management of their contact"

xxv. HSE Team shall not allow the overage, person with diabetes, lung infection, cancer, or any other team member having chronic health issues.

VI. Communication with Community

The community may be concerned about the presence of non-local workers, or the risks posed to the community by local workers' presence on the project site. The following actions should be considered by ESMP Staff:

- Other forms of communication should be used; posters, pamphlets, the means used should take into account the ability of different members of the community to access them, to make sure that communication reaches these groups.
- Face to face meetings should be avoided or safe distance should be maintained.
- The community should be made aware of the procedure for entry/exit to the site, the training being given to workers, and the procedure that will be followed by the project if a worker becomes sick.
- Community as well workers should be encouraged to use the existing project grievance mechanism to report concerns relating to COVID-19, preparations being made by the project to address COVID-19 related issues, how procedures are being implemented, and concerns about the health of their co-workers and other staff.

VII. Procedures for Team Traveling, Material Transportation & Work on Site:

a) Team Traveling

i. Before traveling make sure that the latest information on the area where COVID-19 is spreading is readily available, the information may be accessed through www.covid.gov.pk and www.who.int/emergencies/diseases/novel-coronavirus-2019/sutation-reports/.

ii. Based on the latest information, assess the benefits and risks related to upcoming travel plans and avoid sending a large number of team members on field visits also exclude older employees and those with medical conditions such as diabetes, heart and lung disease to areas where COVID-19 is spreading.

iii. Make sure all persons traveling to locations reporting COVID-19 are briefed by a qualified professional.

iv. Employees traveling to sites must-have face mask and hand sanitizer of alcohol-based hand rub. This can facilitate regular hand-washing.

v. Seating arrangement of such vehicles amongst the individuals occupying it shall be such that 3 feet distance is maintained. Individuals occupying such vehicles shall wash hands with soap before entry into site or premises and, subsequently, their hands shall be sanitized

vi. All Vehicles must have the minimum possible number of travelers as per the Guideline of Sindh Government. (2 to 3 person/vehicle)

b) Material Transportation

i. The temperature of the drivers, conductors, loaders, and other staff of the vehicle transporting such materials shall be monitored at entry points along with other indicators of COVID-19 that are flu, cough, and muscular pain, etc. No person(s) associated with such vehicles having any or all symptoms of COVID19 shall be allowed to enter the site or premises.

ii. The material like steel, wood, and cloth, iron, plastic the COVID-19 for days, therefore, all such raw material shall be properly sanitized and disinfected before entry to site or premises is granted.

iii. Seating arrangement of such vehicles amongst the individuals occupying it shall be such that 3 feet distance is maintained. Individuals occupying such vehicles shall wash hands with soap before entry into site or premises and, subsequently, their hands shall be sanitized.

iv. Raw materials, machinery, and any other material required to be processed shall be only allowed to enter the site or premises after the vehicle is completely sanitized and disinfected at the entry point

c) Working on Site

a. all labor be maintained in the Camp during the project construction period

b. HSE Team should check the COVID parameters of each worker before the start of work and record may be shared on the group by 9:00 am every day.

c. If any worker **found suspected should not be allowed on-site** for work and after examination exhibits all the symptoms of COVID-19 immediate attention should be given and contact Pak Corno Helpline (03001111166) for further guidance on immediate basis.

d. Daily toolbox talk should include COVID-19 preventive measures on a regular basis and preventive measures should be made mandatory for the contractors and subcontractors.

e. All the team members conducting inspections should minimize their time on-site to the barest minimum necessary to ensure compliance with the Specification. **DO NOT LINGER** on-site and return as soon as possible to the colony.

f. All staff must be sprayed and cleaned on returning to the camp and a wash facility has been set up at the site gate.

f. The guards may be instructed to enforce these measures. Gloves, masks, shoes and helmet must be left at the gate after spraying.
g. All the workers working on site, should be provided with protective clothing; coverall, face masks, gloves and hand sanitizers for their regular use.

d) Infected Persons/Team Member Isolation:

a. At each camp site at least one room should be declared as quarantine quarter, with appropriate facilities.
b. If an individual after examination exhibits all the symptoms of COVID-19 immediate attention should be given and contact Pak Corno Helpline (03001111166) for further guidance on immediate basis.
c. Allocate quarantine quarters at camp site and keep the infected person isolated from the remaining staff until the doctor decides return to the wider community.
d. No healthy person will be allowed to enter or access the quarantine quarter at all times not even after wearing proper PPEs.
e. Medical doctor handling the infected person for initial first aid; should use following PPEs; medical masks, gown, apron, eye protection goggles or face shield (respirator N95 or FFP2 standard) and boots.
f. Healthcare wastes produced during the care of COVID-19 patients should be collected safely in designated containers and bags, treated and then safely disposed.

VIII. Training of ESMP Security Staff

- Training of the ESMP staff and security staff will be carried out by the ESMU PMT team and PISSC team.

IX. Monitoring & Reporting Mechanism

Keeping in view the aggressive behavior of pandemic, effective and timely reporting will be the key to success; Environment officer of each sub-project will be the focal person, prepare a report on below format a on daily basis and submit to the PISSC through what sup group already working and PISSC Environment Specialist shall compile and submit the report 10:00 am on daily basis. (10:00 am – 10:00 am- 24hrs)

a) <u>Health Status of Workers</u>

- Contractor shall provide the Status in **Daily/Weekly report** of implementation, which includes following;

  - Total number of staff available on site
  - Number of total patients tested
  - Number of patients reported positive
  - Number patients reported negative
  - Number patients reported quarantine at hospital or home

b) <u>Status of Personal Protective Equipment and other supplies at each Sub-project site</u>

  - Temperature guns
  - Number of Gloves available and used

- Number of Mask available and used
- Availability of Hand sanitizer
- Number of Coverall available and used
- Contractor shall also submit the details of items procured and any actions taken for COVID-19 in each IPC and verified by the PISSC.

X. Signages / Communication

All Contractors shall install following signages at prominent locations after translation into Sindhi language. These are given as sample, while more could be developed jointly.

XI. Construction Contract Coverage for COVID 19 under Existing ESMP Budget.

The ESMP of existing contracts are prepared according to FIDIC guidelines, which cover the major resources to deal with conventional requirements. However following resources are available on each site, which are given in below table.

HSE related resources available at sub project sites

S.NO	Name of Sub-project	Name of Contractor	Number of Health & Safety Staff at Site	Ambulance
1.	Bhatta Siro 2	TBN		
2.	Sohrio Wah	TBN		
3.	Namaro	TBN		
4.	Viakasar	TBN		
5.	Gordhro-2	TBN		
6.	Sudran Nadi	TBN		
7.	Adhigam - Syed Alam Shah	TBN		
8.	Nagar - 2 (Layari)	TBN		
9.	Jhanjhoo Nadi	TBN		
10	Pathar	TBN		
11	Targaam Budhesar	TBN		

XII. ESMP Budget for COVID Management

Given the unprecedented condition and specialized requirements for the provision of Personal Protective Equipment, like a special face mask, hand gloves, temperatures guns, hand sanitizer etc.

can be used from the existing budget of ESMP and contingency amount provided in each contract. In addition to this, any un-utilized amount may also be used for the procurement of PPE and other required arrangements to handle with this pandemic situation.

Following are the amount which may be utilized for the procurement of PPE's and other instruments;

S.NO	Name of Sub-project	Name of Contractor	ESMP Budget	Amount Used till date	Amount remaining
1.	Bhatta Siro 2	TBN			
2.	Sohrio Wah	TBN			
3.	Namaro	TBN			
4.	Viakasar	TBN			
5.	Gordhro-2	TBN			
6.	Sudran Nadi	TBN			
7.	Adhigam - Syed Alam Shah	TBN			
8.	Nagar - 2 (Layari)	TBN			
9.	Jhanjhoo Nadi	TBN			
10	Pathar	TBN			
11	Targaam Budhesar	TBN			

Find the latest information from WHO on where COVID-19 is spreading:

https://www.who.int/docs/default-source/coronaviruse/getting-workplace-ready-for-covid-19.pdf?sfvrsn=359a81e7_6