

Environmental Impact Assessment

February 2018

PAK: Balochistan Water Resources Development Sector Project

Project No. 48098-002

Part 3 of 5

Prepared by Irrigation and Power Department, Government of Balochistan for the Asian Development Bank (ADB).

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4 PROJECT NEED AND ALTERNATIVES

206. This chapter intends to present the justification and feasibility of the selected sub-project scheme among a total of 5 sub-project schemes. Furthermore, this chapter intends to present the different alternatives considered by the team design for the particular Sri-Toi Water Storage Dam and irrigation system.

4.1 No Project Alternative

207. The Project Area can be considered as poor from an economic perspective. Subsistence farming is the economic mainstay. In case the proposed project is not implemented, the socio-economic conditions will not change as such. With the increasing population and scarcity of resources, residents are forced to abandon their homes in search of livelihood and grazing grounds for their cattle stock.

208. From the environmental perspective, the project site comprising of dam pondage area as well as irrigation channel and proposed land for irrigation are arid in nature having little or no rain and too dry to support vegetation. Water availability is scarce in area hence the proposed project will contribute positively to the project area.

4.2 Sub-Projects Alternative

209. Based on the five stages selection process, the following five sub-projects, valued at US\$ 51.92 million were selected for pre-feasibility study:

- Ahmedzai Perennial and Floodwater Irrigation
- Sabakzai Dam Irrigation Project
- Sri Toi Water Storage Dam and Irrigation
- Killi Sardar Akhter - Perennial and Floodwater Irrigation

210. Sri-Toi water storage dam, valued at US\$ 31.94 million was selected as the Core Sub-project from the selected five sub-projects. Feasibility and engineering design are being carried out for the selected core sub-project, and will be duly submitted in a subsequent report.

211. The summary of the pre-feasibility results at the basin level are presented in the following sections.

212. The available water at the sub-project level estimated using the catchment area in the Arc SWAT Model is given in **Table 13**.

Table 1: Water Available for Potential Sub-projects in Zhob River Basin

No	Sub-project Name	Surface Water Availability (MCM)
1	Ahmedzai Perennial and Floodwater Irrigation	7.41
2	Sabakzai Dam Irrigation Project	18.1
3	Sri Toi Water Storage Dam and Irrigation	34.71
4	Killi Sardar Akhter - Perennial and Floodwater Irrigation	2.94

213. It is evident that the potential for water availability at Sri Toi Dam Sub project is greater than the remaining sub-projects.

214. Command area development has been included as an integral part of all sub-projects which includes: a) watercourse improvement and lining; b) precision land levelling; c) farm and field layout using surface irrigation hydraulics; d) Katcha tracks for disposal of produce; e) service and supply providers and strengthening; f) productivity enhancement demonstrations; and g) social organization and capacity building of male and women organizations.

215. Watershed development activities under a sub-project included development of earthen micro-catchments (eyebrow terraces), digging of pits, addition of compost, and termite treatment and plantation of timber/forest/arid fruits trees, shrubs and grasses. In steep slope areas, the eyebrows will be strengthened using loose stones. As far as possible, the check structures and gabion structures must be avoided and only incorporated in critical locations.

216. The proposed and existing command areas in the selected sub-projects are given in **Table 14**.

Table 2: Land use wise area under five sub-projects of Zhob River Basin

S. No.	Sub-Project	Improved Irrigated Commands		Watershed Area	Khushkaba Area	Total Area
		New	Existing			
1	Ahmed Zai Perennial and Flood Irrigation	180	427	52	200	859
2	Sabakzai Dam Irrigation Project	0	3,000	350	0	3,350
3	Sri Toi Water Dam Irrigation	4,027	0	400	361	4,788
4	Killi Sardar Akhter Perennial Irrigation	0	230	22	0	252

S. No.	Sub-Project	Improved Irrigated Commands		Watershed Area	Khushkaba Area	Total Area
		New	Existing			
5	Improvement of Farmers' Managed Irrigation	0	4,370	0	0	4,370
Total		4,207	8,027	824	561	13,619

217. The bold section demonstrates that the Sri Toi Water Dam and Irrigation System will provide the most benefits in comparison to other sub projects.

218. It is expected that in the command area of sub-projects, cropping intensity of 120 percent would be achieved within initial 2-3 years after the operation of the irrigation sub-project.

4.3 Economic and Financial Justification

219. Among the selected sub-projects, **SRI TOI WATER STORAGE DAM** had highest annual Net Value Production (NVP) as compared to the other sub-projects in the Zhob river basin largely because of the larger command area. However, the beneficiaries are reduced by one-half to one-third due to higher unit cost per hectare.

220. Detailed economic analysis is presented in **Table 15** and **Table 16**.

Table 3: Cost of development of sub-projects in Zhob river basin sub-projects

Sub-Project	Cost (Rs. In million)						
	Infrastructure	Command Area Development	Watershed and Groundwater	Khushkaba Farming	Gender	Capacity Development	TOTAL
Ahmedzai Perennial and Floodwater Irrigation	183	25	4	15	5	5	236
Sabakzai Dam Irrigation Project	490	75	25	74	5	5	673
Sri Toi Water Storage Dam Irrigation	2,970	79	280	15	5	5	5,445
Killi Sardar Akhter Perennial Irrigation	83	13	2	-	5	5	108
Farmers Managed Irrigation Sub-Projects Improvement							525
Total	3,726	192	311	104	20	20	6,987

221. It is evident from the above figure that the cost of development of Sri Toi Project is the most at Rs. 5,445 Million followed by Sabakzai Dam Irrigation Project, Farmers Managed

Irrigation Sub-Projects Improvement, Ahmedzai Perennial and Floodwater Irrigation and Killi Sardar Akhter Perennial Irrigation.

Table 4: Economic analysis of selected sub-projects

S. No.	Sub-Project	Cost/ha (Million Rs. /ha)	Benefit- Cost Ratio	NVP (Million Rs.)	FIRR (%)	EIRR (%)
1	Ahmedzai Perennial and Floodwater Irrigation	0.28	1.38	82.10	17.59	18.48
2	Sabakzai Command Area Development	0.20	1.10	290.30	12.83	14.46
3	Sri Toi Water Storage Dam Irrigation	0.70	1.50	901.50	15.33	16.27
4	Killi Sardar Akhter Perennial Irrigation	0.43	1.21	31.30	16.29	16.63

222. The preliminary cost estimates were prepared for Sri Toi Dam's infrastructure works including source development and irrigation network, command area development, watershed management and groundwater recharge, Khushkaba farming development, gender development and service/supply providers capacity development works and summarized in **Table 17**.

Table 5: Estimated cost and target of selected sub-projects in Zhob river basin

S. No.	Sub-Project	Estimated Cost (Million \$)	New Command Area (ha)	Improved Command Area (ha)	Number of Households
1	Sri Toi Water Storage Dam Irrigation	51.8	4,027	-	853
2	Farmers Managed Irrigation Sub-Projects Improvement	4.47		4,370	1500

4.4 Justification of Dam Design at Sri Toi

223. **Table 18** below provides comparison of alternatives with respect to design of different irrigation schemes:

Table 6: Comparative analysis of different irrigation schemes

Option	Reasons for selection/Rejection
Perennial and Flood Irrigation Scheme (PIS+FIS)	Since perennial flow is available at Sri Toi, initially a weir diverting water to a flood and perennial channel was considered as an economical option. However, the river has subsurface flow during few months which cannot be intercepted through construction of a weir during low flow seasons. Furthermore, flash floods occur frequently in this area and the floodwater cannot be reliably utilized for the design command area without proposing a storage structure. Therefore, this option was abandoned.
Infiltration Gallery	As a second design alternative, an infiltration gallery was considered. But the abundant surface water particularly during high flow seasons and in floods will pass un-utilized and the total command area would be significantly reduced. The topography of the area is very mild therefore; the conveyance conduit from the infiltration gallery would lose a huge patch of cultivable land till the daylight point. Therefore, this option was also not selected.
Cascade Dam	The option of three small cascade dams was also considered. Each dam was set 15 meters high. The combined area capacity curve of these dams was developed. It showed that the combined storage of only 1 MCM which is negligible as compared to the proposed dam of 36.5 MCM. Since, this option was not able to fulfil the requirements of command area, therefore, it was also not considered.
Dam	A storage dam was evaluated as the best option based on the project location hydrology, topography and available land. A dam will fulfill all the necessary requirements to utilize the potential of the area which include; storage of flood water for reliable perennial irrigation, protection of command area from severe floods, maximum utilization of area for command area development. Several options and axes were compared for the most optimum dam configuration which also included cascades of three 15-m high dam. However, the final selected option is a single 66-m high earthfill dam with one dyke and an overflow spillway. The details of the selected option are discussed below:

4.5 Justification of Dam Location at Sri Toi

224. Selection of dam axis: The dam axis has been selected after reviewing the general topography of the area through site visits and analysis of satellite based imagery and terrain. The selected dam axis has sound rock on both abutments. The foundation geology will be confirmed through geotechnical investigation currently in progress by the design team through boreholes along the axis to verify the selection.

225. At the proposed axis, a dam with considerable storage would be constructed. The dam crest length is nearly 231 m with two additional dykes. This option was selected because of its adequate storage capacity of 36.5 MCM and overall project economics.

226. Two alternate options were also considered for the dam axis. One option is upstream of the selected dam axis. This option would require additional dykes with lesser storage capacity of 25 MCM, which will not fulfil the requirement of command area.

227. The residents of Sri Toi are mainly depending on agriculture and livestock. They rely on traditional irrigation techniques like sailaba and khushkaba. The supply of water is not assured in these systems. The construction will provide perennial water to the command area. The perennial supply of water will enable the farmers to grow not only seasonal crops but also fruits which are suitable to regional climatic conditions.

4.6 Justification with respect to Environment

228. An **embankment dam** is created by the placement and compaction of a complex semi-plastic mound of various compositions of soil, sand, clay, or rock. It has a semi-pervious waterproof natural covering for its surface and a dense, impervious core. This makes such a dam impervious to surface or seepage erosion.¹

229. **Earthen Dam or Earth-filled dam** is a type of Embankment dam that is made of compacted earth. Most have a central section of an impermeable material to stop water from seeping through the dam. Such dams are a good choice at sites with wide valleys and can be built on hard rock or softer soils. The geotechnical investigation for dam foundation at the site will confirm the availability of hard rock as foundation and hence the structural stability of the infrastructure. Preliminary Stability Analysis of the Dam has been carried out. Once the geotechnical investigation results in the form of borelogs are made available to the design team, a final Stability Analysis will be checked.

230. Since the tributary is ephemeral in nature i.e. lasting for a short period after rains, the proposed project aims to elongate time frame and in due course the water storage dam would support ecology in longer time span. The construction of dam will change land use of the project site. Presently the project site is a barren land with low to no vegetation, shrubs or non-migratory ecology species. The terrain is laid with large sized boulders to fine silt. The provision of pondage area will store water and ensure water is available for irrigation purposes to the adjacent villages for a longer period of time in a year. The unlined irrigation canals would recharge ground water.

¹ "Dam Basics". PBS. <http://www.pbs.org/wgbh/buildingbig/dam/basics.html#emb>

231. Since this tributary is ephemeral in nature, there will not be any fragmentation / compartmentalization of environment up-stream or down-stream of the tributary.

4.7 Justification of Design as Earthen Dam

232. Siltation is a major issue for all dams. The rate of sedimentation in Balochistan is relatively high as compared to other parts of the country. Sedimentation Analysis has been carried out by the design team.

233. The result of this calculation is given as follows:

Table 7: Dam Sedimentation Analysis

S.No.	Description	Condition	Result	
			(MCM)	(acre-feet)
1	Gross Storage	Ungated	36.49	29,579
2	Dead Storage		6.49	5,261
3	Live Storage	Ungated	30	24,318
4	Total Depletion of Dead Storage		10 Years	
5	Life of the Dam		80 Years	

234. It has been estimated that the dead storage capacity that will deplete in the **early 10 years** which is computed as **6.49 MCM (5,216 acre-ft)**. The annual sediment load has been computed as **0.901 Million Short Tons (MST)**. The life of the dam has been estimated as approximately **80 years**.

235. The provision of multi-level intakes for this dam is proposed. This design provision will allow inclusion of multiple gates at different levels. In case of silt deposition at the lower level, middle and higher-level intakes will be functional. The factor of silt deposition is considered during the dam life of 80 years.

236. The design life of the proposed Earth Dam is taken as 80 years with due considerations to reservoir sedimentation and provision of multi-level intakes for this dam. Provisions of chimney and horizontal filter are considered to counter the piping erosion effect of water through the dam embankment.

237. Selection of the dam type as discussed above for any particular site is primarily governed by the foundation conditions and availability of construction material. The geology and foundation conditions at the dam site usually dictate the type of dam suitable for that site. Competent rock foundations with relatively high shear strength and resistance to erosion and seepage offer few restrictions to select the type of dam that can be built at any site.

238. Geo-technical studies have been carried out at the Sri Toi site to analyze the conditions and quality of bedrock for dam foundation and abutments. The boreholes at the dam axis represent alluvium deposits of 3-4 m deep. The rock cores obtained at the dam axis are assigned values based on Core Recovery percentage (CR %) and Rock Quality Designation (RQD) during geotechnical investigation which are used to decide the dam type based on foundation conditions. After the completion of geotechnical investigation following four alternate types of dam have been analyzed for the selection of dam. These alternate options are:

239. A clay core earthfill dam has been preferred over other options for the following reasons:

- The concrete faced rockfill dam has advantages over clay core earthfill dam only where:
 - a) earthfill material is not readily available,
 - b) rainfall is high,
 - c) extensive grouting is required and
 - d) excessive settlements are not expected.
- These conditions do not exist at Sri Toi dam site:
 1. At Sri Toi, the narrow river valley and moderately hard foundation makes the selection of a rigid type concrete gravity dam a workable option. However, geotechnical investigation carried out identified the presence of horizontally layered alternate strata of fractured and weak strength shale indicating that concrete dam is not favorable due to chances of settlement.
 2. Materials for the construction of a clay core earthfill dam are readily available in the vicinity of the proposed dam site. Judicious use of material from excavations such as from spillway, intake and outlet structure will be used as dam fill material in designated embankment zones. The bulk quantities of sandy gravel and sandstone obtained from excavations will be effectively used to provide stabilizing zones on both upstream and downstream shoulders of the embankment dam. Sand available in the riverbed may be utilized as fine filter and gravels which will be used in drainage blankets. The coarse filter, gravel and rip-rap may economically be obtained from nearby borrow areas. On the other hand, the cost of concrete or suitable rock construction in the area is high.
 3. Requisite level of expertise has not been achieved by the local contractors yet. Only few major concrete face rock fill dams have been constructed in the country. On the other hand, numerous clay core earthfill dams have been constructed in the country. Local contractors possess necessary expertise for this type of dam construction. Therefore, it has been proposed that the central clay core will be acting as an impervious barrier in the dam body.
 4. Packer test has been carried out to determine rock permeability and expected dam Underseepage. The water tightness of dam foundation can be achieved by taking the

clay core or cutoff down to the impervious bedrock. Furthermore, adequate level of grouting will be performed in the fractured rock based on the rock lugeon value and other geotechnical test results.

5 BASELINE CONDITION

5.1 Area of Influence

240. The basis for determining the areas covered under the Projects Area of Influence is the ADB Environmental Safeguards Good Practice Sourcebook (Dec 2012)² which states:

241. "The area of influence may span:

- *Primary project site and ancillary facility sites that will be owned, developed, operated or managed by the borrower/client or its contractors. Examples of ancillary facilities include access roads, borrow pits, spoil disposal areas, pipelines, canals, tunnels, depots and construction camps.*
- *Associated facilities not funded by the project but whose existence and viability are entirely dependent on the project and whose services are essential to project operation.*
- *Areas and communities potentially affected by cumulative impacts from further planned development of the project, other sources of similar impacts in the geographical area, any existing project or condition, and other project-related developments that are realistically defined at the time the assessment is undertaken.*
- *Area and communities potentially affected by induced impacts from unplanned but predictable developments or activities caused by the project, which may occur later or at a different location. For example, a new road constructed through an intact forest provides access to a gas field. The road improves access to previously difficult to reach forest resources, resulting in illegal logging, local settlement and agricultural activities."*

242. Accordingly, for the purpose of the Sri Toi Project EIA, the AOI has been divided into several specific sub-areas. The following are the main parts of the AOI:

- **Construction Site:** including dam, dykes, spillway, reservoir and canal, additional structures and immediate surroundings (construction camps, quarries, borrow and disposal areas, etc.);
- **Affected Structures:** The structure that may be physically affected due to project construction;
- **Project Foot Print Area:** this is the area directly related to Dam, Dykes, Spillways, Reservoir and Canal Right of Way (ROW), Canal, Outlets, command area etc;

243. No resettlement is envisioned, however, land distribution among the tribe members at individual basis of ownership need to be done.

² These guidelines are broadly followed by IFC Performance Standard 1 criteria for establishing Area of Influence

5.2 Physical Environment

244. This section describes the physical environment of the proposed project area. The emphasis is given on geology, soil conditions, climate, water resources and quality, ambient air and noise quality and seismology of the project area.

5.2.1 Geography

245. Balochistan is situated in the southwest of Pakistan and covers an area of 347,190 square kilometres (134,050 sq mi). It is Pakistan's largest province by area, constituting 44% of Pakistan's total land mass. The province is bordered by Afghanistan to the north and north-west, Iran to the south-west, Punjab and Sindh, and Khyber Pakhtunkhwa and the Federally Administered Tribal Areas to the north-east. To the south lies the Arabian Sea. Balochistan is located on the south-eastern part of the Iranian plateau. It borders the geopolitical regions of the Middle East and Southwest Asia, Central Asia and South Asia. Balochistan lies at the mouth of the Strait of Hormuz and provides the shortest route from seaports to Central Asia. Its geographical location has placed the otherwise desolate region in the scope of competing global interests for all of recorded history.³

246. Balochistan is rich in exhaustible and renewable resources; it is the second major supplier of natural gas in Pakistan. The province's renewable and human resource potential has not been systematically measured or exploited due to pressures from within and without Pakistan. Local inhabitants have chosen to live in towns and have relied on sustainable water sources for thousands of years.⁴

247. The capital city Quetta is located in a densely populated portion of the Suleiman Mountains in the north-east of the province. It is situated in a river valley near the Bolan Pass, which has been used as the route of choice from the coast to Central Asia, entering through Afghanistan's Kandahar region. The British and other historic empires have crossed the region to invade Afghanistan by this route.⁵

248. Zhob means Oozing Water. Zhob is the 2nd oldest district of Balochistan Province after Quetta. It was given the status of District in 1890 and was named as Fort Sandeman in deference of Sir Robert Sandeman. The district was renamed as Zhob, by Zulfikar Ali Bhutto, the then Prime Minister of Pakistan, in 1975. The district is located in the Northeast of provincial capital Quetta at a distance of 260 km (crow flight) and 320 Km (ground distance). Geographically the district lies between 67°48'41"-69°44'43" East longitudes and 30°26'54"-31°57'8" North latitudes. The total geographical area of the district, according to 1998 Census was 20297 Sq. Km until it was bifurcated into two districts, Zhob and Sherani. Presently the

³ https://en.wikipedia.org/wiki/Balochistan,_Pakistan#Geography

⁴ https://en.wikipedia.org/wiki/Balochistan,_Pakistan#Geography

⁵ Bolan Pass – Encyclopedia Britannica Eleventh Edition

Geographical area of the district is 12400 sq. Km (District Development Profile 2011). For administrative purpose the district has been divided into Two Tehsils and 24 Union Councils.

249. Zhob district is situated in the extreme north-east of Balochistan province. Afghanistan lies to the north-west, while South Waziristan Agency (FATA) lies to the north of Zhob. The eastern boundary is marked by the Suleiman range and D.I. Khan district, Sherani District on North-east, Loralai and Musa Khel district border on the south and south west and Killa Saifullah district on the immediate west. Topographically, the district is covered with mountains and hills, which are intersected by broad valleys of Zhob River and its tributaries. The district lies between Toba Kakari Range and Suleman Range extend on Western and Eastern boundaries of the district, respectively. The lowest point of the district is 1500 meters above sea level. People live up to 2500 meters. The highest peak in the district is Takht-i-Suleiman (Solomon's throne) at 4000 meters.

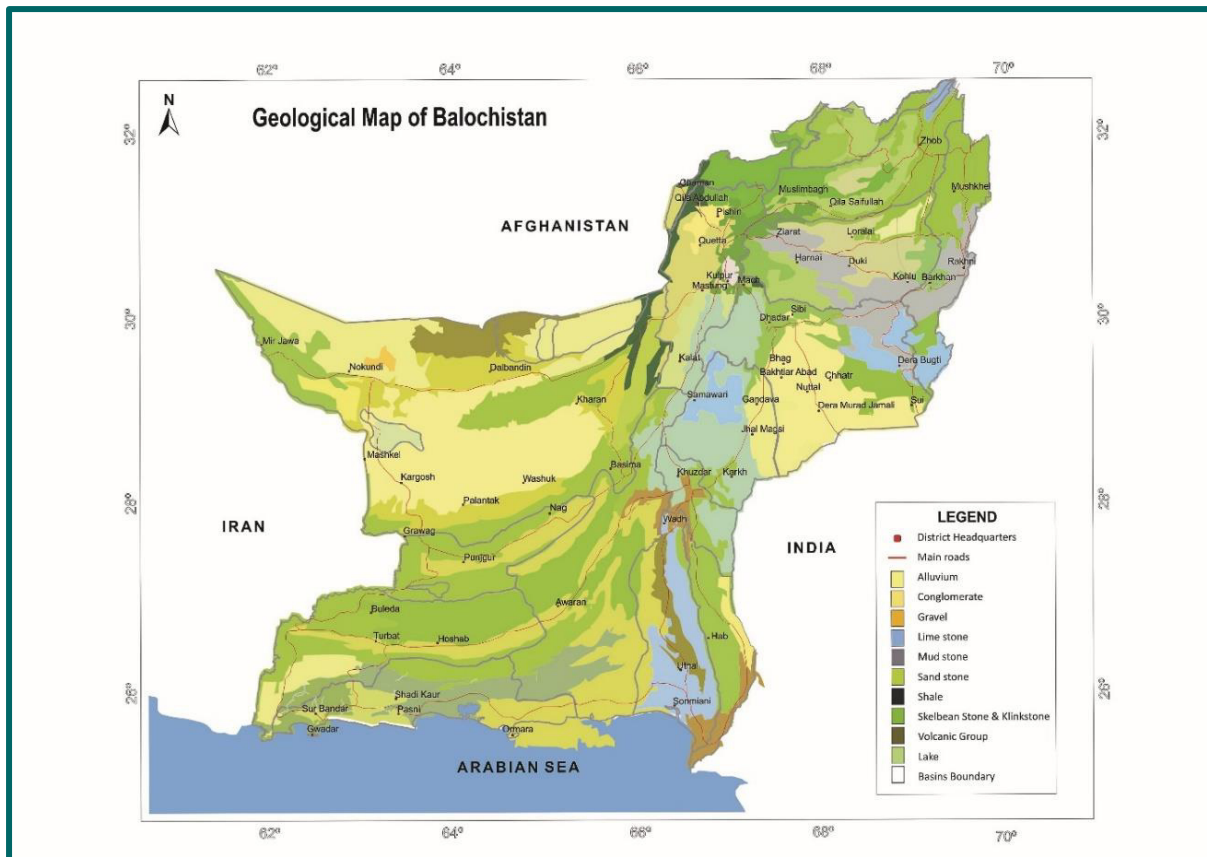
5.2.2 Project Location and Surroundings

250. The proposed Project is located in the Union Council of Mir Ali Khel, tehsil and district Zhob, about 62 km north-east of Zhob on Sri Toi river, the main tributary of Zhob river near Kili Gul Khan. The latitude and longitude of the Dam site is 31° 35' 52" North, 69° 15' 58" East and the mean altitude of the command area is 1350 m above mean sea level. The location of the proposed dam, shown in **Figure 4**.

251. Access from Zhob to the dam site is via Zhob-Wana road. Initially in the direction of north-east for a distance of 42 Km then turning to Samabza road in south-east direction up to Kili Hazrat Sahab by a link metaled road by travelling 10-kms, followed by katcha shingle/gravel track for a distance of another 10 Km up to the dam site. The journey takes about 2.25 hours from Zhob town. **Figure 5** shows the project location.

5.2.3 Geology

252. The geological setting of Balochistan is characterized by zones of convergence and oblique faulting. In fact, Balochistan possesses unique place where the principles of plate tectonics, subduction, convergence collision, transformation can be studied. Tectonics of Balochistan is characterized by well-developed and exposed example of interaction of major fault systems in a regime of convergence where one type of fault terminates against another. The Chaman transform fault zone traverse the entire province interacts with the central Zhob and the Makran convergence zones. These fault systems are of direct relevance to hydro-geological control on groundwater reservoir (**Figure 9**). In this context twenty-six important faults have been identified in the province.

Figure 1 - Geological map of Balochistan, Pakistan

(Source: Geological Survey of Pakistan and ADB TA-4560 PAK, 2007)

253. The stratigraphy of the province is quite complex and entails great lateral variations in contemporaneous sedimentation. The nature, distribution and sequential intricacies are largely dependent upon the position, proximity and nature of the source areas and the environments of deposition.

254. In terms of depositional basins, the province has been divided into five zones. The rocks exposed range from Perm carboniferous to recent age and are largely of sedimentary origin. Rocks of igneous origin predominate in parts of Zhob region in the north and of Lasbela region in the south. The sedimentary sequence is composed of calcareous and arenaceous rocks. Most of the sedimentary rocks stem from marine environment and others particularly in the south and south-western parts of the province are fluviatile, deltaic, littoral or paludal (swamp). No sedimentary rocks of deep origin are known and perhaps all the marine sediments were deposited in shallow waters.

255. Deposits of Aeolian origin are confined to surficial accumulation of sub-recent to recent age represented by the dunes and sandy tracts of the deserts. Glaciation is not marked in either the Pleistocene deposits or in the older strata.

256. Unconformities are common within certain well-defined zones. The unconformities individually are of small areal extent but collectively represent a shifting scene of emergence. Nearly the whole, if not all, of the interval of time from the late Palaeozoic to the Recent is represented by stratified rocks exposed in the province, but perhaps not in any individual, uninterrupted surface section.

257. Rocks of igneous origin occur in autochthonous and allochthonous forms. Eruptive rocks of Chagai volcanic and Koh-e-Sultan are the product of the subduction process and the rocks of igneous origin exposed in Zhob, Bela axial belt and in Raskoh range are the ophiolites-allochthonous bodies of fragmented oceanic crust abducted on continental margin.

258. In Sri Toi area main rocks are covered in dam site area is mainly sedimentary in nature. The dam site is located in narrow gorge. The recent alluvium is present in the river bed and consists of rounded and sub-rounded gravels and boulders with some sand and fine particles. Abutments comprise of very steep slopes having 75 to 80 NW dip almost vertical in outcrop. The site having rock of Eocene, Oligocene and Miocene age prominent at that location. **Figure 10** and **Table 20** provides the details of dam site geology:

Figure 2 - Sri Toi Geological Map

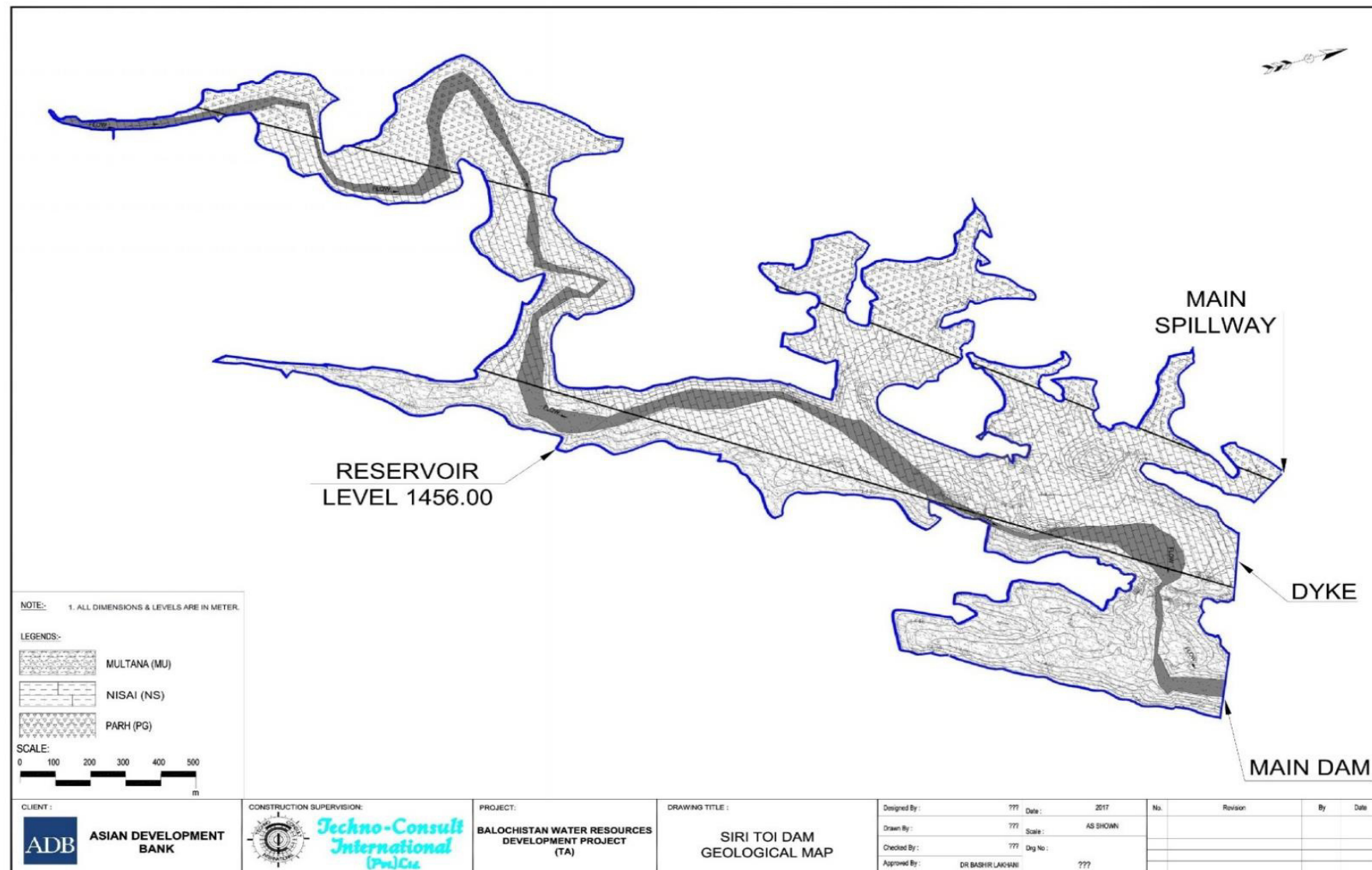


Table 8 - Site Geology of the Sri Toi Dam

Formation	Age	Lithology	Location	Strike	Dip & Dip Direction	Fold Axis
Malthanai Formation	Late Miocene	Sandstone/ Conglomerate Interceded with Red Colored Mudstone/Siltstone	Main Dam	NE/SW	700 To 820 In N-W Direction	Syncline Fold Axis
Nisai Formation	Eocene	Thick Marine (Fossiliferous) Shale with Occasional Thin Limestone Horizons.	Dyke	NE/SW	780 To 800 In N-W Direction	Anticline Fold Axis
Nisai Formation & Parh Group	Eocene & Paleocene To Late Cretaceous	Thick Marine (Fossiliferous) Shale with Occasional Thin Limestone Horizons & Volcanic Group/Shale.	Spillway	NE/SW	580 To 650 In N-W Direction	Core of Anticline Fold Axis

259. The left abutment contains Malthanai, Nisai and Parh group having lithology describe above in the table. Having generally anticline fold axis with steep to gentle slope from Malthanai formation to Parh Group with dipping generally in NW direction with amount of dip varies as 650 to 800.

260. The right abutment mainly contains Malthanai Formation having lithology sandstone, shale and conglomerate with the dipping angle almost vertical having joints and minor sedimentary structures.

261. The valley portion of the proposed dam consists of two parts, the channel and the terrace. The channel of Zhob River comprises of varying sizes of rounded to sub-rounded gravels and boulders of heterogeneous nature with some sand and fines. It is estimated that the thickness of this overburden is about 6 to 8 m (19.70 ft. to 26.3 ft.). The terrace, a vast plain exists in between the channel and the right abutment. The exposed rock in the terrace is sandstone and conglomerate. These rocks are coarse to fine grained, thinly to moderately bedded, grey to red in color, moderately strong, slightly too moderately weathered near surface and closely to moderately joint.

262. The reservoir floor is covering area almost 1.67 sq. km and the reservoir level is about 1459.5 m. It is consisting mainly on alternation of thick layers of impervious sandstone and shale somewhere conglomerate. These rocks are appearing in outcrop friable and loose but they are firm and sound below surface. Therefore, the site has enough stability and watertight

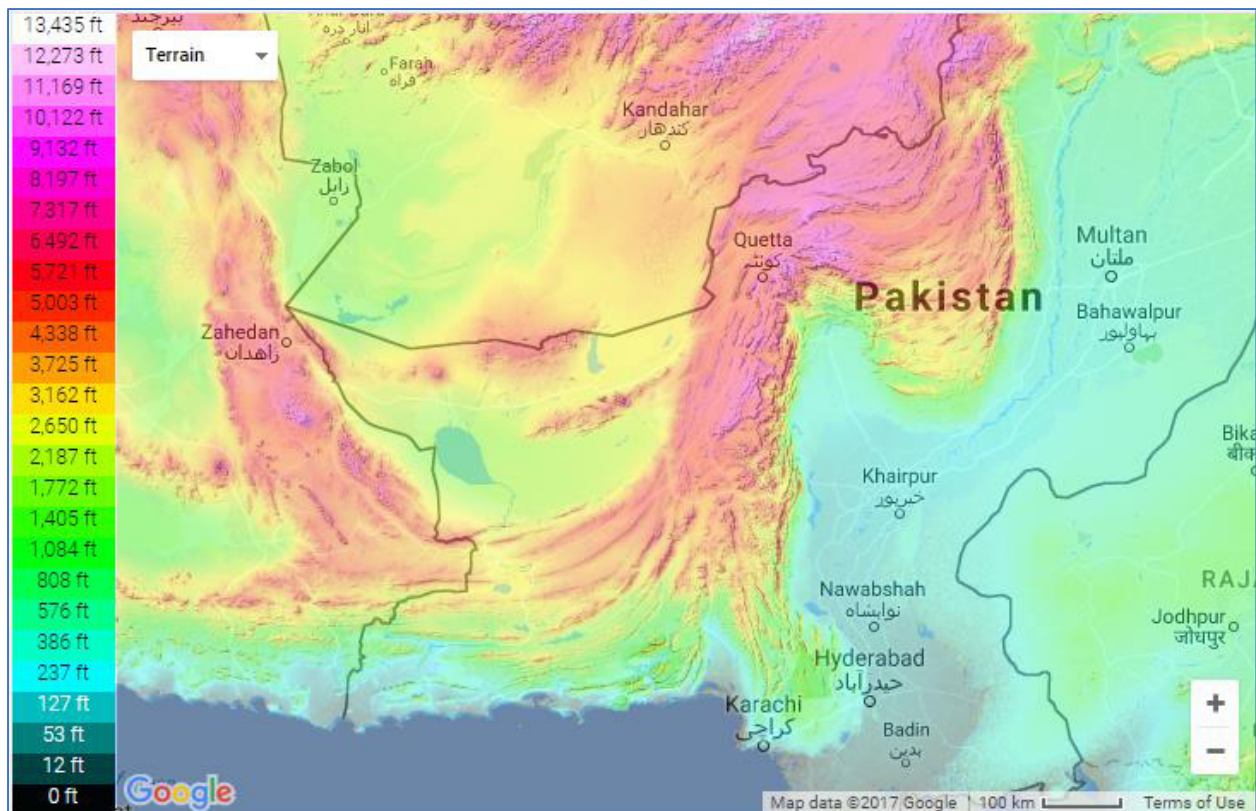
to be used for dam building. There is no fault near the dam site area, some existed fault in the area are too far to have any effects on the dam stability. As concerned to hydrogeological view, there is no any leakage or discharge of water. This is attributed to the imperviousness of the rock layers below the dam side and reservoir.

5.2.4 Topography

263. The Balochistan plateau is located in the south-west of Pakistan with altitudes mainly ranging from 600 – 3010 meters. This is an extensive area of 347,190 km² with a number of distinct natural topographical and drainage features.

264. The Kharan Desert is located in Northeast Balochistan. The desert is in the center of a large empty basin. Topographic map of Balochistan is shown in **Figure 11**.

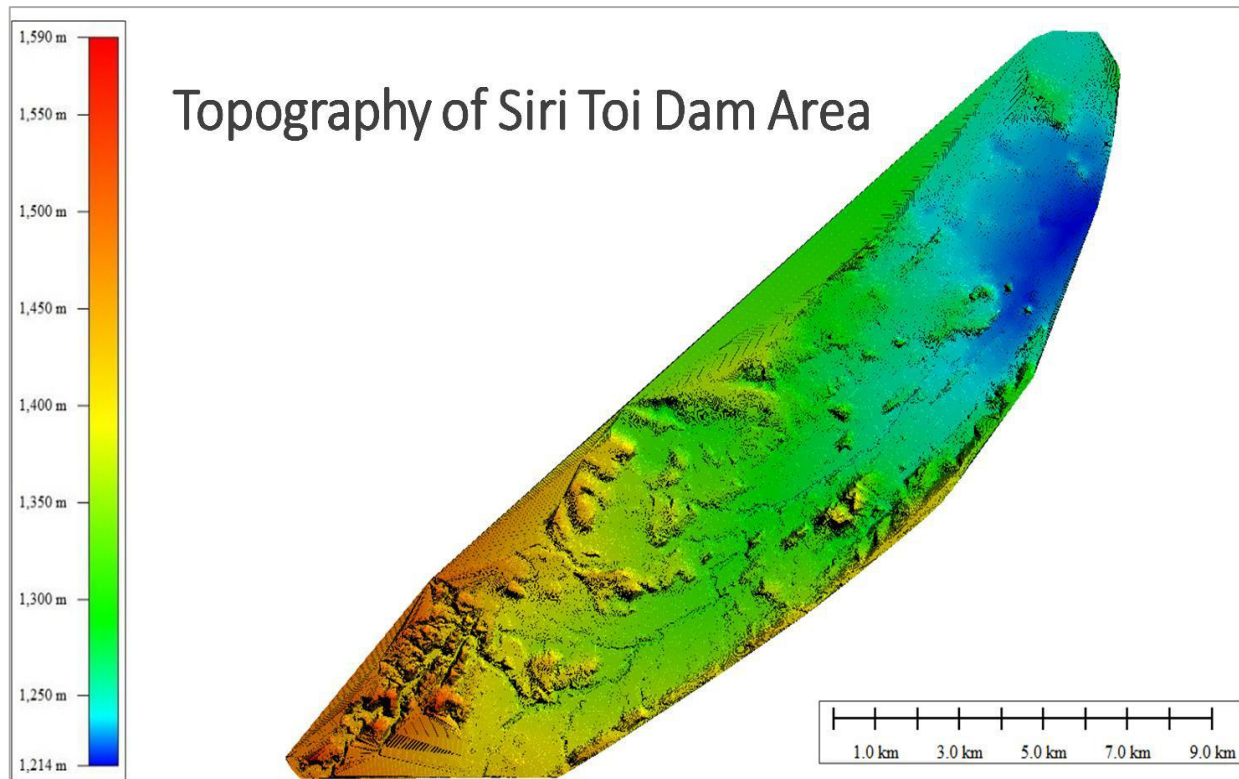
Figure 3 - Topographic Map of Balochistan



265. Sri Toi has several narrow and steep canyons along the main river alignment. Some distance downstream of the proposed dam axis the valley opens wide to a relatively flat area on both sides of the river banks having an average width of around 2-km. Several small and medium height mounds lie in this area that is excluded from the command area. In order to fulfill the irrigation requirement of 30 MCM for the design command area a 66 m high dam was required. Therefore, primarily a location where abutment hills exceeding 66 m was identified. A suitable dam location that would require minimum number of dykes for the reservoir rim was

sought which was identified few kilometers upstream of the proposed command area. **Figure 12** below presents topographic profile of Sri Toi Dam area:

Figure 4 - Topographic Map of Sri Toi Dam Area



5.2.5 Hydrology

266. Balochistan is an arid region characterized by low rainfall and frequent dry spells and persistent droughts. The scarcity of water is one of the most critical issues of Balochistan. Despite being the country's largest province in terms of geographical area, Balochistan is facing acute water scarcity. The increase in population and demand for economic development has resulted in indiscriminate abstraction of groundwater, which is only 9% of the total water resource available in Balochistan. Now the deep groundwater is being used through drilling of tube-wells up to the depth of 300 m and water table is lowering at a rate of 2-6 m per annum. The lowering of water table and groundwater depletion is basin specific. . Situation is rather critical in basins within the national electric grid areas, where water table is lowering at a rapid rate and depletion is posing serious concerns due to rapid installation of tube wells, as Government of Balochistan provides subsidy on the electric charges for tube well. Last year Government of Balochistan has provided a subsidy of PKR 2,800 Million.⁶

⁶ Quetta Electric Supply Corporation (QESCO)

267. The 9th five-year plan for Balochistan describes total water potential of the province as 12.2 million-acre feet (MAF) originating from the following sources as presented in **Table 21** below:

Table 9 - Dam Site Geology of the Sri Toi Dam

Inland and coastal streams	5 MAF (41%)
Indus assured supplies	3.9 MAF (32%)
Flood supplies	2.5 MAF (20%)
Groundwater	0.8 MAF (7%)

Source: Water Potential of Balochistan

<http://waterinfo.net.pk/?q=node/77>

268. Sri Toi dam site is located in the northern part of the basin on an isolated tributary of the Zhob river. There is almost no existing sub-project diversion upstream of this location which indicates substantial potential for development of new sub-project. The annual average availability of water is nearly 57 MCM with a catchment area of 971 km². There is substantial ephemeral flow at this sub-project level with high flood peaks during high flow season. The significant variation in river flow regime envisages a design of a combined perennial and floodwater in the sub-project.

269. The overall water balance at basin level is carried out through hydrological modeling of the whole river basin. Streamflow and base flow is predicted for each sub-project by specifying location on the particular river reach in a GIS supported hydrological model ArcSWAT. The model is used to simulate groundwater and surface water based on the available meteorological, land use and soil data records.

270. The results from the model were compared with measured flows during the site visit. During the site visit in November 2016, 0.71 cumecs flow was observed in the river. The ArcSWAT model for November estimates that the river will have 0.96 cusec flow. This shows that the order of magnitude estimated by the model is in close conformity with the actual flows.

❑ Water Quality

271. Water quality in Balochistan is variable. Surface water is generally favorable to marginal in case of Hingol river with an average TDS and pH of 159 mg/L and 7.16 indicating good quality for agriculture and for drinking. Also, TDS and pH in Karkh river were 640 mg/L and 7.75 indicating good quality. The groundwater quality in northern parts is generally better than in the southern part of Balochistan. Water samples from tubewells of Quetta division are fit to marginally fit for irrigation (Source: Idris M, Vegetable Seed Farm, Sariab). Groundwater quality in coastal parts has marine influence. The Agricultural Farm at Pasni near the bank of Shadikaur river has no other orchard except salinity tolerant date-palm trees, this is due to saline water having estuarine effect. Groundwater in Balochistan has generally high concentration of fluoride, iron and nitrate in many districts (Source: Shima M, Pakistan Council

of Research in water resources, Islamabad). In many cases the HCO_3 contents are much higher than maximum permissible limit of 244 mg/L for crops, this is because the ions leach out and dissolve in groundwater during weathering of rocks.

272. Groundwater quality as assessed from tubewell water, dugwells and water pumps was generally within permissible limits. However, Sri Toi Manda (surface) and tubewell (ground) waters showed high salinity. Although, no vast soil salinity was observed except in local patches, land levelling is essential to manage root zone salinity. In unlevelled field salts accumulate on high spots. The ground water quality is given in **Table 22**.

Table 10: Summary of Ground Water Quality

S. No.	Source of water	pH	Soluble salts		Cations	Anions		RSC (meq L ⁻¹)	SAR
			EC (dSm ⁻¹)	TSS (mg kg ⁻¹)	Ca + Mg (meq L ⁻¹)	CO ₃ (meq L ⁻¹)	HCO ₃ (meq L ⁻¹)		
1	Sri Toi tube well (ground water)	7.9	1.55	1085	6.3	BDL	4.80	1.5	1.69

BDL=Below Detection Level

273. Surface water stored in depressions during field visits was collected and tested in laboratory. **Table 23** presents result of surface water quality.

Table 11: Summary of Surface Water Quality

S. No.	Parameter	Units	Sampling Locations		
			Wall Site 1	Storage Area	Wall Side 2
1	Turbidity	NTU	BDL	BDL	BDL
2	TSS	mg/L	BDL	BDL	BDL
3	TDS	mg/L	2041	1971	1807
4	pH @25°C	-	8.15	8.15	8.30
5	Aluminum (Al)	mg/L	BDL	BDL	BDL
6	Antimony (Sb)	Mg/L	BDL	BDL	BDL
7	Arsenic (As)	mg/L	BDL	BDL	BDL
8	Barium (Ba)	mg/L	BDL	BDL	BDL
9	Boron (B)	mg/L	BDL	BDL	BDL
10	Cadmium (Cd)	mg/L	BDL	BDL	BDL
11	Chromium (Cr)	mg/L	BDL	BDL	BDL
12	Copper (Cu)	mg/L	BDL	BDL	BDL

S. No.	Parameter	Units	Sampling Locations		
			Wall Site 1	Storage Area	Wall Side 2
13	Lead (Pb)	mg/L	BDL	BDL	BDL
14	Manganese (Mn)	mg/L	BDL	BDL	BDL
15	Nickel (Ni)	mg/L	BDL	BDL	BDL
16	Mercury (Hg)	mg/L	BDL	BDL	BDL
17	Selenium (Se)	mg/L	BDL	BDL	BDL
18	Zinc	mg/L	BDL	BDL	BDL

BDL=Below Detection Level

5.2.6 Seismic Conditions

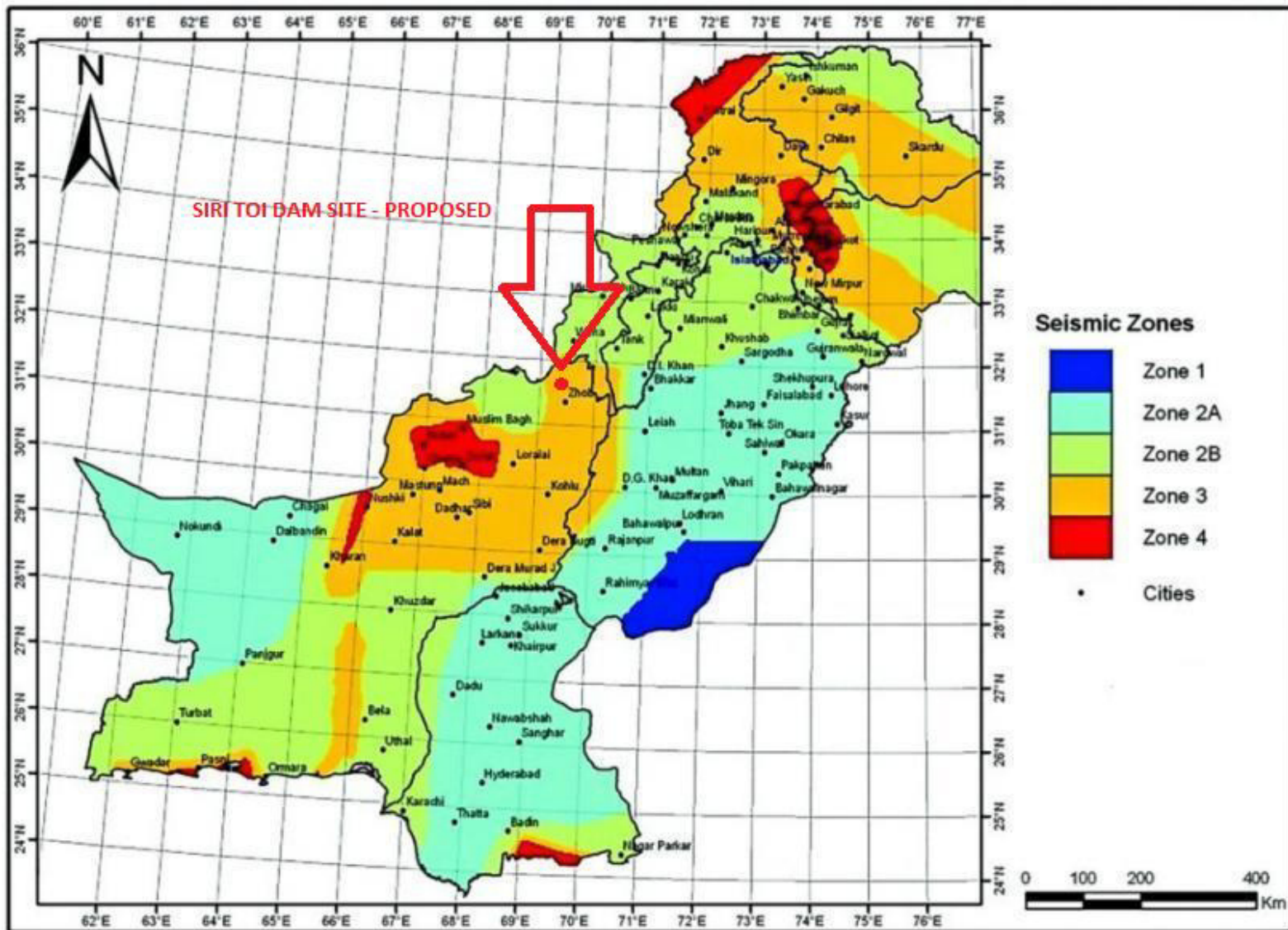
274. The entire province of Balochistan lies in a seismically active region. The province has experienced devastating earthquakes in the past. A powerful earthquake with a magnitude of 7.0 on the Richter scale was recorded on May 31, 1935 and devastated Quetta town and resulting in 35,000 fatalities.

275. Again, on the Nov 28th, 1945, an earthquake measuring 8.6 on the Richter scale hit Balochistan killing almost 4000 people.

276. A history of recorded earthquakes is attached as **Annexure 11**.

277. The seismic zoning map of Pakistan, indicates that the project area lies in the zone 3. This zone is classified as Moderate Damage Risk Zone which is liable to Medvedev–Sponheuer–Karnik scale (MSK) VII and also 7.8 on Modified Mercalli (MM) scale. The Medvedev–Sponheuer–Karnik scale, also known as the MSK or MSK-64, is a macro seismic intensity scale used to evaluate the severity of ground shaking on the basis of observed effects in an area of the earthquake occurrence. An explanation of MSK intensity is given as **Annexure 12**. The updated Seismic Zoning Map of Pakistan is shown below as **Figure 13**.

Figure 5: Seismic Zoning Map of Pakistan



5.2.7 Climate

278. The climate of Balochistan is generally arid (Rasul et al., 2012; Burke et al., 2005). The province can be divided into three broad climatic zones:

- Hyper-arid (<100 mm/year) - Chaghai, Makran coastal areas and south-east of Lasbela
- Arid (100-250 mm/year) - Northeast of Zhob, Loralai, Sibi, Kachhi, Lasbela plains, and Pab-Mor ranges
- Semi-arid (250 – 400 mm/year) - Suleiman ranges covering Toba Kakari area, Marri Bugti areas, and Pab Khirthar mountain ranges and Brahui ranges.

279. The climate of the sub-project is semi-arid and lies in monsoonal belt. Mean annual rainfall varies between 250-400 mm per year. It receives most of its rainfall from July to September. The region observes cold winters and hot summers with temperatures soaring as high as 38 °C in summers.

□ Temperature

280. The temperature regime in Balochistan is extremely variable and is directly related with the altitude.

281. High altitude areas with cooler temperatures usually experience a mean annual temperature between 10°C to 18°C. Frost and snow prevail during winters. Low altitude temperate climate region has mean annual temperature between 18°C and 24°C. Tropical temperature dominates in the low mountain belt and low land facing the Arabian Sea with a mean annual temperature between 29°C and 37°C (Rees et al., 1990; Burke et al., 2005).

282. The province experiences frequent spells of droughts and occasional but torrential floods. Perennial rivers are rare in the region and life is mostly dependent on runoff farming ('Khushkaba') or Spate irrigation (flood water harvesting or 'Sailaba'). Approximately 40% of irrigation water in Balochistan comes from the Indus River which irrigates only 5% of the province. This is because of rugged terrain and poor infrastructure.

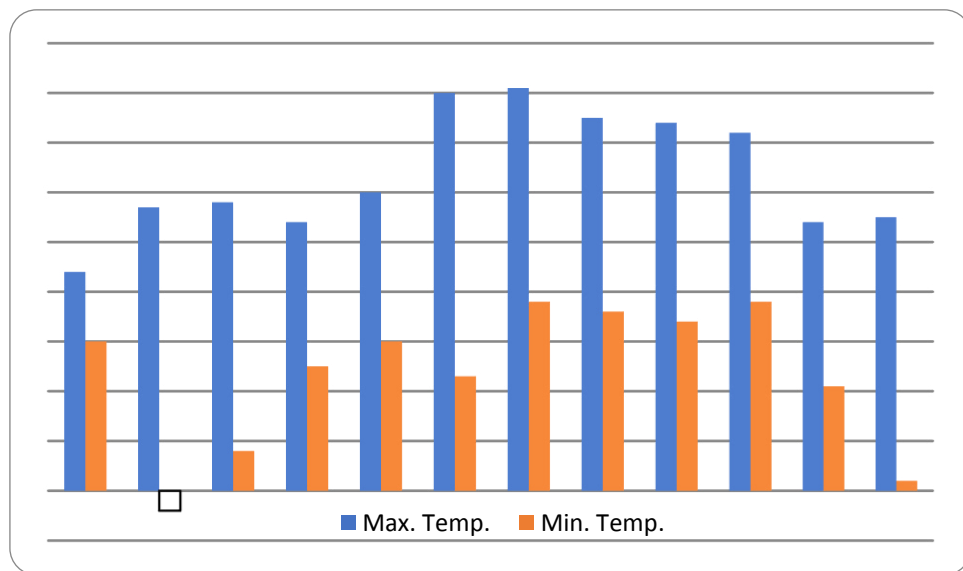
Table 12: Average Monthly Temperature for Zhob 2016

S. No.	Month 2016	UoM	Max. Temp.	Min. Temp.
1	January	°C	22	15
2	February	°C	28.5	-2
3	March	°C	29	4
4	April	°C	27	12.5
5	May	°C	30	15

S. No.	Month 2016	UoM	Max. Temp.	Min. Temp.
6	June	°C	40	11.5
7	July	°C	40.5	19
8	August	°C	37.5	18
9	September	°C	37	17
10	October	°C	36	19
11	November	°C	27	10.5
12	December	°C	27.5	1

Source: Pakistan Metrological Department

Figure 6: Monthly Mean Max and Min Temperatures



☐ Rainfall and Humidity

283. Approximately 40% of average rainfall in eastern and southern Balochistan occurs in the months of July and August (monsoon dominated environments). However, less than 10% of average rainfall occurs in monsoon in western parts of the province (temperate climate regions). This makes rainfall dependability throughout upland Balochistan generally low (Rees et al., 1990).

284. In a report published by Pakistan' National Disaster Management Authority, Monsoon Season 2016 unfolded with five rain spells at regular intervals starting from 28 June to 16 September 2016. As per Pakistan Meteorological Department (PMD), Monsoon 2016 remained 25% Above Normal against predicted rainfall of 10 - 20% Above Normal. During the

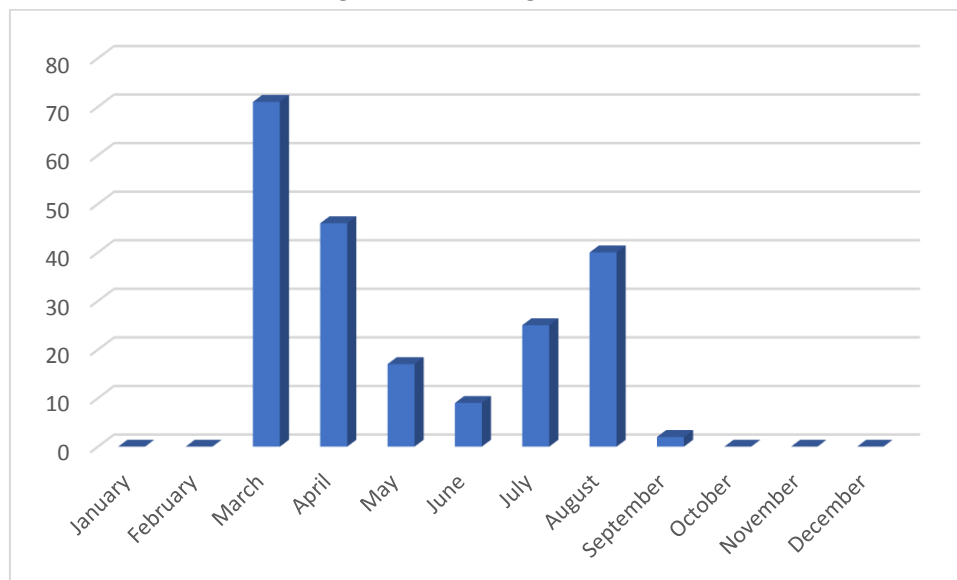
month of August, rainfall was largely in excess across much of the Country while in July, the Country experienced slightly less rainfall⁷.

Table 13: Average Rainfall data for Zhob 2016

S. No.	Month 2016	UoM	Average Rainfall
1	January	mm	0
2	February	mm	0
3	March	mm	71
4	April	mm	46
5	May	mm	17
6	June	mm	9
7	July	mm	25
8	August	mm	40
9	September	mm	2
10	October	mm	0
11	November	mm	0
12	December	mm	0

Source: Pakistan Metrological Department

Figure 7: Average Rainfall



⁷ Pakistan' National Disaster Management Authority, "POST DISASTER REPORT MONSOON 2016", <http://www.ndma.gov.pk/publications/Post%20Monsoon%202016%20Report%202%20March%202017.pdf>

5.2.8 Soils

285. Major part of Balochistan is covered by mountains and stony/gravel terraces. Bolan and Jhal Mangsi districts exceptionally cover large tracts of plain area. The piedmont plain is the major landform in whole area. Due to intricate pattern of vast mountainous tracts influenced by network of many hill torrents, the soils are usually gravelly and shallow. The non-gravelly soils are deep and extensively occur in Quetta valley, Zhob valley, Kachhi plain and the southern districts. The colors of these soils are generally in 10 YR hue which are usually silty to clayey with pH ranging between 7.8 and 8.3. Extensive areas of undeveloped soils occur in Zhob river basin and flooding areas of Basol river, Dasht River and Porali River.

286. The soil of the Sri Toi Dam project area is alluvium material i.e. piedmont alluvium. The piedmont alluvium is nearly level to gently sloping. The top soil is dark brown, moist, silt loam to silty clay loam, slightly sticky, slightly plastic, friable, slightly hard, fine tubular pores, few scattered gravels, and has a clear smooth boundary.

287. The subsurface soil is dark brown to reddish brown in color texture, and has a weak sub angular block structure, sticky, plastic, friable, slightly hard, fine tubular pores, few fine roots, and a clear smooth boundary. The piedmont alluvium is used for limited general cropping, under irrigation and dry farming condition.

5.2.9 Ambient Air Quality

288. Ambient air in the Project Area, is generally clean, because only a few houses were visible in the project areas. There are no industrial setups within the area of influence of the Project Area. Vehicular traffic is absent as well as road infrastructure. Spot monitoring of Suspended Particulate Matter was tested and is given as **Table 26**. The monitoring for SPM was done for a period of **2 hours** as there wasn't any sensitive receptor near the proposed project area. **Table 26** below shows **average 2 hours** results. The proposed project site is a barren site and the nearest village, Kili Hazart Sahib is location about 16 km from the proposed project site. The equipment used for air monitoring is **Hazdust EPAM 5000** and test method is **USEPA PM₁₀, 2.5 method 201a** Lab reports are attached as **Annexure 13**.

Table 14: Results of Ambient Air Quality

Parameters	Location			NEQS
	Wall Side 1	Storage Area	Wall Side 2	
Suspended Particulate Matter ($\mu\text{g}/\text{m}^3$)	8	Nil	12	500 (24 hrs. avg)

Source: Monitored in the Project Area by Laboratory Team.

289. The results presented in **Table 26** clearly depicts that the ambient air quality of the Project Area is clean as the values of all monitored parameters are far below the values of NEQS.

5.2.10 Ambient Noise

290. Ambient noise levels were measured and the **average 2 hours** monitoring results are given as following in **Table 27**. Noise monitoring was done with a type 1 noise meter.

Table 15: Summarized Results of Noise Monitoring

S. No.	Location	Noise Level dB(A)	NEQS Day Time	NEQS Night Time
1	Wall Side 1	30.1	50-55	45
2	Storage Area	<28	50-55	45
3	Wall Side 2	<28	50-55	45

Source: Monitored in the Project Area by Laboratory Team.

291. Sensitive receptors are people or other organisms that may have a significantly increased sensitivity or exposure to contaminants by virtue of their age and health (e.g. schools, day care centers, hospitals, nursing homes), status (e.g. sensitive or endangered species), proximity to the contamination, dwelling construction (e.g. basement), or the facilities they use (e.g. water supply well). The location of sensitive receptors must be identified in order to evaluate the potential impact⁸. There are no sensitive receptors within the area. The nearest village is Kili Hazrat Sahib which is about 16.5 km from the proposed dam site.

5.3 Biological and Natural Environment

292. Sri Toi refers to an ephemeral stream collecting water from the surrounding mountains and travels almost 62 Kms to meet river Zhob, the surrounding area is dry and arid, when receive rain, it turns in to disaster, instead of benefits, as per estimates the system has the potential of 57 MCM of water covering around 971 km².

293. The proposed project does not interfere with any ecological parameters, however, can be seen as a positive contributor in improving the carrying capacity and overall improvement of the ecosystem.

294. This has been observed during the desk review that only, 11% of resource has been documented and 89 % is still yet to be organized and documented. These possess a major

⁸ http://www.smchealth.org/sites/main/files/file-attachments/651311584receptor_survey.pdf

challenge for the team engaged in EIA study. A careful estimate has been made to evaluate the net benefit and it revealed an enhancement in cultivable command area of 4,027 hectares.

295. This would definitely ease the burden on natural ecosystem of the surrounding areas. The dam site is a zonal and represents a rocky base, with patches of stagnant water.

296. The following sections present the current status of the project area vis-à-vis biotic environment. The section is based on extensive literature review, site visits, and interviews with key stakeholders (Forest and Wildlife Departments).

297. Sri Toi is tough terrain to approach, it has numerous rocky undulations, which makes it difficult to reach, this can be assessed by looking at the image of the access route.



Access road to proposed dam site



Approaching proposed dam site after meeting with local community



Another view of approach road to proposed dam site

298. Sri Toi like the whole district geography is typical of a mountain eco-system represents a typical pastoral dependence and rain fed agriculture. The habitat of the project area and its surroundings are broadly categorized as Hills, Foothills, plains and stream beds. Sri Toi specifically represents dry arid alpine terrain, with marginal vegetation cover, mainly comprising of shrubs, no tree species was recorded during the field visit.

5.3.1 Flora

299. The major forest type is Sub Tropical Broad-Leaved Evergreen Scrub forests. These forests occupy the altitudes between 2500 to 5500 feet elevation.

Table 16: Major Forest Types in Zhob District

#	Taxon	Vernacular/ English name	Family	Life form	Conservation status
01	<i>Pinus gerardiana</i>	Chilgoza Pine	Pinaceae	Tree	Near threaten
02	<i>Olea ferrugenea</i>	Olive	Oleaceae	Tree	Not assessed
03	<i>Pistacia khinjik</i>	Shina	Anacardiaceae	Tree	Least concern
04	<i>Pistachia cabulica</i>	Uzhgai	Anacardiaceae	Tree	Not assessed
05	<i>Reptonia buxifolia</i>	Gurgura	Sapotaceae	Tree	Not assessed
06	<i>Fraxinus xanthoxyloides</i>	Shang/ Wild Ash	Oleaceae	Tree	Not assessed
07	<i>Prunus eburnean.</i>	Wild almond	Rosaceae	Tree	Not assessed
08	<i>Periploca aphylla</i>	Barara	Ascalpidaceae	Shrub	Not assessed
09	<i>Prunus creasus</i>	Anang	Rosaceae	Shrub	Not assessed
10	<i>Scorzonera mollis</i>	Arghuch	Asteraceae	Shrub	Not assessed
11	<i>Datura fastuosa</i>	Datura	Solanaceae	Shrub	Not assessed
12	<i>Narium odorum</i>	Gandarae	Apocynaceae	Shrub	Not assessed
13	<i>Othonnopsis intermedia</i>	Gangu	Asteraceae	Shrub	Not assessed
14	<i>Sophora griffithii</i>	Ghuzera	Fabaceae	Shrub	Not assessed
15	<i>Allium sphaerocephalum</i>	Injaora	Alliaceae	Shrub	Not assessed
16	<i>Zizyphora clinopolioides</i>	Maurai		Shrub	
17	<i>Phragmites communis</i>	Nal	Gramineae	Shrub	Least concern
18	<i>Withania cougularis</i>	Khamazurgae	Solanaceae	Shrub	Not assessed
19	<i>Malcolmia africana</i>	Khatol	Brassicaceae	Shrub	Not assessed
20	<i>Caragana ambigua</i>	Makhi	Fabaceae	Shrub	Not assessed
21	<i>Eremurus aucheriana</i>	Shezgae	Aspholpdiaceae	Shrub	Not assessed
22	<i>Plantago ovata</i>	Shkanpara	Plantigenaceae	Shrub	Not assessed
23	<i>Haloxylon griffithii</i>	Shorae	Amarantheaceae	Shrub	Not assessed
24	<i>Artemisia meritima</i>	Tarkha	Asteraceae	Shrub	Not assessed
25	<i>Rhazya stricta</i>	Urgalama	Apocynaceae	Shrub	Not assessed

#	Taxon	Vernacular/ English name	Family	Life form	Conservation status
26	Achillea santolina	Zawala	Asteraceae	Shrub	Not assessed
27	Peucedanum sp.	Ragholae	Apiaceae	Shrub	Not assessed
28	Panicum colonum	Rakhpatti	Poaceae	Grass	Not assessed
29	Tullipa stellata	Sanda	Liliaceae	Shrub	Not assessed
30	Lactuca sp.	Sandreza	Asteraceae	Shrub	Not assessed
31	Daphne oleoides	Malaghunae	Thymelaeaceae	Shrub	Not assessed
32	Nannorrhops ritchiana	Mazari	Arecaceae	Shrub	Not assessed
33	Dodonea viscosa	Sanatha	Sapindaceae	Herb	Not assessed
34	Chrysopogon aucheri,		Poaceae	Grass	Not assessed
35	Sorghum halepense	Barau	Poaceae	Grass	Introduced
36	Heteropogon contortus	Barwaza	Poaceae	Grass	Not assessed
37	Poa bulbosa	Margha	Poaceae	Grass	Not assessed
38	Typha angustifolia	Lukha	Typhaceae	Shrub	Not assessed

Reference: (Provincial and District Forest Departments, IUCN, UNDP, WWF, GEF)

□ Topographic distribution of vegetation

300. Vegetation zones of the district consist mainly of the following categories:

Table 17: Vegetation Zones of Zhob District

Vegetation Zone	Floristic composition
Hills	Olive (<i>Olea ferruginea</i>), Blue pine (<i>Pinus gerardiana</i>), Shina (<i>Pistacia khinjik</i>), Uzhgai (<i>Pistachia cabulica</i>), Gurgura (<i>Reptonia buxifolia</i>), Shang/ Wild Ash (<i>Fraxinus xanthoxyloides</i>), Wild almond (<i>Prunus eburnea</i>), etc.
Foothills	Olive (<i>Olea ferruginea</i>), Phulai (<i>Acacia modesta</i>), Sanatha (<i>Dodonea viscosa</i>), Gymnosporia spinosa, Ber (<i>Zizyphus nummularia</i>), Khamazurgae (<i>Withania eugenia</i>), Khatol (<i>Malcolmia africana</i>), Makhi (<i>Caragana ambigua</i>), Shezgae (<i>Eremurus aucheriana</i>), shkanpara (<i>Plantago ovata</i>), Shorae (<i>Haloxylon griffithii</i>), Tarkha (<i>Artemisia merittima</i>), Urgalama (<i>Rhzya stricta</i>), Zawala (<i>Achillea santolina</i>), Pamangi (<i>Bouca rosia aucheriana</i>), Ragholae (<i>Peucedanum sp.</i>), Rakhpatti (<i>Panicum colonum</i>), Sanda (<i>Tillipa stellata</i>), Sandreza

Vegetation Zone	Floristic composition
	(Lactuca sp.), Malaghunae (Daphne oleoides), and Mazari (Nannorrhops ritchiana).
Plains and Stream beds	Commonly found in the entire district where Tamarix sp. and Saccharam sp. are commonly found.

Reference: (Provincial and District Forest Departments, IUCN, UNDP, WWF, GEF)

□ Rangelands

301. The type of rangeland present in the district is classified as Suleiman Mountain Ranges. It has species like: *Stipa pennata*, *Pennisetum orientalis*, *Chrysopogon aucheri*, and *Cymbopogon sp.* etc. The productivity is good with average productive capacity of 250 kg /hectare. The rangelands in the district belong to communities living around them. Due to communal ownership, usually these are accessible to all members of the community and also to nomads passing through the area on their traditional routes of migration to new areas.

302. Photographs of few floral representatives are given as **Annexure 14**.

303. Habit wise vegetation distribution at Sri toi attached as **Table 30**.

Table 18: Habitat wise vegetation distribution at Sri Toi

Vegetation Zone	Floristic composition
Hills	Bare
Foothills	Alhagi maurorum, Cympopogogn sp, Chrysopogogon sp
Plains and Stream beds	Narium oleander, Tamarix sp, Cympopogon

5.3.2 Fauna

□ Wildlife

304. Wildlife habitat type is Steppic Forest in Intermediate Latitude. There are no historical bench marks to determine the status of wildlife in the area. However, according to the community the number of wildlife species has declined; which could aptly be attributed to casual attitude for hunting and habitat degradation.

305. As the floristic composition of the project area suggests a marginal condition for other life forms to support. This has been supported by the fact that most of the people living in the surroundings of project area has pastoral dependence. They left the area as the existing ecosystem lost its capacity to cater the need of other life forms.

306. This has also reflected on the wildlife reported from the area, the ecosystem represents variation in its carrying capacity with the variation in seasonal change. As listed above, there was a marginal diversity and quantitative representation of flora, not offering much to attract other life forms.

❑ Aquatic Environment (Fish)

307. No comprehensive data set was prepared for the faunal composition in Zhob district and as such no census report was available regarding status of key wildlife species in the district. Sri Toi represents an **ephemeral system**; therefore, it does not offer a consistent condition for aquatic life to flourish, therefore no aquatic fauna was listed and observed during the field visit.

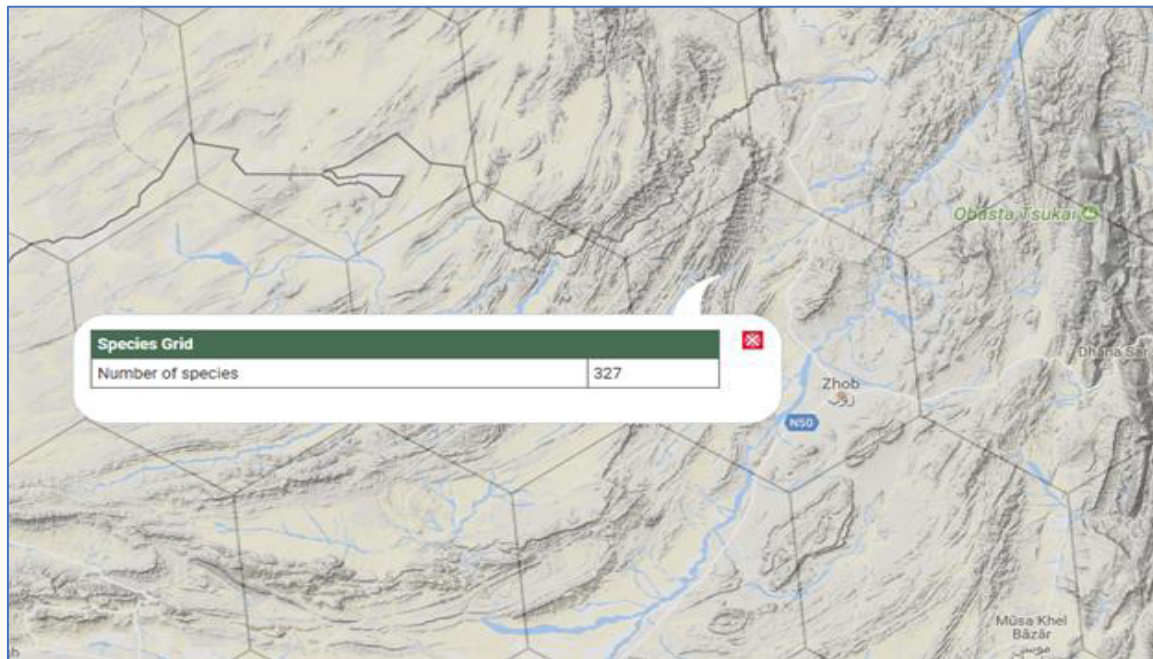
308. The tributary as mentioned above represents ephemeral system only with flowing water during the flood season only. During flooding season, the water drains into the adjacent land. The water outfall usually brings amphibian life in the area but due to no flood collection mechanism, it does not flourish. In post-BWRDP scenario, the storage dam will act as a storage pond for the aquatic life to sustain.

309. In the post-BWRDP scenario, estimated surface water availability in the basin will be around **457 MCM**. With the proposed Sri Toi water storage dam and irrigation system the net withdrawal will be around **179 MCM**; therefore, balance water available will be around **278 MCM**. As per hydrology study this is sufficient for maintaining **environmental flows** and continue to contribute inflows to the **Gomal Zam Dam** without causing any ecological problems.

❑ Faunal Survey

310. The above-mentioned situation did not provide clear picture of fauna in the project area. Therefore, baseline faunal survey was carried out. Following are the justifications for performing baseline faunal survey:

- Not enough secondary data (related with faunal attributes) is available for the project area to make a sound judgement about the presence / absence of fauna;
- In the EIA study the faunal data is based on interview with local people which needs to be verified in field through spot sampling; and
- The IBAT database, shows 327 fauna and flora species in the area including VU species (Please refer to the **Figure 16**). This information can be interpreted as “possible occurrence”, i.e. have the same level of reliability as the data obtained from the local population.

Figure 8: IBAT Database VU Species

- Lastly, the expected arrival time of migratory birds in the area is November.

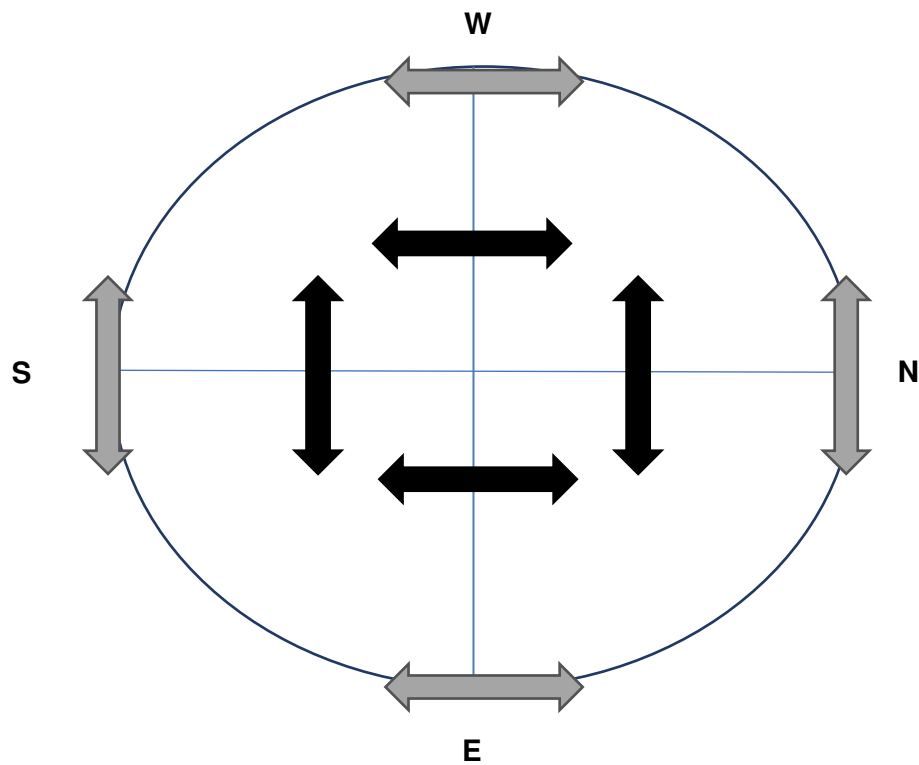
311. Baseline faunal survey was based on spot monitoring for five days. The methodology to execute the survey is presented below:

❑ Methodology for Faunal Survey

312. The faunal survey is based on spot sampling. A circumference of 2 kms from the proposed dam site was surveyed in four (4) dimensions, i.e. North, South, East and West. Two (2) sampling points were marked at each side thus making a total of eight (8) sampling points.

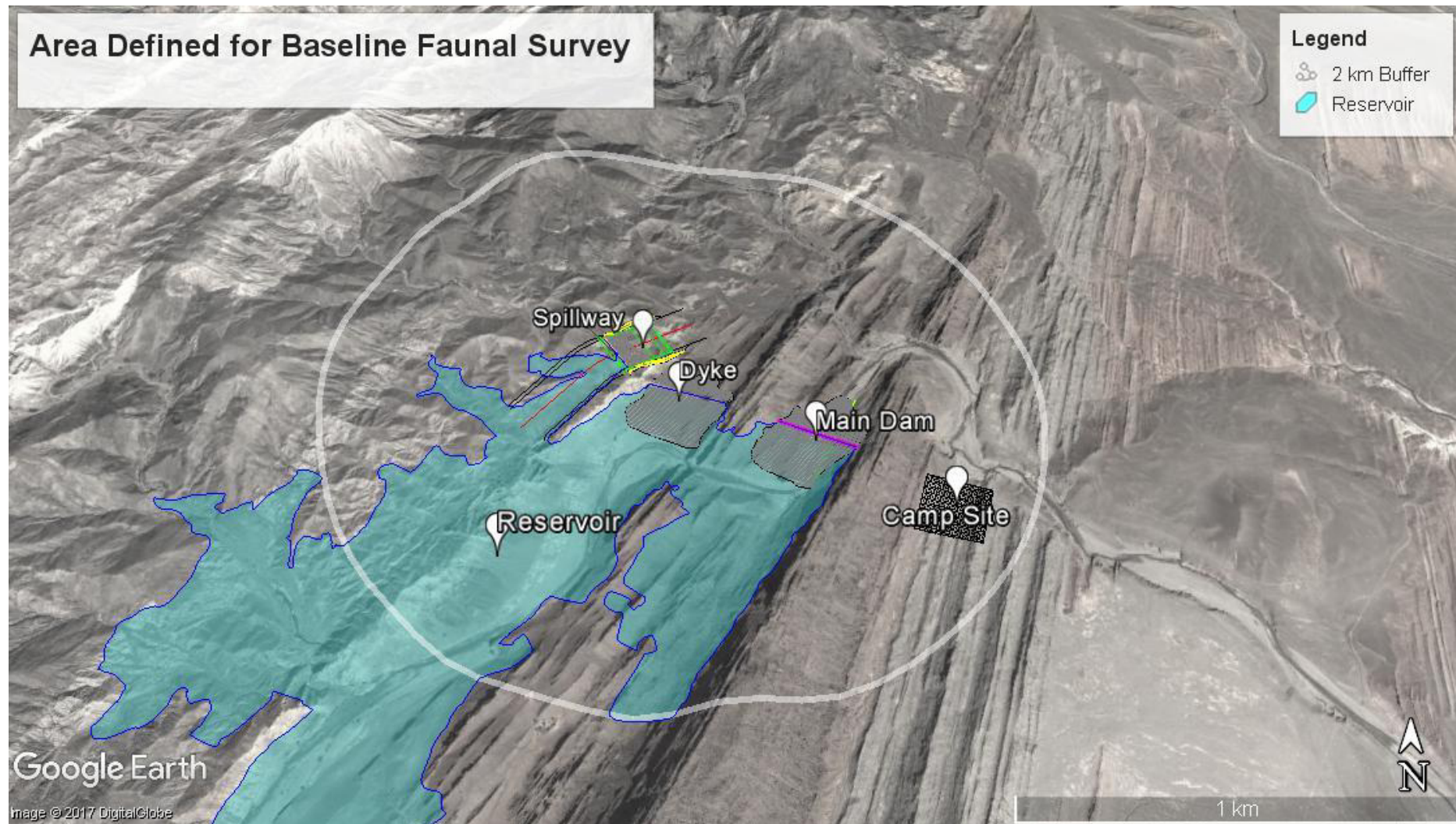
313. Each sampling point would be undertaken by a transect walk of 100 meters, and list the faunal composition for Mammals and Birds only on either side of transect, using appropriate tools and equipment (GPS, binoculars, cameras and spot scope). This study would be qualitative, spot representative and does not reflect the seasonal variability of the ecosystem, since it's early winter in the project area which theoretically is the time for amphibians and reptiles to undergo hibernation, therefore, amphibians and reptiles is not included in the faunal survey.

Sampling Spread in circumference of 2 kms, 1 km on each radius



314. **Figure 17** presents defined area where faunal survey was carried out.

Figure 9: Area Defined for Baseline Faunal Survey



315. The survey is qualitative in nature and would represent spot composition of the fauna for the area sampled. The field activity was carried out in 5 days. The faunal survey was conducted during 1st week of November 2017, as it coincided with the arrival time of migratory birds in the area. Moreover, the weather conditions were also manageable during this period.

□ Findings of Faunal Survey

316. Through interviews, direct sightings and evidences, recorded the occurrence of a total Seven mammal species (**Table 31**), of which we confirmed the occurrence of 3 species fox, wolf and Hyena through direct evidences like pug marks, pelts, faces, territory marking signs and interviews with local residents. The Balochistan Black Bear, Suleiman Markhor and Afghan Urial, which was reported to occur in the past, are now apparently extinct.

Table 19; List of Mammal Species in Sri Toi Area

S. No.	Common Name	Zoological name	Local Name
1	Suleiman Markhor	<i>Capra falconeri jerordeni</i>	Ghar sanay
2	Common leopard	<i>Panthera pardus</i>	Prang
3	Fox	<i>Vulpes</i>	Gedara
4	Wolf	<i>Canis lupus</i>	Leva
5	Afghan Urial	<i>Ovis orientalis vignei</i>	Sezha
6	Asiatic steppe wild cat	<i>Felis silvestris</i>	Spilmai Gedara
7	Hyena	<i>Hyaena</i>	Kazhabal

• Small Mammals

317. Cape hare was found very common in the entire area during survey. A total 07 Cape hare were counted during the survey.

• Carnivores

318. For the determination of population status of carnivores, nights walks were arranged. In the plains the survey team used vehicle and search lights. After seeing the eyes of carnivores in high powerful lights, noted the eye colors and consulted the literatures. In foothills, search lights were used in the same way. One (1) Indian gray wolf, two (2) red fox, three (3) Asiatic jackals and one Indian Crested Porcupine were sighted. While indirect observations were made on the droppings, foot prints of several carnivore species such as striped hyena, Jungle cat, afghan hedgehog, Caracal and Indian gray wolf. Skin of Panther observed in a house, using for prayers.

• Resident and Migratory Birds

319. Direct sight techniques like ground nests searching and stand watch techniques were used for this survey. 16 species of birds were observed in the area (**Table 32**). Chakoor and Seesee partridges were found very common throughout the area. The birds were mostly observed near water points. Two (2) small flocks of Chakoor and see partridges were observed in the area. Hunters to trap eagles were observed on three different locations with hunting materials.

Table 20: List of birds sighted during survey

Common Name	Scientific Name
Chukar	<i>Alectoris chukar</i>
See-see Partridge	<i>Ammoperdix griseogularis</i>
Eurasian Griffon	<i>Gyps fulvus</i>
Eurasian Sparrowhawk	<i>Accipiter nisus</i>
Demoiselle Crane	<i>Anthropoides virgo</i>
Rock Pigeon	<i>disambiguation</i>
Eurasian Collared Dove	<i>Streptopelia decaocto</i>
Spotted Sandgrouse	<i>Pterocles senegallus</i>
Common Buzzard	<i>Buteo</i>
Common Swift	<i>Apus</i>
Common Kingfisher	<i>Alcedo atthis</i>
Green Bee-eater	<i>Merops orientalis</i>
Hoopoe	<i>Upupa epops</i>
Crested Lark	<i>Galerida cristata</i>
Common Rock Thrush	<i>Monticola saxatilis</i>
Rock Bunting	<i>Emberiza cia</i>

Table 21: People Who Contributed

S. No.	Name	Profession
1	Saeedullah Khan	Sociologist
2.	Muzaffar Khan	Field Biologist
3.	Mayen Khan	Zoologist
4.	Naqeebullah Khan	Field Coordinator

- **Reptiles**

320. The survey team observed lizards in six different locations. At one location hunted Afghan Tortoise shell was observed. Many snake species are reported from the area. Due to hibernation period, no snake species observed in the present survey while 2 lizard species observed in the survey, Clif rcer (Coluber rhodoracus) and Agama (Agama spp.) are available everywhere.

321. No species with endangered or threatened status (as per IUCN red list) were observed in the project area during the faunal survey.

322. The photographic record of faunal survey is provided below. Baseline Faunal Survey Report of Sri Toi Dam Area attached as **Annexure-24**.



□ Wetlands

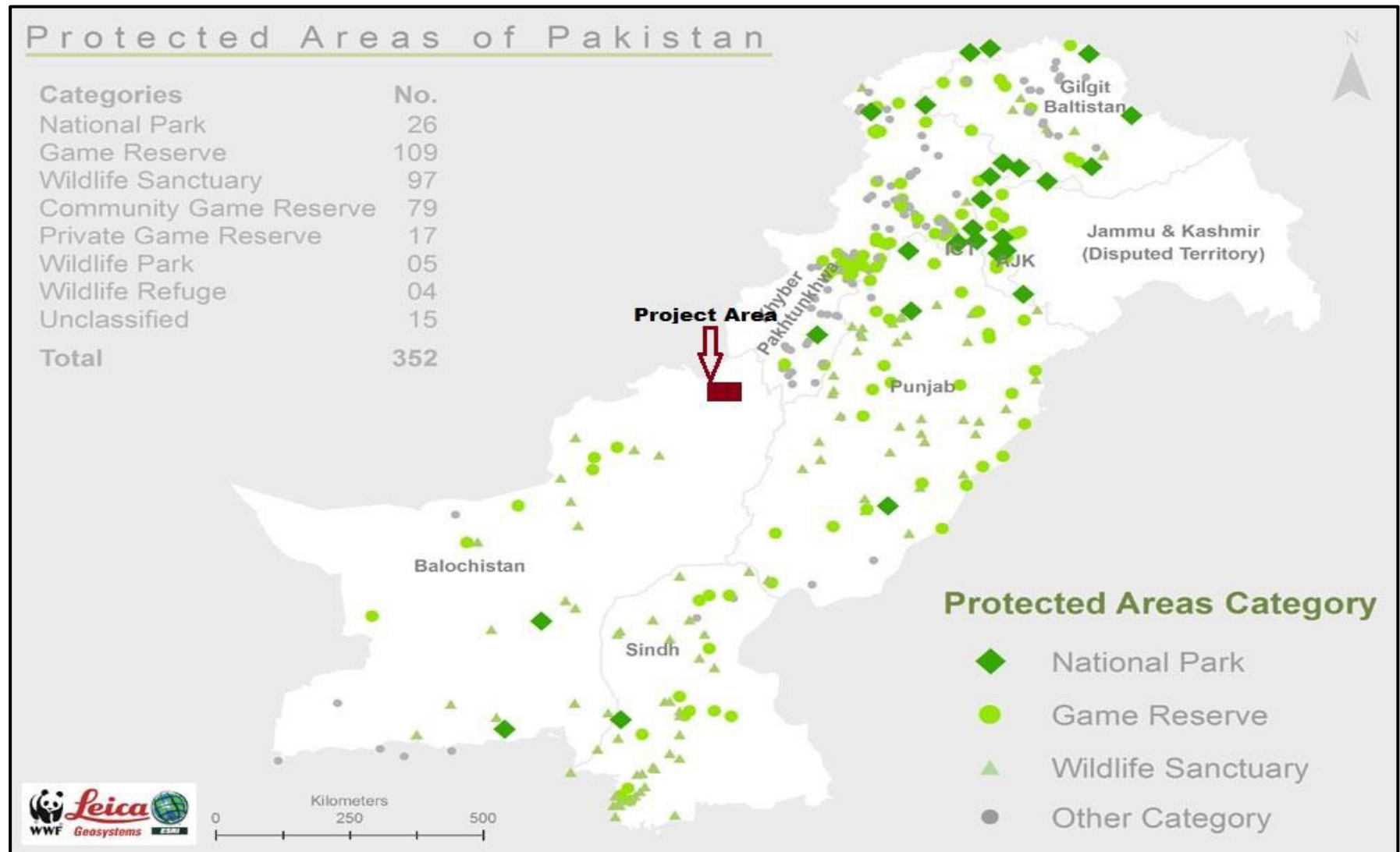
323. Sabakzai Dam, Zhob River, Wasta Dam, and Chakhon are important wetlands in the district. Among these Sabakzai Dam has been constructed recently. No study has been conducted yet for its potential as wetland and its resident and migratory/visiting species but it is anticipated that this lake will become an important wetland in the years to come. Wasta Dam is an important stop of migratory cranes. The Zhob River, throughout its length, is an important wetland for resident and winter visiting species.

324. Photographs of few faunal representatives are given as **Annexure 14**.

5.3.3 Ecosystem Sensitivities

325. There are no notified protected areas present in the project vicinity. Approximately more than 200 km south of the project area is **Tor Ghar Community Game Reserve in District Qila Saifullah** game reserve. **Figure 18** gives clear picture of the area ecosystem sensitivities:

Figure 10: Protected Area Map



5.4 Socioeconomic Profile

326. The total population of Zhob District according to 1998 census was 193,458 persons (105319 males 54.44% and 88139 females 45.56%) whereby; its projected population as of 2010 was 240,486 (132267 male and 108219 female) based on the 2.28% growth rate (Census 1998). The urban population is 23% and rural population is 77%. The household size accordingly was averaged as 8 dwelling in 34,294 housing units.

327. Despite being one of the oldest districts of the province, the district is underdeveloped. Poor and inadequate social infrastructure, less communication channels and public utilities, compared to other districts of Balochistan are the major reasons for low pace of development of the district, let alone the inadequate health facilities and in-sufficient education facilities. Only 70% percent of the population of Zhob district has access to clean drinking water and 62% has access to improved sanitation facilities (MICS 2010). The population is generally poor and due to high malnutrition, poor living conditions, inadequate health care facilities, high fertility, they experience high level of mortality and morbidity. The vulnerable groups including women and children are particularly at risk. Education sector is also very weak compared to other districts of Balochistan; as only 32% of the population complete primary or higher-level education (PSLM 2008-09).

328. The major portion of the population earns their livelihood from Agriculture and livestock husbandry owing to diverse agro-climate. Though only 6-8% of the geographical area of the district is being used for Agriculture, still the crop yields are far higher than rest of the province. Agriculture Crops are sown both in Rabi and Kharif seasons. Crops cultivated during Rabi season include: Wheat, Barley, Vegetables and Fodder whereas in Kharif Sorghum, Maize, onion, potato vegetables and Fodder are sown. Besides the field crops, farmers in the district also grow fruit crops. Major fruits grown in the district include Apple, Almond, Apricot, pomegranates and grapes.

□ Population and Community Structures

329. The main tribe living in the sub-project area belongs to the Arabzai clan of Mandokhail, list of the main villages is given in **Table 35**. These are ultimate beneficiaries of the project. Pushto is spoken as the major language in the area while small number of the people can speak Urdu. The communities belong to Muslim religion group. No issue of resettlement was observed.

330. Houses are mainly constructed of locally available impermanent materials, typically mud or sub-baked bricks fused with baked mud strengthened with chopped straw. These materials make poorer households susceptible to invasion of vermin and seasonally unstable, needing reconstruction after heavy rainy season. The houses made of impermanent materials, generally do not have border walls.

Table 22: Name of Villages, Total Households and Population in Sri Toi Water Storage Dam Irrigation Sub-project

Sub-project Villages				
S. No.	Village Name	Tribe	Estimated No of Households	Estimated Population
1	Tora Darga	Mandokhail	262	2730
2	Killi Hazrat Sahib		48	2251
3	Tora Ghundi		37	509
4	Loya Mana		29	347
5	Shinawarhza		10	129
6	Qatal Khan		23	388
7	Ahmad khail		33	595
8	Landi Bobi		45	658
9	Nave Oba		75	548
10	Kanrhi Zam		21	227
11	killilandi		10	167
12	Orgharhi		8	250
13	Sankasi		9	250
14	Doshana		20	223
15	Zawai		20	546
16	Gada Khail		61	1926
17	Ormani Shpah		17	139
18	Bobi Arbzai		85	618
19	Sur Ghundi		36	273
20	Hashikasi		7	30
21	Fakhri		8	57
Total			864	12861
Average Family Size			15	

❑ Existing Irrigation Infrastructure

331. The upstream command area of the sub-project, (located on left bank of the river) is presently being sown as khushkaba during the Rabi season, and some 16 ha are being cultivated using groundwater abstracted from open wells/tubewells. The remaining command area is lying barren due to lack of access to surface water. The water table in the area varies from 37 to 46 m. In the command area of the dam some 4 Karezes/springs and around 180 open wells/tubewells are functional and providing water for irrigation.

❑ Land availability, Ownership and Land Tenure

332. The land rights are also equitable and nearly all landholders have pieces of lands as the land in the sub-project area is distributed. About 4027 ha is the expandable land which could be commanded from the same source. While currently the left bank land cannot be commanded from the same source, therefore the farmers have developed tubewells in the left bank command area. However, if the sub-project is developed these lands could also come under command. In the watershed of the sub-project no villages were reported by the community and there was nearly no access in the watershed through vehicle. The land in the watershed also belong to the Arbzai clan. The project site has been used at grazing fields for many decades and has been in the protective custody of the Arabzai clan. The sub clan of Arabzai clan are Ahmed Khel, Saidal Khail and Karzai Ahmed Khel. This land is now a barren land due to absence of water. Resettlement in the form of physical dislocation of people or their homes is not envisioned for this project. Some land owners have demanded that this land should be properly distributed to individuals of the tribe. Recently the Balochistan Irrigation and Power Department, the project proponent, involved Commissioner / Deputy Commissioner Zhob to resolve this matter. The matter has been resolved and the land has been handed over to its rightful owner. The project proponent will acquire land from these private land owners for the said Project. **Table 36, 37 and 38** below present the land acquisition requirements and its compensations:

Table 23: Land Acquisition and Compensation for Dam

Main Dam Components	Survey No.	Clan Ownership	Area (Acres)	Barren	Nallah bed	Hilly	Estimated Compensation Cost @ PKR: 57,500/ Acre (Including 15% CAS)
				(Acres)	(Acres)	(Acres)	
Reservoir Area	Unsettled	Ahmedkhel	413.5	413.5	106.38	307.12	23,776,250.00
Potential River Bed			106.38				
Spillway	Unsettled	Ahmedkhel	9.32	9.32	0	0	535,900.00
Dyke	Unsettled	Ahmedkhel	9.28	9.28	0	0	533,600.00
Main Dam Axis	Unsettled	Ahmedkhel	14.33	14.33	0	0	823,975.00
Road	Unsettled	Ahmedkhel	51.39	51.39	0	0	2,954,925.00
Temporary Land Acquisition for Contractor's Camp for 3 Years (PKR:5000/Acre per Month)	Unsettled	Ahmedkhel	8.22	8.22	0	0	1,479,600.00
Total							30,104,250

Table 24: Land Acquisition and Compensation of Right Bank Canal (RBC) of Sri Toi Dam Project

Ownership of Clan	Length (m)	Channel Width (m)	Area (Acre)	Barren	Govt.	Estimated Compensation Cost @PKR:57500/Acre (Including 15% CAS)
				(Acres)	(Acres)	
Saidal Khail	19,120	25	118.12	118.12	0	6,791,691.84
C&W Department	5	25	0.03	0.00	0.03	1,776.07
Arabzai	592	25	3.66	3.66	0	210,286.69
TOTAL	19,717		121.80	122	0	5,305,922.69

Table 25: Land Acquisition and Compensation of Left Bank Canal (LBC) of Sri Toi Dam Project

Ownership of Clan	Length (m)	Channel Width (m)	Area (Acre)	Residential	Barren	Estimated Compensation Cost @PKR:57500/Acre (Including 15% CAS)
				(Acres)	(Acres)	
Karzai Ahmed Khel	7,059	25	44	-	44	2,506,814
Karzai Ahmed Khel	25	25	0	0	0	8,878
KaraiZai Ahmed Khel	299	25	2	0	2	106,182
KaraiZai Ahmed Khel	616	25	4	0	4	218,756
KaraiZai Ahmed Khel	1,068	25	7	0	7	379,271
KaraiZai Ahmed Khel	412	25	3	0	3	146,311
KaraiZai Ahmed Khel	69	25	0	0	0	24,503
KaraiZai Ahmed Khel	690	25	4	0	4	245,035

Ownership of Clan	Length (m)	Channel Width (m)	Area (Acre)	Residential	Barren	Estimated Compensation Cost @PKR:57500/Acre (Including 15% CAS)
				(Acres)	(Acres)	
KaraiZai Ahmed Khel	366	25	2	0	2	129,975
KaraiZai Ahmed Khel	52	25	0	0	0	18,466
KaraiZai Ahmed Khel	58	25	0	0	0	20,597
KaraiZai Ahmed Khel	133	25	1	0	1	23,979
KaraiZai Ahmed Khel	254	25	2	0	2	90,201
KaraiZai Ahmed Khel	118	25	1	0	1	41,905
KaraiZai Ahmed Khel	655	25	4	0	4	232,606
KaraiZai Ahmed Khel	35	25	0	0	0	12,429
KaraiZai Ahmed Khel	81	25	1	0	1	28,765
KaraiZai Ahmed Khel	371	25	2	0	2	131,751
KaraiZai Ahmed Khel	723	25	4	0	4	256,754
KaraiZai Ahmed Khel	5	25	0	0	0	1,776
KaraiZai Ahmed Khel	96	25	1	0	1	34,092
KaraiZai Ahmed Khel	59	25	0	0	0	20,952
KaraiZai Ahmed Khel	55	25	0	0	0	19,532
KaraiZai Ahmed Khel	29	25	0	0	0	10,299
KaraiZai Ahmed Khel	196	25	1	0	1	69,604

Ownership of Clan	Length (m)	Channel Width (m)	Area (Acre)	Residential	Barren	Estimated Compensation Cost @PKR:57500/Acre (Including 15% CAS)
				(Acres)	(Acres)	
KaraiZai Ahmed Khel	242	25	1	0	1	85,940
KaraiZai Ahmed Khel	330	25	2	0	2	117,191
Arabzai	5,491	25	34	0	34	1,949,981
-	7	25	0	0	0	2,486
Airabzai	4,571	25	28	0	28	1,623,268
Total	24,165		148	0	148	6,501,232

❑ Water Rights, Allocation of Water and Warabandi

333. Water Rights are transferred with the ownership of land. Land and water rights are equally distributed among shareholders. No other source of water is available for irrigation and all beneficiaries depend on agriculture from the same source. Communal lands are mostly registered as Shamlaat. In 1968 the cadastral records were updated and land rights were registered as Moza Badinzai. Owner of community land are tribes or clans. There are 853 land holding resident families in Tangi War/ Sri Toi dam area.

❑ Gender Issues

334. The female population in Pakistan according to the 1998, Census, is around 48%. In view of this situation, the gender⁹ issues assume special focus and need to be properly addressed and evaluated. The status of women in rural Balochistan, as for the rest of the villages in Pakistan, is acutely disadvantaged. Women bear a disproportionately high share of burden of poverty; have unequal access to economic options and social services lower endowments of land and other productive assets. Women are severely hindered in their horizontal and vertical social mobility. Gender discrimination has become an issue in Pakistan with many Government and non-Government organizations working to resolve the issue. Other parts of Pakistan, women in Balochistan commonly face problems in family law, discrimination at work place, discrimination in education, physical or psychological abuse, and social restrictions. The literacy rate and school enrolment ratio of girls in province is very low, with girls remaining at home to complete domestic chores. The predominant role of women in agriculture has enabled most women farmers to become increasingly responsible for educational and other material needs of their wards, especially for female headed households.

⁹ The sub-project specific gender issues are to be discussed in PSA/Gender Disaggregated Socio-Economic Baseline report.

❑ Existing and Designed Interventions of Agriculture

335. At present there is minimal agricultural activity due to absence of irrigation system in the sub-project area and the landowners cannot bring majority of the command area under cultivation.. The land belongs to Ahmed Khail, which is a sub-tribe of Mandokhel tribe.

336. The projection of agriculture for the sub-project has been made keeping in view the current situation through findings of field surveys in and around the sub-project. The landowners were interested to propose the profitable crops and fruits in the future as by the sub-project development. The proposed cropped area is 4,832 ha with 120% cropping intensity. The gross irrigation requirement and detailed existing and proposed/projected agriculture analysis are attached in the Appendix.

337. The land is still under the communal ownership of the tribe and it has not been put to settlement. Although the crop cultivation on some parts of project area is already being practiced, the proper settlement has not been affected yet. A few villages are present beyond the project area (the nearest being 16 km away), where the inhabitants are busy in livestock rearing as major sources of livelihoods. The proposed area is accessible from Zhob town through a black topped road, which ends up at a village named Hazrat Agha Village.

6 STAKEHOLDER CONSULTATION

6.1 Introduction

338. The basic purpose of conducting the stakeholder consultation was to involve the important stakeholders and local people into the process of project implementation and to incorporate the appropriate environmental and social concerns into the process. Moreover, Pakistan Environmental Protection Act (PEPA) specifies that the stakeholder consultation process shall be an integral part of environmental assessment, and thus makes it mandatory. This section presents the essence of the stakeholder consultation process carried out for the proposed project.

339. Frequent meetings and consultations were held with the community and other stakeholders' vis-à-vis BIPD, forest, agriculture, wildlife, Local Government Representatives, Local Welfare Societies (NGOs), academia, NGOs and community influential. During the meetings, the project objectives were explained to the participants. Their concerns and suggestions were documented and taken care of to enhance the project acceptability on social grounds. Their major concerns related to the environmental impacts and mitigation measures. During field visits, a series of public consultations and scoping sessions were carried out at various locations in the project area.

6.2 Objectives

340. Basic objective of this activity is to have on board the project Affected People, related Governmental institutions and interested non-governmental organizations (NGOs) through:

- Introduction of the project;
- Creating awareness about the project including its impacts;
- Rapport building with APs;
- Involving them in the process of determining the right direction for area development;
- Assessment of the impacts of sub-project, which may occur and their mitigations; and
- Introduction of PEPA- 1997 and ADB environmental and resettlement policy.

6.3 Project Disclosure

341. Relevant guidelines of ADB prescribe that the affected population and institutions should be fully informed by disclosing the information relevant to the project impacts, the proposed policy of mitigation and compensation options. Consultation with Affected Persons (APs) is, therefore, the starting point for all these activities to allay misgivings and apprehensions about the project and elicit their acceptability, ensure their participation in planning and implementation and provide them with opportunity to participate in key decisions of the project that are likely to affect them.

6.4 Stakeholders Identification

342. The approach adopted by the consultants consists of the following steps:

343. Step 1 – List the various resources (natural and otherwise) within the site or in close proximity of proposed project area e.g. sweet water resources, agricultural lands, other types of lands, infrastructure, urban facilities, transportation facilities, forest etc.

344. Step 2 – List the functions and uses for each of the resources.

345. Step 3 – Identify the groups and actors that have a stake in each of the functions and uses of the various resources by asking the following questions.

- Who uses / provides the resource(s)?
- Who benefits from the use of the resource(s)? Who wishes to benefit but is unable to do so?
- Who impacts on the resource(s), whether positively or negatively?
- Who has rights and responsibilities over the use / provision of the resource(s)?
- Who would be affected by a change in the status, regime or outputs of proposed project area and its management?
- Who makes decisions that affect the use and status of the resource(s), and who does not?

346. These questions were answered using field observations, discussions with key persons, literature reviews and personal experience.

347. In doing Step 3, it emerged that a number of the same stakeholders (groups) is relevant for a number of the functions and uses. This allowed the consultants to begin to see the interconnected groups and stakeholders that have an important stake in the site or area.

348. The list of relevant stakeholders is provided in the following **Table 39**.

Table 26: Identification of Stakeholders

Resource	Stakeholders
Forest	Environmental Protection Agency
	Nature conservation NGOs, Academia
	Forest Department
	Wildlife Department
Waterways	Irrigation Department
	Agriculture and Agriculture Extension Department

Resource	Stakeholders
Infrastructure / Fixtures	District Administration / DCO
	Local Administration / TMA / Assistant Commissioner
	Community at large
Land	Agriculture & Agriculture Extension Department
	Irrigation Department
	Livestock Department
Crops and Vegetation	Provincial Forest Department
	Agriculture Department
	Irrigation Department, Livestock Department
	Local Communities
Access Roads	Local Communities
Live Stock	Local Communities, Livestock Department
Overall Issues & Benefits	Elders of the Local Communities DC and Assistant DC Zhob

6.5 Stakeholder Analysis

6.5.1 Organization and Composition

349. Typically, stakeholder consultation requires resources to manage. Therefore, most literature on the topic suggests classifying and categorizing them, so that more focus could be paid to the more important entities.

350. For this project, the stakeholders can be classified into two broad categories; i.e. Internal stakeholders who have some form of legal contract (in any form or at any level) with the proposed project (the project proponents), and External stakeholders who are made up of other individuals, groups or parties that have an interest in the project but are not contractually obligated in any way or form.

351. The approach adopted by the Consultants for identification and classification of the project stakeholders is based on a tailored form of Winch Matrix. This approach is being used for its simplicity, and its relevance for the situation at hand. The consultants first developed a blank format of a matrix containing 08 cells. For the internal stakeholders, the cells are based on the type of envisaged relationship (supply / demand), and the potential of influence (Direct / Indirect stake). For the external stakeholders, the cells are based on stakeholder origin (public / private) and again on their potential of influence. Once the matrix structure is created, each cell is filled with potential stakeholders' names.

258. **Table 40** maps and classifies the envisioned Sri Toi sub project stakeholders

Table 27: Classification of Project Stakeholders

	Internal Stakeholders		External Stakeholders	
	<i>Demand</i>	<i>Supply</i>	<i>Public</i>	<i>Private</i>
Direct stake / Primary Stakeholder	Local Community, BIPD	BEPA Agriculture Department, Forest Department	Land & revenue Department, Town/UC administration	Communities living or doing business in the area
Indirect stake / Secondary stakeholder		Service Providers for this project (technical vendors, labor force, consultants) ADB and other project financiers	Wildlife Department, Livestock Department	BRSP

6.5.2 Public Consultation in Field

352. This activity was initiated by the consultants during May 2017 and earlier alongside the socio-economic survey.

353. During field survey, the Consultants discussed the basic requirements, views and perceptions with the local residents of these settlements about this project. Following opinions were shared by the people of respective areas.

- Generally, the community at Kili Hazrat Sahib has a very positive opinion regarding the proposed project as they perceive that the project will provide canals and supply water for irrigation purpose. This will improve their quality of life, initiate economic activities and income. It will provide grazing and water for live stocks etc;
- An impression exists that some people (Mr. Kareem Mandokhel, Mr. Shahbaz.), are opposing the proposed project and block access to project sites. A meeting with these people revealed that they understand the benefits of the project and were interested in the project but also wanted proper land distribution / delegation from the tribal holdings to individual holdings.

□ **Meeting at Circuit House Zhob (May 12, 2017):**

354. The team left Quetta around 9:30 am and arrived in Circuit House Zhob at 1:30 pm. The team was received and welcomed by the district officers and community members. After exchange of pleasantries, the meeting started, wherein the team leader first introduced the team members. This was followed by the introduction of district officers and community members. Team leader informed the line department officers (Forest and Wildlife Department) and community members that they are here to conduct the Initial Environmental Impact Assessment for construction of Sri Toi Dam. In this regard, they want to schedule meetings with the government line department and community members.

355. Community members and officers of government line department highly appreciated this project and showed their full support for the scheme. They were of the view that construction of dam will help in bringing more area under cultivation, which will increase the agriculture crop and livestock production in this entire area, which would in turn create income generation /livelihood opportunities for a large number of people. They informed that at present community members are practicing agriculture crop production on a very small scale through rain fed mode.

356. For this purpose, water harvesting and spreading structures are used by community members. In some instances, where perennial flows are available, farmers have been also diverted water for crop production. Besides the rain fed and diversion of perennial flows, some of the community members have also sunk tube wells to pull out ground water for crop production. In some areas Karezes are also functional that provides water for crop production and drinking purposes. In addition to these sources of water, some community members in the project areas are pulling out ground water from dug well with the help of diesel operated engines and solar pumps. At present, community members are cultivation crops both in Rabi as well as in Kharif seasons. In Rabi season crops cultivated by the farmers include: wheat, onion, garlic, cucumber, maize, tomatoes vegetable and fodder crops, while in Kharif season the crops sown are: cucumber, brinjal, okra, vegetables fodder crops. Community members have also raised trees of Pistachio, Grapes, Almond and Pomegranate.

357. Agriculture produce is mostly marketed in Zhob town. Community members informed that the land in the proposed project area belongs to a single tribe, namely Ahmed Khel, which is a sub-tribe of Mandokhel tribe. They further added that 90% of the community members have shown their agreement to the construction of Sri Toi dam. They assured that there no issues related to the distribution of land and water exists in the area. However, due to the communal nature of the land ownership, the area needs to undergo settlement, which will determine the ownership pattern at the household/individual level.

358. Community members informed that almost all of the residents of the area are educated and have got good social awareness. They have got the capacities to resolve issues. Residents of the area are very happy that a dam is being constructed here, which would change their lives through conversion of barren land into a productive site. Community member have already taken necessary steps for resolving the issue of land settlement through constituting a committee for this purpose, which comprise two top leaders of the sub-tribe.

359. Community members informed that the entire command area along with dam construction and storage sites belongs to a single tribe Ahmed Khel. Therefore, they do not envisage any issue/challenge and dispute over dam construction, water distribution and land settlement. Community members informed that dam construction would open new vistas of livelihood opportunities in the area that will also contribute towards increasing the productivity in the entire Sri Toi.

360. They also added that local labour is available for undertaking all sorts of activities. Besides labour, all types of machinery for dam construction and land preparation/levelling can also be made available here because Zhob is home of many big construction companies. Similarly, synergies can be developed with the projects of NGO, such as BRSP, and government line departments, which will greatly help in furthering the project goal and objectives.

6.5.3 Consultation with Institutional Stakeholders

361. Besides consulting with the people living in or around the sites that are potentially affected by the project, the consultants also met the major institutional stakeholders, including the Government line departments and the NGOs working in the area.

362. Brief account of the discussion during these meetings is given below:

☐ Syed Pervez Bukhari – Chief Engineer – Balochistan Irrigation and Power Department

363. Chief Engineer of the irrigation and Power Department, Government of Balochistan presented the project background information. The consultants probed the justification of the project and conditions on the ground. The Chief Engineer was very positive that the project would have a positive impact on the community of the sub-project areas.

☐ Mr. Nadir Gul Barech – CEO – Balochistan Rural Support Programme

364. The consultations with BRSP were considered a good gesture and appreciated. They informed the consultants of successful work done by BRSP. The consultants briefed the BRSP team of the project interventions. BRSP expressed views on the positive impact the project

may have on the local people and BRSP's role on agriculture extension in the project area. BRSP advocated synergistic approach as implementing partner for the sustainability of proposed interventions and wellbeing for the villagers.

❑ **Aggrieved Community Representative Mr. Malik Shehbaz of Ahmed Khel – Mandokhel Tribe at Dam Site**

365. The team visited the dam site on May 13, 2017, which was a very beautiful and most suitable for the purpose of dam construction. The site was located close to the village namely Gul Khan, while the second village close to the dam site was Landai Kalayi. The site belonged to Ahmed Khel a sub-tribe of Mandokhel tribe. Many community members also accompanied the team during the visit and had good discussion with them at dam site.

366. Malik Shahbaz representing the aggrieved community having stakes on the proposed dam land met the project team. He expressed his concerns regarding the distribution of land and would oppose the construction of dam if the land distribution was not done. The team noted his concerns and assured him that all the stakeholders will be taken on board and the matters will be resolved before the construction of Dam.

❑ **Mr. Malik Baz Muhammad – Tribal Leader of Ahmed Khel – Arabzai Tribe**

367. On the way, back to Zhob town, the team made a brief stay in the guest house of Malik Baz Muhammad, who is the head of Ahmed Khel tribe. He and other influential of the Ahmed Khel tribe present at the occasion highly appreciated the construction of dam in their area. He assured full on behalf of his tribe for construction of dam and all the activities contained/planned in the project. He added that they are vigorously pursuing the land settlement issue and are very hopeful that this would be resolved in the next two/three months. He informed that all his tribesmen support this move of dam construction and are very happy. He added that by taking into account this fact he can say that the settlement issues would also be resolved very smoothly. He also requested for an increase in the command area so that more households could benefit from agriculture crop production. Influential and tribesmen present at the occasion informed that the entire tribe has delegated its power to Malik Baz Muhammad for land settlement and resolving other such issues that may arise in this context.

368. The consultations were considered a good gesture and appreciated, especially by the landowners and locals of the project. It improves their financial well-being to a great extent because 80 % people job associated with Agriculture work. They emphasized that local villagers should be given priority when employing people for various project-related works and activities according to their skills because non-Local work force coming in the project area that will not be aware of the local customs and norms, may result in conflicts with the local community, keeping in mind the sensitive law and order situation and culture of the area.

6.6 Stakeholders Concerns Summary

369. **Table 41** provide a summary of stakeholders' concern, and proposed mitigation measures. Pictorial profile of stakeholder consultation is given as **Annexure 2**.

Table 28: Concerns Raised by Stakeholders

Concerns	Proposed Mitigations
General	General perception of all the people is that the proposed project will bring economic prosperity and that they would support the project.
Aggrieved Party at the dam site represented by Mr. Malik Shehbaz, stated that distribution of land is mandatory before the construction of dam.	Chief Engineer, Balochistan Irrigation and Power Department has instructed DC Zhob to resolve this matter in accordance with land revenue records and local customs.

6.6.1 Continual Engagement with Stakeholders

370. Notwithstanding the efforts so far put in for public participation, this activity will have to be pursued through the forthcoming implementation phases of the project. In particular, the focus will be on the improvement and modification of the proposed intervention designs.

371. The related institutional arrangements should also be in place for continuous consultation throughout the process of planning and implementation.

7 ENVIRONMENTAL IMPACTS & MITIGATIONS

7.1 General

372. This chapter identifies the significant potential environmental and socio-economic impacts which may occur during the project life. The appropriate mitigation measures are also discussed in this and the subsequent chapters of this report. A brief qualitative description of each aspect and the affected environment in both Project Area and AOI is presented in the following sections.

7.2 Impact Assessment Methodology

373. For the purpose of evaluating the environmental impact of this proposed project, the following steps have been executed:

- Scoping of impacts
- Environmental screening
- Qualitative impact evaluation
- Describing mitigation measures
- Residual impact significance
- Determining cumulative impacts

374. Each of these steps undertaken for the evaluation of environmental impacts and to describe mitigation measures, is described in the following section.

7.3 Scoping of Impacts

375. Potential environmental impacts of the Project on various environmental features in the Project Area are identified through the following studies:

- Environmental quality baseline monitoring of air, noise and water;
- Detailed review and analysis of primary and secondary data available for all environmental parameters in Project Area such as physical, ecological and social resources;
- Desktop study of engineering investigations, studies and designs;
- Consultations with implementing agencies, local government, affected community, traditional and religious leaders of community;
- Stakeholder consultations with relevant government agencies and national NGOs;
- Knowledge assimilation of international best practices on environmental assessment of irrigation projects.

7.4 Notion of Significance

376. The term “**Environmental Impact**” or simply “**Impact**” covers the negative, adverse or harmful as well as positive, desirable or beneficial impacts of the project on environmental settings. Prediction of impacts of the proposed activity is based on factual data; however, the significance of these impacts involves subjective judgment. The nature of the impacts may be categorised in terms of:

- **Direction** - Positive or Negative
- **Duration** - Long or Short Term
- **Effect** - Direct or Indirect
- **Extent** - Wide or Local

377. Impact significance depends on both the nature of the impact and on the sensitivity of the receptor. The more sensitive the receptor the greater will be the significance of impact of that change. For this EIA Report, nature of change is combined with the sensitivity of the receptor to evaluate the significance of the impact. The significance of impact is characterized as very low, low, moderate, high and very high. Environmental issues having “moderate”, “high” and “very high” significance would be provided with mitigation measures. Residual impacts after implementation of mitigation measures have also been provided.

7.5 Environmental Screening

378. For identification of potential impacts of the project, screening of activities causing impacts had been carried out in different phases of the project life. In the impact assessment exercise, major project activities with their associated environmental issues were identified and then their impacts on the relevant physical, ecological, and socio-economic elements of the area were evaluated.

379. In broader spectrum, the project activities could be categorized in the following three phases:

- Planning & Design Phase;
- Implementation & Construction Phase; and
- Operations & Maintenance Phase.

380. During the first phase, the focus will be not only on the engineering design, but also on laying the foundation for integrated planning for water resources management. Extensive inter-departmental coordination will be necessary at this stage for improvement in institutional arrangements and capacity in the areas of environmental and social management and monitoring. Development of decision support systems and training to develop local expertise

is expected to substantially improve the management and monitoring of social and environmental impacts.

381. The planning, information management, and capacity-building activities are all intended to facilitate increased awareness-raising to foster ownership, understanding and mainstreaming of environmental and social considerations. Such activities to be planned and partly to be implemented.

382. The construction phase mainly entails construction of Dam, new canal and other irrigation structures. Construction of the proposal Dam, new canal and other irrigation structures are expected to introduce direct significant benefits to the local population. This phase will be very sensitive in terms of environmental and social implications, because of a wide range of issues including land acquisition, and the very extent of construction activities etc. The interventions planned under this component will become less damage to environment, if the EMP is implemented in letter and spirit.

383. Operations & Maintenance will be another stage where major impacts, both positive and negative, can surface, and the earlier predictions could be validated. This phase will comprise commissioning the newly constructed Dam, new canal and other irrigation structures. While the operation phase mostly consists of engineering activities, it has an equally important requirement of continued inter-departmental coordination, for harvesting the full potential of positive impacts of the project.

384. **Table 42** below presents the screening of activities for proposed Sri Toi water storage dam and irrigation system during design, construction and O&M phases.

Table 29: Screening of Activities

Proposed Sub-activities	Screening Results			Significance Prior to Mitigation			Potential Impacts
	Very Low Risk	Moderate Risk	High Risk	Low	Moderate	High	
Construction of Dam, Main Canal, Left Canal & Right Canal and Irrigation Structures							
A. Design & Planning Phase							
Field surveys	✓			✓			• No potential Impact
Assessment of water availability		✓			✓		• Failure of design

Proposed Sub-activities	Screening Results			Significance Prior to Mitigation			Potential Impacts
	Very Low Risk	Moderate Risk	High Risk	Low	Moderate	High	
Proper Dam site selection and its land acquisition		✓			✓		<ul style="list-style-type: none"> Design failure Social issues Relocation of assets
Route selection (Alignment) of proposed new canal and its land acquisition		✓			✓		<ul style="list-style-type: none"> Social issues Relocation of assets
Water rights issues in the area		✓			✓		<ul style="list-style-type: none"> Social issues
Design works construction of Dam, new canal and other irrigation structures as per proper engineering standards			✓			✓	<ul style="list-style-type: none"> In case of design failure system will be collapsed
Dam reservoir sedimentation		✓			✓		<ul style="list-style-type: none"> System sustainability
Public disclosure of final design		✓			✓		<ul style="list-style-type: none"> Social issues
Coordination with all relevant departments for NOCs		✓			✓		<ul style="list-style-type: none"> Delay in project implementation & cost overruns
Construction of metaled road of about 16 km from Killi Hazrat Sahab to Project site for transportation of construction material and other logistics.		✓			✓		<ul style="list-style-type: none"> Delay in project implementation & cost overruns
Disruption to public life	✓			✓			<ul style="list-style-type: none"> No potential Impact
Disruption to wildlife	✓			✓			<ul style="list-style-type: none"> No potential Impact
Disruption to aquatic life	✓			✓			<ul style="list-style-type: none"> No potential Impact
Risk due to Natural Hazard i.e. flooding and earthquakes			✓			✓	<ul style="list-style-type: none"> System sustainability
B. Implementation & Construction Phase							
Security and Safety Risks		✓			✓		<ul style="list-style-type: none"> Delay in project execution

Proposed Sub-activities	Screening Results			Significance Prior to Mitigation			Potential Impacts
	Very Low Risk	Moderate Risk	High Risk	Low	Moderate	High	
Continued stakeholder engagement		✓			✓		<ul style="list-style-type: none"> • Social issues
Construction contractor mobilization and establishment of campsite and machinery/ equipment Yard		✓			✓		<ul style="list-style-type: none"> • Changes in land use pattern • Influx of external work force • Social conflicts • Workshop facilities may spread oils & chemicals • Deterioration of air quality due to machinery & equipment • Noise • Land degradation due to solid waste disposal of camp site • Water contamination • Loss of vegetation • Health and Safety issues
Transportation of construction material		✓			✓		<ul style="list-style-type: none"> • Soil erosion and contamination • Air pollution • Noise pollution • Health and Safety issues • Damage to infrastructure
Excavation, backfilling and compaction works		✓			✓		<ul style="list-style-type: none"> • Soil erosion • Site overburden • Borrow pit • Loss of natural vegetation • Damage to infrastructure • Sites of Historical, Cultural, Archeological or Religious Significance

Proposed Sub-activities	Screening Results			Significance Prior to Mitigation			Potential Impacts
	Very Low Risk	Moderate Risk	High Risk	Low	Moderate	High	
							<ul style="list-style-type: none"> Noise pollution Air pollution Health and safety issues Blocked of access due to earth works and stockpiling of excavated material
Construction of dam and new canal		✓			✓		<ul style="list-style-type: none"> Noise pollution Air pollution Health and safety issues Blocked of access due to construction works
Construction of structures		✓			✓		<ul style="list-style-type: none"> Noise pollution Air pollution Water contamination Health and safety issues Blocked of access due to construction works
C. Operation & Maintenance Phase							
Unavailability or improper distribution of irrigation water in the area		✓			✓		<ul style="list-style-type: none"> Social issues
Breaching of Dam, canal, and structures			✓			✓	<ul style="list-style-type: none"> Fatal accidents System sustainability
Use of irrigation water for drinking purposes		✓			✓		<ul style="list-style-type: none"> Health issues
Ground water contamination in command area		✓			✓		<ul style="list-style-type: none"> In case of improper drainage ground water will be contaminated
Disposal of waste (connection of waste streams) in the canal		✓			✓		<ul style="list-style-type: none"> Health issues Social issues

Proposed Sub-activities	Screening Results			Significance Prior to Mitigation			Potential Impacts
	Very Low Risk	Moderate Risk	High Risk	Low	Moderate	High	
Use of fertilizers & pesticides		✓			✓		<ul style="list-style-type: none"> Banned fertilizer & pesticides will cause health issues Contamination of fresh water through surface runoff
Increase of agricultural lands		✓			✓		<ul style="list-style-type: none"> Loss of pastoral lands
Periodic cleaning and maintenance of the system		✓			✓		<ul style="list-style-type: none"> Solid waste generation
Community participation for management and operation of the irrigation system		✓			✓		<ul style="list-style-type: none"> Social issues System sustainability
Disruption to aquatic life	✓			✓			<ul style="list-style-type: none"> No Potential Impact
Disruption to public and wildlife		✓			✓		<ul style="list-style-type: none"> Social issues Conservation issues
Health and Safety		✓			✓		<ul style="list-style-type: none"> Vector borne diseases (e.g. malaria) Drowning issues
Risk due to Natural Hazard i.e. flooding and earthquakes		✓			✓		<ul style="list-style-type: none"> System sustainability

385. The following sections dilate upon the environmental issues and the assessment of their impacts. It is to be noted that since most impacts will be similar irrespective of the project component, the description follows a phase wise approach. However, whenever any particular impact is envisaged to be linked to a specific component, the description has been adjusted accordingly.

7.6 Impact Evaluation

386. The next stage of the EIA process is a detailed assessment to forecast the characteristics of the main potential impacts. Known as impact analysis. Impact identification and prediction are undertaken against an environmental baseline, often through indicators e.g. air/water, noise, ecological sensitivity, biodiversity. The aim is to take account of all of the

important environmental/project impacts and interactions, making sure that indirect and cumulative effects, which may be potentially significant, are taken into consideration. The anticipated environmental impacts due to project is based on the methodology provided in section 1.8.11 of this report presented below in **Table 43**.

Table 30: Anticipated Environmental Impacts Assessment

Activity / Issue	Site Specific Impacts	Assessment of Risk
Construction of Dam, Main Canal, Left Canal & Right Canal and Irrigation Structures		
A. Design & Planning Phase		
Field surveys	<ul style="list-style-type: none"> No potential impact 	-
Assessment of water availability	<ul style="list-style-type: none"> Failure of design 	C-3
Proper Dam site selection and its land acquisition	<ul style="list-style-type: none"> Design failure Social issues Relocation of assets 	C-3
Route selection (Alignment) of proposed new canal and its land acquisition	<ul style="list-style-type: none"> Social issues Relocation of assets 	C-3
Water rights issues in the area	<ul style="list-style-type: none"> Social issues 	D-4
Design works construction of Dam, new canal and other irrigation structures as per proper engineering standards	<ul style="list-style-type: none"> In case of design failure, system will collapse 	D-5
Dam reservoir sedimentation	<ul style="list-style-type: none"> System sustainability 	D-4
Public disclosure of final design	<ul style="list-style-type: none"> Social issues 	D-4
Coordination with all relevant departments for NOCs	<ul style="list-style-type: none"> Delay in project implementation & cost overruns 	D-4
Construction of metaled road of about 16 km from Killi Hazrat Sahab to Project site for transportation of construction material and other logistics.	<ul style="list-style-type: none"> Delay in project implementation & cost overruns 	B-2
Disruption to public life	<ul style="list-style-type: none"> No potential impact 	-
Disruption to wildlife	<ul style="list-style-type: none"> No potential impact 	-
Disruption to aquatic life	<ul style="list-style-type: none"> No potential impact 	-

Activity / Issue	Site Specific Impacts	Assessment of Risk
Risk due to Natural Hazard i.e. earthquakes / flooding	<ul style="list-style-type: none"> System sustainability 	D-5 / D-4
B. Implementation & Construction Phase		
Security and Safety Risks	<ul style="list-style-type: none"> Delay in project execution 	C-3
Continued stakeholder engagement	<ul style="list-style-type: none"> Social issues 	C-3
Construction contractor mobilization and establishment of campsite and machinery/ equipment Yard	<ul style="list-style-type: none"> Changes in land use pattern Influx of external work force Social conflicts Workshop facilities may spread oils & chemicals Deterioration of air quality due to machinery & equipment Noise Land degradation due to solid waste disposal of camp site Water contamination Loss of vegetation Health and Safety issues 	B-2
Transportation of construction material	<ul style="list-style-type: none"> Soil erosion and contamination Air pollution Noise pollution Health and Safety issues Damage to infrastructure 	B-2
Excavation, backfilling and compaction works	<ul style="list-style-type: none"> Soil erosion Site overburden Borrow pit Loss of natural vegetation Damage to infrastructure Sites of Historical, Cultural, Archaeological or Religious Significance Noise pollution Air pollution Health and safety issues Blocked of access due to earth works and stockpiling of 	B-2

Activity / Issue	Site Specific Impacts	Assessment of Risk
	excavated material	
Construction of Dam and new canal	<ul style="list-style-type: none"> Noise pollution Air pollution Health and safety issues Blocked of access due to construction works 	B-2
Construction of structures	<ul style="list-style-type: none"> Noise pollution Air pollution Water contamination Health and safety issues Blocked of access due to construction works 	B-2
C. Operation & Maintenance Phase		
Unavailability or improper distribution of irrigation water in the area	<ul style="list-style-type: none"> Social issues 	C-3
Breaching of Dam, canal, and structures	<ul style="list-style-type: none"> Fatal accidents System sustainability 	D-5
Use of irrigation water for drinking purposes	<ul style="list-style-type: none"> Health issues 	C-3
Ground water contamination in command area	<ul style="list-style-type: none"> In case of improper drainage ground water will be contaminated 	C-3
Disposal of waste (connection of waste streams) in the canal	<ul style="list-style-type: none"> Health issues Social issues 	C-3
Use of fertilizers & pesticides	<ul style="list-style-type: none"> Banned fertilizer & pesticides will cause health issues Contamination of fresh water through surface runoff 	C-3
Increase of agricultural lands	<ul style="list-style-type: none"> Loss of pastoral lands 	C-3
Periodic cleaning and maintenance of the system	<ul style="list-style-type: none"> Solid waste generation 	C-3
Community Participation for management and operation of the irrigation system	<ul style="list-style-type: none"> Social issues System sustainability 	C-3
Disruption to aquatic life	<ul style="list-style-type: none"> No potential impact 	-

Activity / Issue	Site Specific Impacts	Assessment of Risk
Disruption to public and wildlife	<ul style="list-style-type: none"> • Social issues • Conservation issues 	C-3
Health and Safety	<ul style="list-style-type: none"> • Vector borne diseases (e.g. malaria) • Drowning issues 	C-3
Risk due to natural hazard i.e. flooding and earthquakes	<ul style="list-style-type: none"> • System sustainability 	C-3

7.7 Mitigation Measures

387. Adverse impacts due to Sri Toi water storage dam and irrigation system and mitigation measures are as follows:

7.7.1 Impacts during Planning and Design Phase

388. Understandably, the potential environmental impacts, in a physical sense, of the design stage are quite low. Since the design stage involves only limited physical activity, its direct impact on environment is also low. The various surveys carried out at the planning level may result in short term impacts on air and soil quality. If the design is carried out without regard to the environmental considerations, it will lead to long term negative implications for local flora, fauna, water quality, water resources, land acquisition etc.

□ Assessment of Water Availability

Potential Impact

389. Improper assessment of water availability and failure of design. This impact would be of moderate significance.

Mitigation Measures

390. Design works will ensure the proper assessment of water availability. BIPD will ensure the annual average available water of 57 MCM for irrigation water from tributary of Zhob River.

□ Proper Dam Site Selection and its Land Acquisition

Potential Impact

391. Improper dam site selection and land acquisition. This impact would be of moderate significance.

Mitigation Measures

392. Most of the significant environmental impacts of the project can be addressed at the design phase, which is mainly the responsibility of the Design Engineers. The site selection of dam should be with regards to the area geology and topography as these plays important role for the sustainability of project. The site selection predominantly determines the environmental implications of the project. Despite having examples of other similar projects, the exact quantum of environmental impacts cannot be predicted at times. Hence, the efficacy of the design will finally be tested only when the results of follow up monitoring become available. The Design Engineers must also add all features for safety of the workers during operation and maintenance.

393. Special considerations will be made for the selection of dam site to ensure proper land acquisition justified to all stakeholders. By adopting the aforementioned measures, the impact would be of low significance.

❑ Route Selection (Alignment) of Proposed New Canal and its Land Acquisition**Potential Impact**

394. Improper route selection of main canal and distributaries will lead to social issues related with relocation of assets. This impact would be of moderate significance.

Mitigation Measures

395. Most of the significant environmental impacts of the project can be addressed at the design phase, which is mainly the responsibility of the Design Engineers. The location of various distributaries and other irrigation structures, nature of construction technology etc. predominantly determine the environmental implications of the project.

396. Special considerations will be made for the selection of routes for both main canal and right & left canals which ensure proper distribution of water for all, alignment must be avoided from any controversial land, and alignment selection must be justified to all stakeholders.

397. BIPD (Irrigation Department) and Land Revenue Department to ensure that the land acquisition act 1894 procedures are followed in a transparent manner. Complete records should be maintained, particularly for asset valuation and compensation payment. The communities' grievances associated with the land acquisition and compensation should be addressed on priority basis, in order to avoid any unrest/mistrust among the communities towards the project. By adopting the aforementioned measures, the impact would be of low significance.

398. A team comprising of sociologists, resettlement experts, as well as scientists will assess the route on site during detailed design.

399. Effective surveys at the project site to be carried out by the team, to ensure local public consultation at the maximum. By adopting the aforementioned measures, the impact would be of low significance.

❑ Water Right Issues in the Area

Potential Impact

400. The Water being the most precious commodity in the area, its usage rights has been established traditionally. Any perceived or real disturbance to these water rights will almost certainly lead to social disturbance in the area. This impact would be of moderate significance.

Mitigation Measures

401. Proper water distribution through “Warabandi System” engaging Water User Associations and BIPD (Irrigation department).

402. An important aspect to be taken into account at the design level is the traditional water rights. This will need to be minutely considered while carrying out the detail designs. Coupled with this, continual two-way communication with the local population will be necessary, to ensure that their perceptions about the project remain realistic, rational, and positive.

403. Conduct social surveys to involve local public at the maximum in design phase, and probe ways and means to tackle these issues so as to maximally benefit them from the proposed project. By adopting the measures, the impact would be of low significance.

❑ Design Works Construction of Dam, New Canal and Other Irrigation Structures as per Proper Engineering Standards

Potential Impact

404. Absence of any design provision (e.g. seismic consideration) may lead to design failure thus resulting in system collapse. The impact significance has therefore been categorized as 'High'.

Mitigation Measures

405. The project should be designed as per applicable national / international engineering standards. Moreover, the project should also be reviewed by the design consultant at the detail design stage. By adopting the aforementioned measure, the impact would be of low significance.

❑ Dam Reservoir Sedimentation**Potential Impact**

406. Storage capacity of dam will be reduced due to sedimentation. This impact would be of moderate significance.

Mitigation Measures

407. Watershed management and erosion control measures have been included as an integral component of the project to control the reservoir sedimentation. These interventions include; structural measures like earthen micro-catchments (eyebrow terraces), digging of pit, addition of compost, termite treatment, plantation of trees, seeding of native grasses, small check dams and water storage ponds. By adopting the aforementioned measures, the impact would be of low significance.

❑ Public Disclosure of Final Design**Potential Impact**

408. Many respondents during the public consultation exercise expressed their concerns about the design and construction quality of the proposed interventions. Failure of any intervention due to inappropriate design or sub-quality construction, will lead to malfunctioning of the system, and may cause localized disaster (e.g. breach of dam and canal). Similarly, many people stressed that maximum possible area should be included in the direct command area by taking the main canal to maximum possible elevation. This impact would be of moderate significance.

Mitigation Measures

409. During the next coming stage of project, it is recommended to share the dam type and canals alignment with the identified stakeholders and local public through meetings and detail presentations;

410. Continued stakeholder engagement and timely public disclosure will help to decrease the significance of impact from moderate to low.

❑ Coordination with all Relevant Departments for NOCs

Potential Impact

411. Under the current mandates of various departments, the proposed project will need approvals and NOCs from various government departments e.g. BEPA etc. These approvals take substantial time and cause delays in project implementation and undue cost overruns. This impact would be of moderate significance.

Mitigation Measures

412. The most important mitigation measure, however, remains satisfactory level of inter-departmental coordination. Once the draft feasibility is ready, the proponent i.e. Balochistan Irrigation and Power Department, should call a meeting of all stakeholder departments and present the project.

413. The meeting should discuss and finalize the role and contribution of various departments in the project. This will be in line with the advice given by various stakeholders during consultations. By adopting the above measure, the impact would be of low significance.

❑ Construction of Metaled Road

Potential Impact

414. Construction of metaled road of about 16 km from Killi Hazrat Sahab to Project site for transportation of construction materials and other logistics. If the road will not be paved, it will delay the transportation of construction materials and other logistics thus causing undue cost overruns.

Mitigation Measures

415. Design team should provide the design of metaled road as a part of feasibility report.

❑ Risk due to Natural Hazards i.e. earthquakes etc.

Potential Impact

416. As per para 212 chapter 3 the Sri Toi Dam Project area lies in zone 3 as per seismic map of Pakistan which clearly shows that the area is in moderate to high risk zone. So due to earthquake the breaching of dam, canal and other irrigation structures is possible. This impact

would be of high significance. The other natural hazard which can affect the area is flooding which would be of moderate significance.

Mitigation Measures

417. Design engineer should ensure that seismic design of dam, spillways, reservoir and other allied and irrigation structures should be carried out as per international engineering standards. By adopting the above measure, the impact would be of low significance.

418. Flood protection bunds has been included as an integral component of the project to control the damages occurred by floods. By adopting the above measure, the impact would be of low significance.

7.7.2 Impacts during Implementation and Construction Phase

419. This will mainly entail construction of dam, canal and irrigation structures.

420. The construction phases of the project might result in a number of environmental aspects that are identified in this section. Activities that have been perceived as potential sources of these environmental concerns are also discussed. These environmental aspects may create temporary hazards of moderate significance to the environmental resources of the Project Area during the project construction phase. However, if managed properly these activities will not pose any serious threat to the environment.

421. The main responsibilities for mitigation during the construction phase of the project rest with contractors appointed to construct the various interventions. BIPD Project Director will however, have the responsibility to manage the monitoring of implementation of mitigation measures by the contractors and will need to implement his own system of internal checks.

422. In order to avoid creation of misunderstandings regarding who is responsible for particular activities recommended for the construction phase, the mitigation measures (in the form of a plan) to be taken should be appended to tender documents. This will ensure that contractors include the cost of mitigatory actions into their bids and will provide a reliable mechanism for enforcement. In fact, most of the recommended actions involve no or very little capital investment, but it depends on the contractor's management to adopt a responsible attitude to environmental protection; ensuring construction activity is being properly planned and mitigatory actions are correctly implemented.

423. This EIA document attempts to enlist all major potential impacts of the project, and their likely mitigations. These impacts and mitigations will be presented in the form of an EMP in the next chapter of this document. During the stakeholder consultation meetings, they

strongly mentioned the need to establish a formal mechanism to monitor project progress in terms of environmental compliance.

424. Once the project construction starts, and through its operations phase, the most likely source of environmental or social impact could be non-compliance of EMP by the concerned entities; whether willingly or otherwise.

☐ **Social Disturbance due to Poor Expectation Management**

Potential Impacts

425. More than any major impact on the physical or biotic environment in the real terms, the proposed project may cause social impact due to misperceptions or poor expectation management. During the various surveys, it was encouraging to note that people were very positive about the potential benefits of the proposed project.

426. It should be noted that in the past, unfulfilled expectations from various false starts to the proposed project have contributed greatly to the disillusionment of the local population.

427. If the expectations of area people are not kept at a realistic level; and then those realistic expectations are not met, the project will cause negative social impact.

Mitigation Measures

428. The public consultation carried out for this EIA assignment is good first step in the direction of expectation management. The project proponent should make formal arrangement for continued communication and engagement with local stakeholders, through the BIPD during construction activities. This will also serve as the grievance redressed mechanism for the project. The prime responsibility will be to keep the community informed about project facts in a proactive manner.

429. The BIPD will formally keep in record all the issues and rational expectations desired by the local public in a register, to ensure that they are duly addressed and fulfilled by the end of the Project.

☐ **Public Utilities**

Potential Impacts

430. Due to the proposed project in construction stage, public utilities affected may create disruption of public services and economics. This impact is however temporary and moderate in significance.

Mitigation measures

431. Incorporate technical design features to minimize effects on public utilities and all public utilities likely to be affected by the proposed project need to be relocated well ahead of the commencement of construction work and Contractor to obtain NOCs from concerned Departments.

☐ Communicable Diseases**Potential Impacts**

432. The Laborer's in the Contractor Camp, truck drivers and like personnel who interact with each other have the potential for the spread of HIV/AIDS if the incidence exists. Majority of the people living in the surrounding of the Project, and potential Labor are not aware of the source, mode of communication or consequences of HIV/AIDS. Although their religious and cultural value system, to a large extent excludes the outbreak or rapid communication of HIV/AIDS, yet its occurrence in such a situation cannot be precluded. It is necessary that awareness and preventive campaigns are run from time to time in the Labor camps and the field offices of the Project to prevent the communicable diseases like Cholera, Typhoid and Tuberculosis.

Mitigating Measures:

433. The Contractor shall:

- Arrange to run an active campaign, in the labour camp, to make people aware of the cause, mode of transmission and consequences of HIV/AIDS;
- Strengthen the existing local health & medical services for the benefit of labour as well as the surrounding villages;
- Ensure cleanliness and hygienic conditions at labour camp by ensuring proper drainage and suitable disposal of solid waste. Inoculation against Cholera will be arranged at intervals recommended by Health Department; and
- Keep all the camps, offices, material depots, machinery yards and work sites open for the inspection of health and safety measures and related documents.

☐ Lifestyle and Culture**Potential Impacts**

434. There are chances of arising of issues related to cultural differences/conflict between the Contractor's workforce and the local inhabitants, conflicts arising due to the mix of local and migratory job seekers as the use of local resources and products be increased. In this

situation, local residents may resist Contractor's workforce attitudes, cultural clashes particularly when local/international contractors are engaged, social disturbance and dissatisfaction with employing outsiders, competition for natural resources e.g. with farmers/livestock raisers etc. may arise. This impact is temporary and minor negative in nature.

Mitigating Measures:

435. This impact can be mitigated by adopting the following mitigation measures:

- Timely and full public consultation and announcement of mobilizing equipment;
- Establishment of formal links with affected communities;
- Seek assistance from and cooperation with local NGOs;
- Familiarize outside labourers on local etiquettes;
- Local labour should be employed for construction works. A dedicated quota (50%) of unskilled jobs should be allocated for the nearby villages; and
- Water supply and sanitation facilities, Contractor's workforces should exacerbate the existing shortages and environmental hazards; contractor should primarily seek their own sources of water in due distance (min. 1 km) from local user's wells.

☐ Security and Safety Risks

Potential Impacts

436. It is a prerequisite for the construction of the project that the project area is not safe from a security point of view. All people working on the project and all local people should be allowed to go about their lives without risks to their safety. This impact is however temporary and moderate in significance.

Mitigating Measures:

437. Frequent consultation with local community leaders should be carried out to ensure that any social frictions are identified and resolved before they become inflamed. There are safety requirements for construction projects that include control of public access to the site along with regulations aimed at safeguarding workers. Suitable arrangements that conform to national health and safety requirements and also appropriate international best practice will need to be followed. There are specific procedures that need to be observed for the transport, storage and handling of explosives that will be required for the operation of quarries and also underground excavation. It will be necessary to liaise with local communities and initiate and support a public awareness program, particularly targeted at children, about the risks and dangers of large construction sites.

❑ Continued Stakeholder Engagement

Potential Impacts

438. Social issues arise due to improper dissemination of project progress. This would generate moderate significant impact.

Mitigation Measures

439. Proponents to establish an environmental & social cell responsible for stakeholder engagement and timely information dissemination. After this measure, impact would be of low significance.

❑ Sites of Historical, Cultural, Archaeological or Religious Significance

Potential Impacts

440. Social issues arise if sites of Historical, Cultural, Archaeological or Religious Significance are not properly managed during the construction phase.

Mitigation Measures

441. During the baseline survey for EIA no sites of Historical, Cultural, Archaeological or Religious Significance were found. However, if such sites encountered during construction following measures should be adopted:

- Proponent and the Supervision Consultant to ensure that the construction staff is educated about the location and importance of the cultural sites that exist in the Project Area.
- Contractor to ensure that these sites are not affected by the construction related activities. These aspects will be included in the trainings to be conducted for the contractor's staff.
- Stop the work immediately in case of chance find of any sites or artefacts of historical, cultural, archaeological or religious significance. Chance Find Procedure, attached as **Annexure 21**. and Antiquities Act 1975 should be followed.
- No disturbance to Graveyards during the construction activities.

Deterioration of Air Quality

Potential Impacts

442. During construction period, the impacts on air quality are mainly due to material movement and the actual construction activities. Due to loading/unloading and stocking of

construction material, the air quality over the immediate influence area will be affected and the PM levels in ambient air might increase, though not in significant levels. The emissions from diesel generator sets, construction equipment and vehicles may deteriorate the air quality in the area. Baseline results of ambient air quality clearly shows that ambient air quality of the Project Area is currently clean as all the measured parameters are within the permissible limits of NEQS.

443. Pollution causing activities during the construction phase are as follows:

- Transportation of construction and excavated material to and from the site in diesel fueled trucks would cause the production of combustion gases (CO, CO₂, NO_x, SO_x). Considering the scale of construction, the population size, and relatively clean environment, moderate impact is expected from this activity. However, the emissions would be of temporary nature.
- Considerable amount of dust would be generated from slope cutting activity and also from other activities such as site clearance, excavation and transportation of excavated and construction material and concrete batching, but its effect would be of localized and temporary nature; and
- The concrete mixer used during concreting also causes above mentioned emissions. Based on the scale of construction and frequency of the operation, the impact of emissions is also assessed to be moderate but temporary.

Mitigation Measures

444. In order to reduce the airborne dust emissions in the construction area due to material transport and construction activities, provisions will be made for sprinkling of water in the area where earth filling and excavation is being carried out. It will be ensured that the construction debris is removed daily. By adopting following measures, impact would be finally of low significance:

- During windy conditions stockpiles of fine material will be wetted or covered with plastic;
- PPEs such as dust masks will be made available to the construction workers at the site to avoid potential health hazards;
- Idling of delivery trucks or other equipment will not be permitted during periods of unloading or when they are not in active use;
- In no case, loose earth will be allowed to pile up along the approach roads;
- All vehicles and other equipment's used during construction will be properly and regularly tuned and maintained;
- All permanently deployed vehicles exhausts will be monitored against NEQS; and
- The possibility of excessive dust generation may be reduced by adopting the best construction practices, precautions such as periodic watering, covering of construction material and usage of low emission equipment's during construction.

- Although blasting is planned currently in any project activity, however at any latter stage during construction, blasting may be required for quarrying or any other activity. A blasting management plan has been attached as **Annexure 15**. Which need to be implemented by construction contractor.

❑ **Deterioration Water Quality**

Potential Impacts

445. Surface Water: The construction of the proposed project may have impact on the surface water quality, in the form of increased turbidity of water, and also from potential discharge of anthropogenic or construction wastes. The activity that may cause impact on surface water is mainly washing of construction equipment and machinery.

446. Contamination to receiving water may also result due to spilling of construction materials. There may be increase in the turbidity levels due to the surface runoff from the construction sites. Results of tested water quality that water is good for irrigation purpose, so the significance of impact is assessed as moderate.

447. Ground Water: Earth works like soil excavation is the only construction activity that may affect groundwater resources the depth of ground water in the project area varies from 25 to 30 meters, but as the groundwater quality is not good having high content of suspended solids. Ground water pollution can take place, if chemical substances and oily waste get leached by precipitation of water and percolate to the ground water table. The activities mentioned above will deteriorate the quality of water, hence the significance of impact is assessed as moderate.

Mitigation Measures

448. By adopting following measures, impact would be finally of low significance:

- The construction activities such as excavation and earth filling and construction of embankment will be scheduled during non-monsoon season;
- Surplus earth will be transported from the construction site and no other disposal will be allowed;
- Spillage of fuel/oils and other construction materials shall be contained with best handling/construction practices and strict skilled supervision;
- Appropriate sanitation and water supply facilities will be provided in the labor camps; and
- Proper sewerage disposal arrangements to be provided such as septic tanks and soaking pits at Camp Sites.

❑ **Soil Stability & Erosion**

Potential Impacts

449. Significant excavation and slope cutting is expected for the project to negotiate level differences. The cut and fill volume of the proposed project is 2,662,000 cubic meter.

450. While every effort should be made to minimize the excavation by optimal utilization of the existing contours, the cutting and filling operations may lead to erosion due to loosening of topsoil. Excavation of soil approximately 2,050,000 m³ may alter the topography and may also lead to soil erosion. This impact would be of moderate significance.

Mitigation Measures

451. By adopting following measures, impact would be finally of low significance:

- Erosion control measures such as ramming of topsoil immediately after excavation and silt controls will be provided to minimize erosion;
- Construction work will not be carried out during heavy monsoon rains;
- It will be ensured that no soil is left unconsolidated after completion of work;
- Photographic record will be maintained for pre-project, during-construction and post-construction condition of the sites;
- Monitoring during the project execution will ensure compliance to the above mitigation measures and their adequacy;
- Prepare material borrowing and disposal plan by the contractor;
- Obtain written consent of the land owner for material (soil) borrowing;
- Keep photographic record (before, during, after) for borrow and disposal areas;
- Leveling of borrow sites;
- Possible natural areas with a high elevation will be demarcated for borrowing earth material;
- Strip and stockpile the top 300 mm of the plough layer for redressing the land where the use of agriculture land is unavoidable;
- Where deep ditching is to be carried out, the top 1 m layer of ditching area will be stripped and stockpiled. The ditch will be initially filled with scrap material from construction and then leveled with the stockpiled topsoil;
- Ditches or borrow pits that cannot be fully rehabilitated will be landscaped; and
- Land owners will be compensated according to the terms of lease agreement.

□ Soil Contamination**Potential Impacts**

452. Soil may be contaminated as a result of fuel/oils/chemicals spillage and leakage, and inappropriate disposal. The waste would be generated from site clearance, excavation, concrete batching, concrete conveyance and construction of substructures and superstructures. This impact would be of moderate significance. The generated solid waste would be in the form of:

- Excavated soil;
- Residual from construction material (construction debris etc.);
- Residual from equipment cleaning (oiled rags, used oil, worn out spare parts etc.); and
- Domestic solid waste from labor camps.

Mitigation Measures

453. By adopting following measures, impact would be finally of low significance:

- The surplus soil from the excavation activity may be reused within the site or recycled to other intervention sites;
- Clearance waste and construction debris should be sent to designated disposal site while waste from equipment cleaning and maintenance should be segregated and stored in color coded containers, these can be resold or reprocessed. No accumulation of solid waste at site shall be allowed;
- Avoid Vehicular traffic on unpaved roads as far as possible;
- Vehicles and equipment shall not be repaired in the field;
- If unavoidable, impervious sheathing shall be used to avoid soil and water contamination;
- Solid waste should be disposed of at designated places and contractor to obtain NOC from district governments for disposal of any material in existing disposal points; and
- Contractor to prepare a primary and secondary solid waste collection system within the premises of contractor camps and get approved by BIPD.

□ Increase in Ambient Noise

Potential Impacts

454. During baseline survey, the recorded ambient noise level was found to vary between 25 to 30 dB (A). When the project activities would start, it is very likely that the existing noise level would be amplified.

455. The major sources of noise pollution during construction activities would be during slope cutting, excavation, loading, transportation, loading/unloading of materials and operation of construction equipment etc. The vibrators used for concreting also produce noise. The amplified noise levels will be temporary in nature and easily mitigated. At most of the

construction sites, there are no major sensitive receptors except for some native reptiles that may inhabit the proposed sites will be temporarily affected by noise.

456. **Table 44** provides the detail of noise level during construction phase due to noise emitted by construction equipment.

Table 31: Noise Generated by Construction Equipment

Activity	Source	Typical Peak Sound Level in Work Cycle (Lm)	Typical Minimum Sound Level in Work Cycle (Lb)
Site Clearing earth work, Loading, Unloading, Leveling, Compaction, Finishing etc.	Concrete Batching Plant	83	78
	Concrete Pump Mobile	82	76
	Concrete Static Pump	82	79
	Transit Mixture	85	80
	Loader	85	82
	Grader	85	83
	Excavator (Type)	85	84
	Excavator (Chain)	85	85
	Dumper	80	75
	Mobile Crain	85	83
	Truck Crain	85	83
	Mate Compactor	80	80
	Mini Roller (MRL)	85	78
	Mini Truck	55	54
	Tractor	84	80
	Tractor Trolley	84	79
	Electric Vibrator (Petrol)	85	84
	Steel Cutting Machine	85	85
	Steel Bending Machine	80	79
	Water Bowser	80	75
	Fuel Pump	82	80
	Power Generator	82	80
	Welding Plant (Diesel)	72	70
	Dewatering Pump (Diesel)	77	73
	Dewatering Pump (Petrol)	77	72

Activity	Source	Typical Peak Sound Level in Work Cycle (Lm)	Typical Minimum Sound Level in Work Cycle (Lb)
	Trailer	84	78

457. The above table depict that use of construction equipment will change the noise levels in nearby settlements, which is approximately 16 km from project site. However, in comparison with Residential Area Noise Quality Standards by WHO the values are within the range.

Mitigation Measures

458. Enhanced noise levels could be prevented and mitigated by careful planning of machinery operations, use of low noise equipment and scheduling of operations only during the daytime in order to reduce these levels.

459. Though the impact of noise may be of temporary nature, the following measures shall be considered and implemented:

- Construction contract will clearly specify the use of equipment emitting noise of not greater than 85 dB (A) for the eight-hour operation shift;
- High noise emitting equipment if any will be fitted with noise reduction devices such as mufflers and silencers wherever possible;
- For protection of construction workers, earplugs will be provided to those working very close to the noise generating machinery;
- High noise emitting equipment if any will be used during regular working hours so as to reduce the potential of creating a noise nuisance during the night;
- Slope Cutting activity will be carried out during fixed hours (preferably during mid-day). The timing should be made known to all the people within 500m from the site in all directions;
- Regular inspection and maintenance of the construction vehicles and equipment will be carried out;
- Replacement of worn out and noise producing parts of construction machinery will be timely done; and
- In case of severe noise, sound barriers will be used to avoid dispersion of sound waves into the nearby community.

259. The implementation of the above measures will generate impacts of low significance.

❑ Water Availability

Potential Impacts

460. Water is available through Karaiz at nearby villages. Labor influx will stress water consumption temporarily. However, it should make sure that contractor will not use village Karaiz for construction and drinking purposes as estimated that water for drinking and construction for the 36 months span of construction period is 81,000 cubic meters and 20,000 cubic meters respectively. In case of water usage from domestic sources (Karaiz), may cause impact of moderate significance.

Mitigation Measures

461. Balochistan Power and Irrigation Department should make arrangements to supply water during construction for drinking as well as construction purposes.

462. Alternately the contractor shall procure water bowzers and store water on site for drinking and construction purposes.

463. Implementation of the above measures will generate impacts of low significance.

❑ Blockage of access due to construction works

Potential Impacts

464. Blockage of access road due to construction activity could cause traffic congestion and will interrupt the construction works.

Mitigation Measures

465. A bypass route should be constructed at the project site to divert the through traffic, thus avoiding the public traffic passing through the site.

466. A traffic diversion plan should be formulated by the contractor and shall be approved by the Supervision Consultant.

❑ Deterioration of Flora

Potential Impacts

467. The surrounding area is dry and arid. Flash floods occur in case of intensive rain. It is estimated that the system has the potential of 57 MCM of water covering around 971 km². Livelihood of resident of Sri Toi depends on pastoral activities and rain fed agriculture. The geography of the area is comprised of Hills, Foothills, plains and stream beds. Sri Toi specifically represents dry arid alpine terrain, with marginal vegetation cover-mainly comprising of shrubs. No tree species were recorded during the transact survey. The construction activity will be no negative impact on the flora of the project area.

Mitigation Measures

468. The following mitigation measures will be implemented during the construction phase to ensure the impact significance remains low:

- The construction crew shall use LPG as cooking fuel. Use of fuel wood shall not be allowed;
- Tree cutting to be done only when absolutely necessary, with prior approval as per form given in Annexure 19;
- Compensatory tree plantation in consultation with Forest department. Removal of one (01) tree should be compensated by plantation of ten (10) trees as per Forest (Amendment) Act 2010.

❑ Deterioration of Fauna

469. The impacts on wildlife will be negligible and the construction activity will have no negative impact on the fauna of the project area.

Mitigation Measures

470. The following mitigation measures will be implemented during the construction phase to ensure the impact significance remains low:

- A 'no-hunting, no trapping, no harassment' policy will be strictly enforced;
- Trading of wild animals or birds by project personnel will also be prohibited; and
- Wildlife protection rules will be included in the Camp Rules.

❑ Socio-economic Impacts

Potential Impacts

471. The construction activity would involve people of labor class frequenting the area for the entire length of construction period. The surrounding residential area is inhabited by people who associate very closely with a certain set of cultural values. The area being a part of a rural setup, it is quite uncommon for residents to experience and easily adjust to the presence of

outsiders in their areas for any length of time. The significance of the impact is considered to be moderate.

Mitigation Measures

472. By adopting following measures, impact would be finally of low significance:

- In case, people from outside the area are engaged in the construction or operation of the project activities, this might result in cultural conflict with the local communities. Therefore, it is imperative to engage local work force as much as possible, and also develop and implement a strong community communication and participation plan;
- The contractor will be liable to engage at least 50% of its required (unskilled) labor force from within or around the project area; and
- It is highly recommended that the project proponent includes some CSR measures specifically for the tail-end population.

Health & Safety

Potential Impacts

473. Various activities during the construction phase of the project could have health & safety impacts on workers and the people living in the nearby vicinity.

474. The activities such as loading and unloading of excavated soil and construction material will be expected during the construction phase of the project. Workers safety would be at risk if they are not adequately trained. The impact on worker safety will be direct and of moderate significance.

475. During the construction of structures, activities such as fabrication, installation of formwork, installation of scaffoldings could have serious safety risks to the workers. The use of heavy machinery and vehicle is expected during the excavation and transportation activities. The safety of workers is of prime concern while dealing with such machineries and vehicles. The probability of such accident at project site is low but the significance might be of moderate nature.

Mitigation Measures

476. By adopting the following measures, the impact would be finally of low significance:

- Usage of heavy machinery will be planned carefully and only skilled persons will be allowed to operate the equipment;

- Provisions of proper signboards and informing the local people about the activity will be important. In addition, personal protection equipment such as helmets, gloves, dust masks, boots and earmuffs etc. will be provided for the workers;
- Adequate water supply and sanitation facilities will be provided in the labor camps;
- Caution signboards for the road users and surrounding people will be provided to avoid any accidents at the work site;
- In case of traffic diversions, proper signboards will be provided sufficiently ahead of the work site; and
- First aid facility should be in place and an ambulance should be available at site for 24 hrs.
- Contractor should develop and implement Health and Safety Manual for Construction works.

7.7.3 Impacts during Operation and Maintenance Phase

477. This will be the phase where major impacts, both positive and negative, can surface, and the earlier predictions could be validated. This phase will comprise commissioning the new interventions. While the operations phase entails mostly engineering activities, it has an equally important requirement of inter-departmental coordination, for harvesting the full potential of positive impacts of the project.

☐ Unavailability or Improper Distribution of Irrigation Water in the Area

Potential Impacts

478. As per the feasibility calculations, sufficient water will be available for the project and if not, social issues will arise. This impact would be of moderate significance.

Mitigation Measures

- It is obvious that more consistent and regulated availability of water will be a beneficial outcome. To further improve the situation, BIPD could play a key role to involve the local staff of agriculture department to ensure the best utilization of available water;
- As previously mentioned, many area people mentioned the need for potable water supply arrangements for the area. Once the consistent availability of water is assured, the Local Government could make potable water supply arrangements for the nearby villages;
- Agreements between different communities;
- Water management rules and regulations must incorporate ways to tackle such issues as water scarcity and surplus flows;
- Local water user associations and groups need to be trained and involved to operate the canals, channels, gates, inlets, outlets and other structures;
- Compensate downstream Farmers in case of any water rights losses; and
- Discourage Spate agriculture.

- Desilting of irrigation channel after regular intervals.

479. Above measures will step down the significance of impact from moderate to low.

❑ Breaching of Dam, Canal and Structures

Potential Impacts

480. Breach of dam, canal and irrigation structures is unlikely to occur. However, it will threat system sustainability and fatal accidents and following factors may also contribute to this process:

- Improper operation of water control facilities;
- Reservoir sedimentation
- Deterioration of free board due to cattle trespass and other factors;
- Tampering of outlets;
- Canal siltation;
- Action of borrowing animals such as rats and porcupines;
- Inadequate supervision;
- Lack of timely and adequate repairs;
- Lack of coverage of hydraulic gradient; and
- Fatal accidents like flooding of settlements. Due to seismic conditions of the area as mentioned in chapter 3 of this report, the probability of breaching of dam can occur if seismic considerations are not incorporated into the design. The nearest existing settlement is present at a distance of 16.5 km from the project area. However, this settlement pattern may change due to development of the command area with future settlements coming in much closer to the canal area.

481. The impact significance has therefore been rated as 'High'.

Mitigation Measures

482. To mitigate the above-mentioned impacts following measures shall be adopted:

- BIPD should ensure the design review during operation phase by panel experts;
- BIPD (Irrigation Department) to monitor the system regularly;
- The important facilities that need attention and annual maintenance are canal embankments, falls and control structures and bed levels which are affected by siltation or scour. Canal section has been designed to ensure safety by following the standard design principals to design the banks against piping. In addition, all *nullah* crossings have been provided with Cross-drainage structures of at least 40 years return period flood capacity

with adequate freeboard. For major *nullahs*, canal syphons have been provided so that *nullah* flows unhindered and therefore does not cause damage to the canals;

- Include capacity building of the communities in the O&M activities;
- Liaise with the communities to identify potential weaknesses in the system that could cause breaches;
- Ensure that the canal brick lining is regularly monitored to avoid any cracking impact from weathering;
- The construction and rehabilitation of flood protection bunds as part of the project will be regularly checked to undertake any prone damage;
- Repairs on urgent basis; and
- Emergency response plan for Dam and canal breach shall be followed, which is attached as **Annexure 16** of this report.
- A training program should be executed by BIPD for locals with special emphasis on public evacuation during emergency conditions.

483. Above measures will step down the significance of impact from high to low.

☐ Use of Irrigation Water for Drinking Purposes

Potential Impacts

484. Karaiz is the only existing water source in the project area. With availability of sweet water in the canal, there will be a tendency to use it for potable purposes as well. However, this may lead to health-related issues. This impact would be of moderate significance.

Mitigation Measures

485. To mitigate the above-mentioned impacts following measures shall be adopted:

- Train local community on safe drinking water;
- Coordinate with Local Government to install small filter plants at suitable locations for potable water;
- Place warning and information signs about dangers of using irrigation water for potable purposes;
- Local Government to assure potable water quality as per WHO/ GOP standards;
- Turbidity and free residual chlorine tests shall be regularly performed;
- Arsenic will be tested as per WHO/GOP standards; and
- Keep continuous check on the site by employing security professional to check and shun the water usage (for potable purposes) by local public.

486. Above measures will step down the significance of impact from moderate to low.

☐ Ground Water Contamination in Command Area

Potential Impacts

487. New irrigation infrastructure might hinder and adversely affect the natural drainage pattern. This may result in localized flooding. This may also lead to water use rights issues later on. However, the current natural flow of rain water is such that it generally comes in flash floods from the hill torrents in the Project Area. In case of improper drainage system ground water will contaminate (become brackish). This impact would be of moderate significance.

Mitigation Measures

488. By adopting the following measures, the impact would be finally of low significance:

- Periodic maintenance of drainage structures; and
- Ground water monitoring wells should be established in command area to monitor the salinity of ground water by BIPD.

❑ Disposal of Waste (Connection of Waste Streams) in the Canals**Potential Impacts**

489. This impact will lead to serious health issues and will be of moderate significance.

Mitigation Measures

490. Proper monitoring of canals alignment and disconnect all identified waste streams would step down the significance of impact to low.

- Keep regular monitoring through that no waste is dumped within the canals; if it is dumped, fine should be imposed;
- Arrange awareness programs for the local public to educate them about the harms caused by disposal of waste into canals;
- Labelled sign boards to avoid entry of waste disposal;

❑ Enhanced / Induced Use of Fertilizers and Pesticides**Potential Impacts**

491. With additional area under cultivation, and with better water availability for existing area, cropping intensity will increase, resulting in an automatic increase of fertilizers and pesticides use. Use of any banned fertilizer and pesticide will cause health issues. It may also cause contamination of fresh water through surface runoff. This would be an impact of moderate significance.

Mitigation Measures

492. By adopting the following measures, the impact would be finally of low significance:

- Concerted efforts by the department of agriculture to disseminate information regarding sustainable use of fertilizers will help in keeping the use at an optimal level;
- Ammonium Nitrate (AN) and Calcium Ammonium Nitrate (CAN) fertilizers will not be allowed; and
- Use of restricted pesticides identified by WHO shall not be allowed. The list of restricted pesticides is attached as **Annexure 17** of this report.

▣ Increase of Agricultural Lands**Potential Impacts**

493. The cultivated area currently is very low. The reason for this low level of cultivation is poorly distributed rainfall, and poor position of perennial water streams (either natural or man-made). In the Project Area, the cropping intensity is almost negligible. One of the key factors is that the area lacks a dependable irrigation system despite having the potential for one.

494. Hence it is safe to assume that the proposed project will increase the area under cultivation with a cropping intensity of around 120%. There may be tendency that farmers may cultivate crops at their own decisions that may also affect efficient use of water. The impact should be of moderate nature.

Mitigation Measures

495. By adopting the following measures, the impact would be finally of low significance:

- One aspect that will need to be monitored is that additional area under cultivation should be used for crops suitable to the overall climatic conditions of the area and farmers should follow the pattern as given in Agriculture Report of this Project; and.
- Increase in the cultivated area will also mean reduction in pastoral lands. However, the livestock would still benefit by using farm residue and mostly by availability of fodder crops. The Irrigation department (Project proponent) will work with the Agriculture department to ensure that stall feeding practices take root for livestock, so that the remaining pastoral lands are available for the wild animals.

▣ Periodic Cleaning and Maintenance of the System**Potential Impacts**

496. The blessing of any available resource might be wiped out by poor governance. Non-functional water use associations, leakage, improper maintenance of structure, broken outlets, and poorly maintained field channels may result in unequal utilization of water. This impact would have a moderate significance.

Mitigation Measures

497. By adopting the following measures, the impact would be finally of low significance:

- The proposed project is an integrated irrigation program. The proponent will also facilitate it to become an integrated community development program through formal structure made by BIPD and through the community engagement. Timely and correct sharing of information will enable other line departments to implement their own development schemes in the area;
- The BIPD will develop and implement a proactive maintenance plan for the proposed project, with predefined periodicity;
- Monitoring results;
- Ensure proper disposal of waste at designated landfill/disposal sites; and
- Efficiency of the system will be at its best by adopting proper maintenance activities such as silt removal and bed scratching at periodic intervals.

❑ Community Participation for Management and Operation of the Irrigation System

Potential Impacts

498. The impact may lead to social and system sustainability issues and would be of moderate significance.

Mitigation Measures

499. By adopting the following measures, the impact would be finally of low significance:

- Ensure community participation in management and operation of the irrigation system; by implanting O & M manual for Farmers' management of Irrigation System prepared as a separate document for Sri Toi Irrigation Project;
- Training of related communities; and
- Interaction of FAO with the rest of community is recommended throughout the Project implementation. Moreover, any change in the design or structure or operation if incurred, it must be done in consultation with the local public.

❑ Disruption to Public and Wildlife

Potential Impacts

500. Expected changing behavior of the wildlife for movement and drinking water due to canal is envisaged. The other impacts which likely to be occur is as follows:

- The dam traps sediments, which are critical for maintaining physical processes and habitats downstream of the dam (include the maintenance of productive deltas, barrier islands, fertile floodplains and coastal wetlands);
- Agriculture expansion will disturb habitat and use of potential pesticides will affect biodiversity;
- Discharge of toxic matters (pesticides, toxic metals etc.) and their condensation in food chain may affect sensitive animals immediately; all living organisms may expire when the stream becomes unable to recover itself; and
- Hunting of migratory birds because of wetland may affect their population.

501. It is also envisaged that during the operational phase the construction of canals would give problems to local community especially in terms of crossing the canals to reach the other side.

502. The impact may lead to disruption of public movement as well as wildlife conservation issues and would be of moderate significance.

Mitigation Measures

503. Design has already provided cattle drinking troughs at different intervals and pedestrian bridge for canal crossing approximately at 500 m interval. Watershed management activities on the catchment and stream bank will be afforested. Agricultural advisory services will be started to grow organic vegetables and crops. Biological control of pests will be adopted through agriculture department support. As dam will be constructed, with the coordination of Forest and wild life and conservation organization, environmental awareness regarding hunting control will be raised. It will be the responsibility of BIPD to ensure the proper maintenance of aforementioned structures. By adopting the aforementioned measures, the impact would be finally of low significance.

□ Health and Safety**Potential Impacts**

504. During the operational stage of project significant human safety issues will arise due to the impounding of the reservoir. These include the need to raise awareness of the dangers of drowning in the reservoir, especially due to the rapid changes in water level that will be experienced.

505. The proposed project can also result in an increase in the vector borne diseases (e.g. malaria) due to presence of a large water body.

506. The impact may lead to health and safety issues and would be of moderate significance.

Mitigation Measures

507. A training program will be organized by BIPD at community level for health and safety practices adoption and ensure the community participation. This program should be instigated through the local schools to warn about the dangers of water borne diseases to children. Proper medication to treat the water borne diseases should also be available in nearby BHUs. By adopting the aforementioned training on health and safety, the impact would be finally of low significance.

508. Team members of HSE Department shall be deputed to prohibit swimming in dam, spillway or dykes. Warning signs shall also be posted for public awareness.

❑ Risk due to Natural Hazard i.e. Flooding and Earthquakes

Potential Impacts

509. Occurrence of natural hazard i.e. flooding and earthquakes can damage even destroy the dam, canals and irrigation structures and will be a threat of system sustainability and impact would be of moderate significance¹⁰.

Mitigation Measures

510. Emergency Response Plan for Flood Protection Bund will be followed which is attached as **Annexure 18** of this report. By adopting this measure, the impact would be finally of low significance.

7.8 Cumulative Impacts

511. The best definition of Cumulative Impact Assessment (CIA) is defined by The US Council on Environmental Quality as “the impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions”

512. The purpose is to assess the impacts of Sri Toi Dam Project cumulatively with those of other proposed projects within AOI limits and this chapter has been prepared in accordance with TOR.

❑ Methodology

513. AOI or Study Area of project is defined in Chapter 5 of this report that includes the area to be considered for cumulative assessment, Map showing the boundaries of AOI. This CIA draws on the findings from other assessments conducted as part of this EIA including:

- Chapter 5.0 Baseline
- Chapter 7.0 Impact Assessment

¹⁰ This is due to the fact that the seismic considerations have already been incorporated during the design stage thus resulting in moderate impact significance.

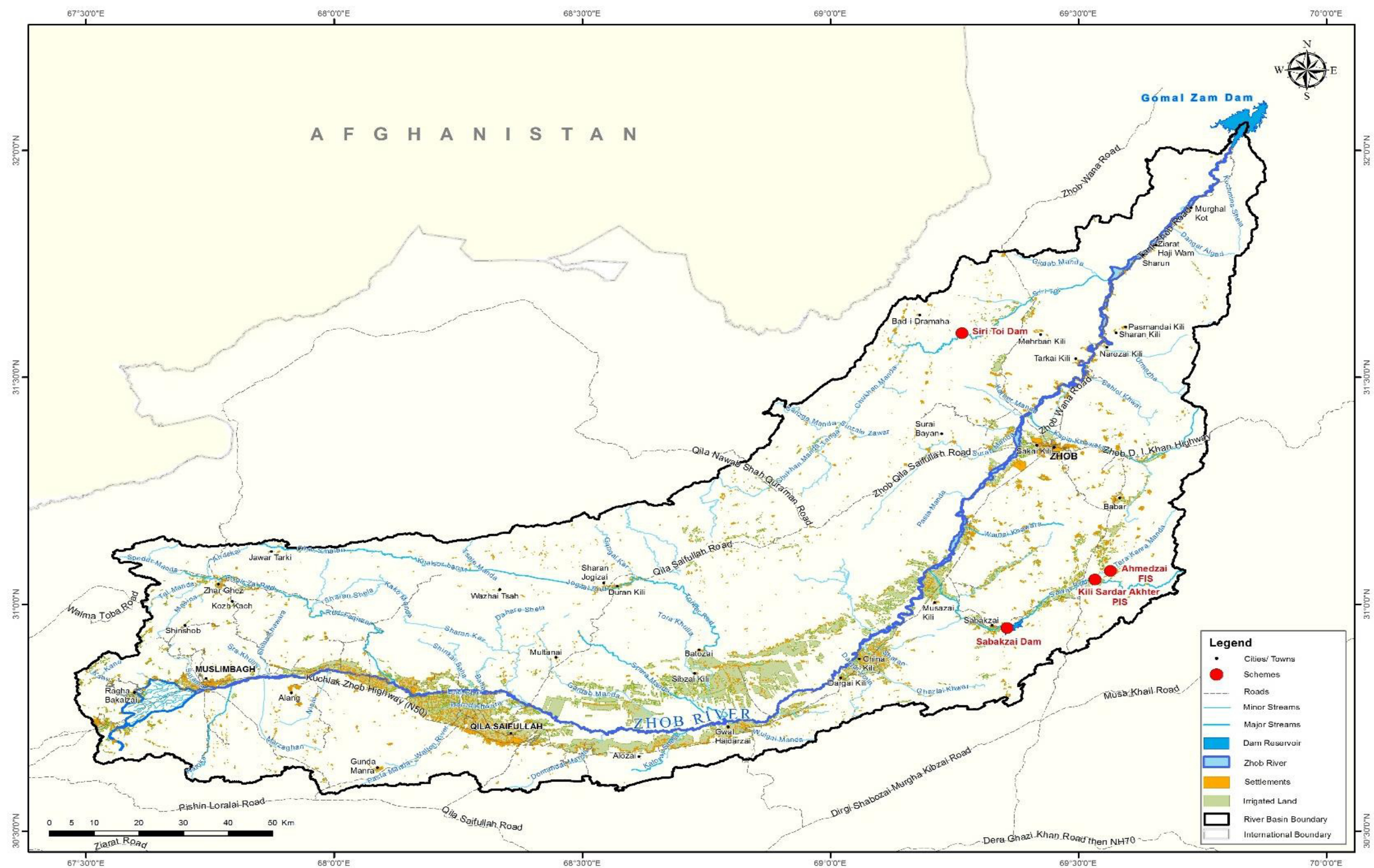
□ Identification of Current and Proposed Projects

514. CIA is a challenging task as its analysis builds upon information derived from direct and indirect impacts due to present and future interventions in a defined geographical area including the current and proposed project. Therefore, cumulative impacts on the projects are, in concept, related to (i) existing projects located within AOI of Sri Toi; and (ii) proposed developments planned within and nearby to AOI of Sri Toi. As a first step, an effort was made to identify the projects within the AOI through various sources such as district level departments, Government of Balochistan planned programs and information through locals. These projects will be considered along with Sri Toi Irrigation Project for direct and indirect effects as part of CIA. However, no planned projects were found within the AOI of Sri Toi Dam. Moreover, the following projects are planned under Balochistan Water Resources Development Project (BWRDP) Preparatory Technical Assistance by ADB:

- Ahmedzai Perennial and Floodwater Irrigation – Sub Project
- Sabakzai Dam Irrigation Project – Sub Project
- Killi Sardar Akhter Perennial Irrigation – Sub Project

515. Again, there will be no cumulative impact due to Sri Toi Irrigation Project and the above-mentioned projects as these are planned on different tributaries of Zhob River and are far away (70 – 100 kms) from the Sri Toi Project site. **Figure 19** presented below provides clarity regarding the distance of above-mentioned projects with Sri Toi Irrigation Project:

Figure 11: Location Map of Sri Toi Irrigation Project and Other Sub-Projects



7.9 Residual Impacts

516. Residual impacts after implementation of mitigation measures have also been evaluated and presented below in **Table 45**.

Table 32: Residual Impacts

Activity / Issue	Site Specific Impacts	Assessment of Risk	After Implementation of Mitigation Measures Residual Impacts
Construction of Dam, Main Canal, Left Canal & Right Canal and Irrigation Structures			
A. Design & Planning Phase			
Assessment of water availability	<ul style="list-style-type: none"> Failure of design 	C-3	C-1
Proper Dam site selection and its land acquisition	<ul style="list-style-type: none"> Design failure Social issues Relocation of assets 	C-3	C-1
Route selection (Alignment) of proposed new canal and its land acquisition	<ul style="list-style-type: none"> Social issues Relocation of assets 	C-3	C-1
Water rights issues in the area	<ul style="list-style-type: none"> Social issues 	D-4	D-1
Design works construction of Dam, new canal and other irrigation structures as per proper engineering standards	<ul style="list-style-type: none"> In case of design failure system will be collapsed 	D-5	D-1
Dam reservoir sedimentation	<ul style="list-style-type: none"> System sustainability 	D-4	D-1
Public disclosure of final design	<ul style="list-style-type: none"> Social issues 	D-4	D-1
Coordination with all relevant departments for	<ul style="list-style-type: none"> Delay in project implementation & cost overruns 	D-4	D-1

Activity / Issue	Site Specific Impacts	Assessment of Risk	After Implementation of Mitigation Measures Residual Impacts
NOCs			
Construction of metaled road of about 16 km from Killi Hazrat Sahab to Project site for transportation of construction material and other logistics.	<ul style="list-style-type: none"> Delay in project implementation & cost overruns 	B-2	B-1
Risk due to Natural Hazard i.e. earthquakes / flooding	<ul style="list-style-type: none"> System sustainability 	D-5 / D-4	D-1 / D-1
B. Implementation & Construction Phase			
Security and Safety Risks	<ul style="list-style-type: none"> Delay in project execution 	C-3	C-1
Continued stakeholder engagement	<ul style="list-style-type: none"> Social issues 	C-3	C-1
Construction contractor mobilization and establishment of campsite and machinery/ equipment Yard	<ul style="list-style-type: none"> Changes in land use pattern Influx of external work force Social conflicts Workshop facilities may spread oils & chemicals Deterioration of air quality due to machinery & equipment Noise Land degradation due to solid waste disposal of camp site Water contamination 	B-2	B-1

Activity / Issue	Site Specific Impacts	Assessment of Risk	After Implementation of Mitigation Measures Residual Impacts
	<ul style="list-style-type: none"> Loss of vegetation Health and Safety issues 		
Transportation of construction material	<ul style="list-style-type: none"> Soil erosion and contamination Air pollution Noise pollution Health and Safety issues Damage to infrastructure 	B-2	B-1
Excavation, backfilling and compaction works	<ul style="list-style-type: none"> Soil erosion Site overburden Borrow pit Loss of natural vegetation Damage to infrastructure Sites of Historical, Cultural, Archaeological or Religious Significance Noise pollution Air pollution Health and safety issues Blocked of access due to earth works and stockpiling of excavated material 	B-2	B-1
Construction of Dam and new canal	<ul style="list-style-type: none"> Noise pollution Air pollution Health and safety issues Blocked of access due to construction works 	B-2	B-1
Construction of structures	<ul style="list-style-type: none"> Noise pollution Air pollution 	B-2	B-1

Activity / Issue	Site Specific Impacts	Assessment of Risk	After Implementation of Mitigation Measures Residual Impacts
	<ul style="list-style-type: none"> Water contamination Health and safety issues Blocked of access due to construction works 		
C. Operation & Maintenance Phase			
Unavailability or improper distribution of irrigation water in the area	<ul style="list-style-type: none"> Social issues 	C-3	C-1
Breaching of Dam, canal, and structures	<ul style="list-style-type: none"> Fatal accidents System sustainability 	D-5	D-2
Use of irrigation water for drinking purposes	<ul style="list-style-type: none"> Health issues 	C-3	C-1
Ground water contamination in command area	<ul style="list-style-type: none"> In case of improper drainage ground water will be contaminated 	C-3	C-1
Disposal of waste (connection of waste streams) in the canal	<ul style="list-style-type: none"> Health issues Social issues 	C-3	C-1
Use of fertilizers & pesticides	<ul style="list-style-type: none"> Banned fertilizer & pesticides will cause health issues Contamination of fresh water through surface runoff 	C-3	C-1
Increase of agricultural lands	<ul style="list-style-type: none"> Loss of pastoral lands 	C-3	C-1
Periodic cleaning and maintenance of the system	<ul style="list-style-type: none"> Solid waste generation 	C-3	C-1
Community Participation for management and	<ul style="list-style-type: none"> Social issues System sustainability 	C-3	C-1

Activity / Issue	Site Specific Impacts	Assessment of Risk	After Implementation of Mitigation Measures Residual Impacts
operation of the irrigation system			
Disruption to public and wildlife	<ul style="list-style-type: none"> Social issues Conservation issues 	C-3	C-1
Health and Safety	<ul style="list-style-type: none"> Vector borne diseases (e.g. malaria) Drowning issues 	C-3	C-1
Risk due to natural hazard i.e. flooding and earthquakes	<ul style="list-style-type: none"> System sustainability 	C-3	C-1

7.10 Positive Impacts due to Sri Toi Dam and Irrigation Project

260. Positive impacts due to proposed interventions are presented in **Table 46** with their enhancement measures:

Table 33: Positive Impacts of proposed interventions

Positive Impacts	Likelihood/Significance
Employment opportunities to some locals for design phase surveys.	Possible/Low
An anticipated positive impact on socio-economic conditions during construction phase is the creation of limited-time employment opportunity for the local population. Since the project interventions will require substantial input from manual labor, even people with relatively lower levels of education or skills could get short term employment.	Possible/Moderate
A substantial land will be irrigated under the proposed scheme.	Almost Certain/High
Household income will increase substantially with irrigation improvement measures owing to availability of water for irrigation, crop yields, increase in the number of animals, and availability of other occupational opportunities.	Almost Certain/High

Positive Impacts	Likelihood/Significance
The Project will positively contribute in improving the carrying capacity of biological environment and overall improvement of the ecosystem.	Almost Certain/High
Availability of irrigation and agriculture would support livestock growth and in due course of time would enable farmers to diversify in areas of dairy production	Likely/Moderate
Water storage in the dam body will attract water birds especially those migrating from Siberia to warm area during winter. Depending upon the size of the water body, it serves the purpose of a wetland.	Almost Certain/High
Availability of water for cultivation of crops will support cropping during Rabi as well as Kharif season over the entire command area. During due course of time, availability of water will support agriculture and other production system and will help in converging into an integrated system wherein all the components of the ecosystem will be producing at their optimal level including the human element.	Likely/High
Due to sufficient amount of water available during the operation phase of the project, the soil conditions in the area will be improved and increase the cropping intensity to 120%.	Likely/High

8 ENVIRONMENTAL MANAGEMENT PLAN

8.1 General

517. The EMP is a strategic approach towards the effective implementation of the mitigation measures and environmental protection of the Project Area and its surroundings. This EMP ensures that the undue or reasonably adverse impacts of a project are prevented and the positive benefits of the project are enhanced. According to this plan, all the activities related to various phases of the project are controlled and monitored.

518. This EMP encompasses all the phases of the project and may be used as a quick reference by the personnel(s) of client and contractors for effective implementation of the proposed mitigation measures and tracking the overall environmental performance of the project.

519. This EMP addresses all the significant impacts that are identified during the impacts identification process of the EIA. It should be amended in consultation with the concerned regulatory authority, in this case BEPA, if any issue has been overlooked or if any need would arise as the project continues.

8.2 Structure Of EMP

520. The contents of this chapter are given below:

- Regulatory Requirements
- Purpose & Need of the EMP
- Objectives of the EMP
- Scope of the EMP
- Institutional Arrangement for Implementation of EMP
 - Institutional Arrangements for Implementation of EMP during Construction Phase
 - a. Role and Responsibilities of the Functionaries involved in EMP Implementation
 - b. Reporting Mechanism
 - c. Non-Compliance of the EMP
 - Institutional Arrangements for Implementation of EMP during Operation Phase
 - a. Role and Responsibilities of the Functionaries involved in EMP Implementation
 - b. Reporting Mechanism
- Environmental Mitigation Plan
- Environmental Monitoring Plan
- Implementation of EMP
 - NOC and other Approvals
 - Stakeholder Coordination
 - Trainings

- Communication & Documentation
- Grievance Redressal Mechanism (GRM)
- Environmental Management Cost
- Change Management

8.3 Regulatory Requirements

521. This EMP refers to the applicable legal framework given earlier as **Chapter 2** for the proposed project for the protection of the environment.

8.4 Purpose & Need of the EMP

522. Primarily, the purpose of this EMP is to serve as a quick reference for the consultants, contractor as well as the proponents to implement the proposed mitigation measures effectively and to monitor the overall environmental performance of the project. Furthermore, to house the procedure, which the proponent follows to implement and maintain this EMP. The need of the EMP is mentioned as follows:

- Ensure that attention is paid to the actual environmental effects arising from construction, and operation of the proposed project;
- Ensure that anticipated impacts are maintained within the levels predicted;
- Ensure that unanticipated impacts are managed or mitigated before they become a problem; and
- Ensure that environmental management brings about real environmental benefits and achieves environmental sustainability, rather than the Environmental Approval Process being a mere paper chase to secure a development approval¹¹.

8.5 Objectives of the EMP

523. The main objectives of the EMP during different phases of the project is to implement mitigation measures and to evaluate the effectiveness of mitigation measures as proposed in the EIA and recommend improvement if any need would arise.

8.6 Scope of the EMP

524. The scope of the EMP includes the following phases of the project:

- Planning and Design Phase;
- Implementation and Construction Phase; and
- Operation Phase.

¹¹ Guidelines for Preparation and Review of Environmental Reports, 1997

525. All the activities performed during these phases will be controlled and monitored according to this EMP.

8.7 Institutional Arrangement for Implementation of EMP

526. The following is a broad guideline has been proposed for institutional setup under this project as a reference for BIPD. It is based on the recommendations for PIU of ADB's Sri Toi Irrigation Project. The final organizational structure, working and monitoring of Institutional setup would be proposed by the BIPD and would be finalized in consultation with ADB's Resident Mission in Pakistan.

8.7.1 Institutional Arrangements for Implementation of EMP during Construction Phase

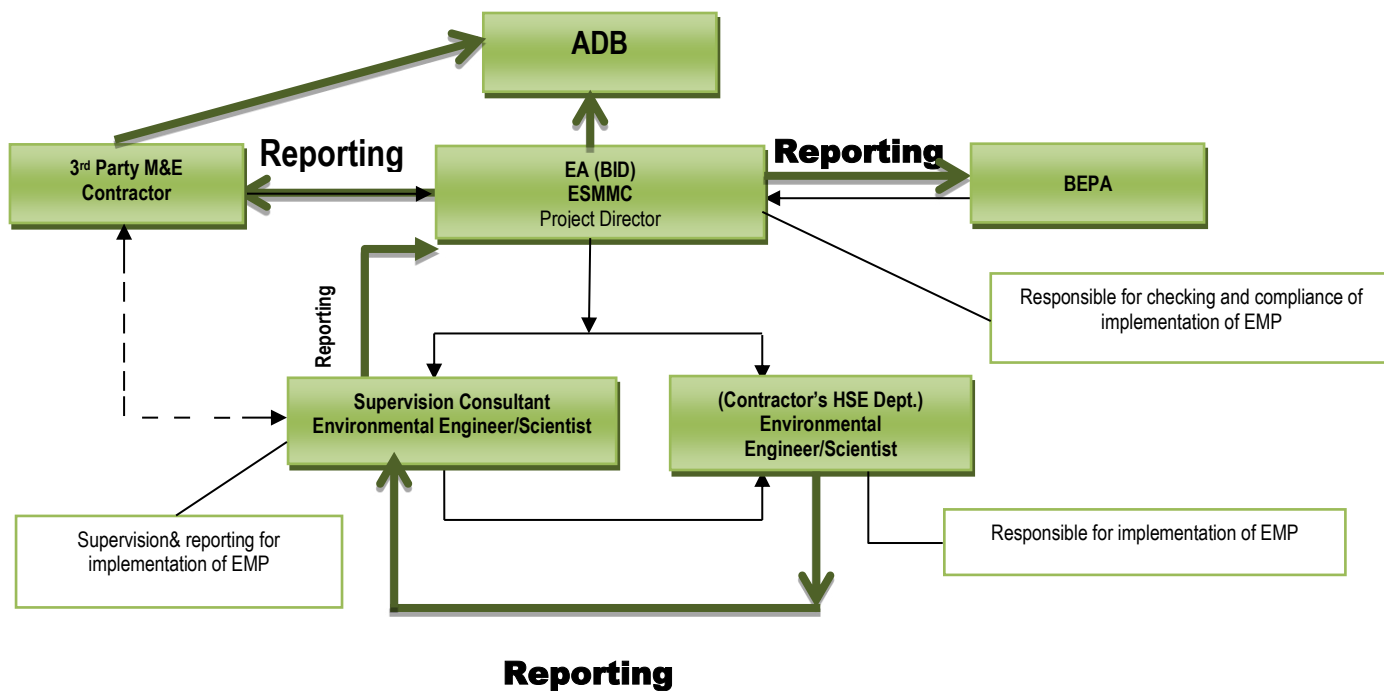
527. The Chief Engineer (BIPD) will formulate an Environmental & Social Management and Monitoring Cell (ESMMC) which will comprise senior professionals, and should preferably have representative of various stakeholders including local administration. The Cell should also include at least one technical expert from R&D institutions (either from academia or international NGOs e.g. IUCN / WWF), and a representative from BRSP.

528. The key players involved during construction stage of the proposed project are the ESMMC, 3rd Party M&E Contractor, Balochistan Environmental Protection Agency, the Contractor and the Supervisory Consultants (SCs). The roles, remits and responsibilities of these organizations are outlined below.

529. The following staff will be involved in the implementation of EMP:

- ESMMC Representative;
- 3rd Party M&E Contractor;
- SC's Environmental Engineer/Scientist; and
- Contractor's Environmental Engineer/Scientist.

530. The Construction Contractor will make a bond through contract documents to implement the EMP. The whole EMP will be included as a clause of the contract documents. The organizational setup for implementation of EMP is given below:



□ Roles and Responsibilities

a) BEPA

531. BEPA is the regulatory authority for issuance of NOC for this proposed project. As part of its mandate, protection of environment is its responsibility. Therefore, this agency will undertake an audit (as and when required) of project activities with respect to the protocols as defined in EMP.

b) 3rd Party M&E Contractor (if required)¹²

532. 3rd Party M&E shall be responsible for:

- To make sure that all the contractual obligations related to the environmental and social compliance are met;
- To monitor the progress regarding implementation of environmental safeguard as provided in EMP;
- Oversee the Compliance of all the monitoring programs as given in EMP;
- Check randomly whether monitoring of the environmental aspects of the project during construction phase is being properly carried out;

¹² Normally in other ADB's Projects 3rd Party M&E contractor performed the monitoring of EMP as well.

- Document and disclose monitoring results and identify necessary corrective and preventive actions in the periodic monitoring reports, and make follow-up on these actions to ensure progress toward the desired outcomes;
- Make sure that the Contractor is implementing the additional measures suggested by the M&E Contractor; and
- Reporting the status of EMP compliance to BIPD and ADB

c) Chief Engineer/ Project Director, BIPD / ESMMC:

533. Project Director will have responsibility for assuring implementation of EMP. This includes the following:

- Ensuring that the required environmental training is provided to the concerned staff;
- The Project Director will be responsible for carrying out random site visits to the construction sites to review the environmental performance of the Construction Contractors;
- Review monitoring reports for the progress of environment related activities;
- Make sure that the Construction Contractor is implementing the additional measures suggested by the Supervision Consultant in environmental monitoring reports;
- To assist Contractor for obtaining necessary approvals from the concerned departments.
- Maintaining interface with the other lined departments / stakeholders; and
- Reporting to the BEPA on status of EMP implementation.
- Reporting to ADB on status of EMP implementation.

d) Supervision Consultant: Resident Engineer

534. Resident Engineer's (RE) roles and responsibilities will be:

- To oversee the performance of Construction Contractor to make sure that the Construction Contractor is carrying out the work in accordance with the tender design and follow the specifications;
- Ensuring that the day-to-day construction activities are carried out in an environmentally and socially sound and sustainable manner;
- Strong coordination with the Construction Contractor and ESMMC.

e) Supervision Consultant: Environmental Engineer/Scientist

535. SC's Environmental Engineer/Scientist will perform following roles and responsibilities:

- Directly reporting to the RE;
- Preparing Environmental training materials and implementing programs;

- Ensure the implementation of the mitigation measures suggested in EMP;
- To supervise and monitor environmental activities being performed at site;
- To organize periodic environmental training programs and workshops for the consultant's and contractor's staff;
- Periodic reporting as mentioned in EMP; and
- Suggest any additional mitigation measures if required.

f) Construction Contractor: Environmental Engineer/Scientist

536. Contractor will be bond to appoint a Site Environmental Engineer/Scientist with relevant educational experience and background. Contractor's Environmental Engineer/Scientist will carry out following activities:

- Implementation of the mitigation measures at construction site;
- Contractor will be bond through contract to take actions against all the special and general provisions of the contract document;
- Contractor will make sure the compliance of EMP recommendations and will also be responsible for effective liaison with local heads of villages;
- Provision of proper Personal Protective Equipment (PPEs) to the workers and train them for their proper use;
- To conduct the environmental and health & safety trainings to the workers/labor; and
- Coordinate with Environmental Engineer of SC.

□ Reporting Mechanism

537. Progress reporting related to environmental activities will be responsibility of Supervision Consultant, Environmental Engineer/Scientist. He will also be responsible for submitting monthly EMP compliance report for the project to the PD. A bi-annual report of environmental activities shall be submitted to ADB by BIPD / Supervision Consultant.

538. PD will in turn add his remarks / comments / feedback and submit the Report to ADB and BEPA in accordance with the frequency defined by them. In case the frequency is not defined and/or communicated, bi-annual monitoring reports based on the monthly monitoring report will be submitted to ADB for disclosure on ADB website.

□ Non-Compliance of the EMP

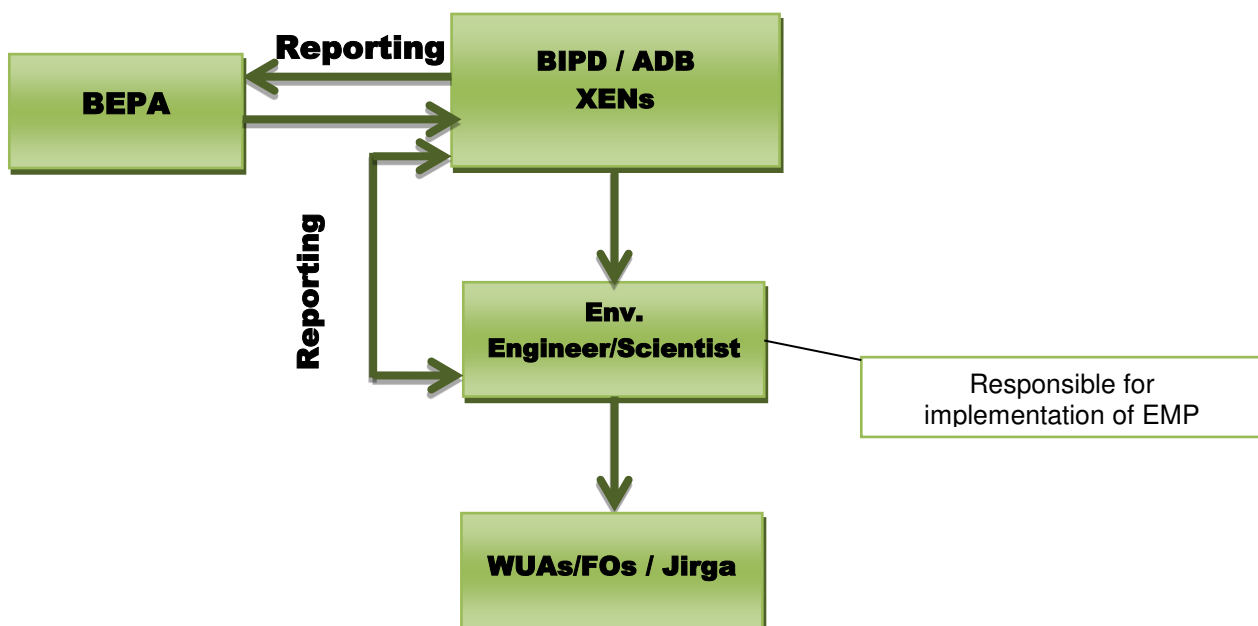
539. The implementation of the proposed EMP involves inputs from various functionaries. Construction Contractor will be primarily responsible for ensuring implementation and reporting of the mitigation measures proposed in the EMP, which will be part of the contract documents. In addition, the Contractor will also need to prepare Site Specific Environmental Management Plan (SSEMP) and get it approved from Consultant / BIPD before start of any

construction phase. The SSEMP will provide the risk rating for each construction activity and will provide mitigation measures to reduce activities with higher degree of risk. Various plans, and layout maps (construction camp layout plan) will also form part of SSEMP. The provision of the environmental mitigation cost will be made in the total cost of project, for which Construction Contractor will be paid on the basis of monthly compliance reports. However, if the Construction Contractor fails to comply with the implementation of EMP and submission of the monthly compliance reports, deductions will be made from the payments to the Construction Contractor claimed under the heads of environmental components.

□ Institutional Arrangement for Implementation of EMP during Operation Phase

540. The key players involved during operation phase of the proposed project are BIPD, BEPA, Water User Associations (WUA) and Farmer Organizations (FOs) or Jirga. The roles, remits and responsibilities of these organizations are outlined below. The following staff will be involved in the implementation of EMP. Organizational setup for implementation of EMP is also given below.

- WUA and FOs, or Jirga; and
- BIPD, Environmental Engineer/Scientist.



□ Roles and Responsibilities

a) Environmental Engineer/Scientist

541. Environmental Engineer/Scientist will have responsibility for assuring implementation of EMP. This includes the following:

- Coordinating and planning the overall activities, as per EMP;

- Environmental Engineer/Scientist will randomly check the operation of project and make sure system is in compliance with EMP;
- Make sure that the WUA & FOs are implementing the measures suggested in the EMP and to report in environmental monitoring reports; and
- Bi-annual reporting to BEPA on environmental compliance of the project during operation stage.

b) Water User Association (WUA) and Farmer Organizations (FOs), Chairman & Vice Chairman / Jirga

542. WUA and FOs will ensure the implementation of the mitigation measures at operation site and will report to BIPD.

8.8 Environmental Management Plan

543. Potential impacts and their mitigation measures are devised against the project activities to minimize their significance. Responsibilities for the collection and analysis of data as well as the reporting requirements have been outlined in **Table 47**. Implementation of environmental impact mitigation measures during construction is to avoid and reduce short- and long-term potential environmental impacts. Incorporation of environmental impact mitigation considerations into the tender and contract documents is a fundamental pre-requisite for effective implementation of the EMP.

Table 34: Environmental Mitigation Plan

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
Construction of Dam, Main Canal, Left Canal & Right Canal and Irrigation Structures				
A. Design & Planning Phase				
Assessment of water availability	Failure of design	Design works will ensure the proper assessment of water availability. BIPD will ensure the annual average available water of 57 MCM for irrigation water from tributary of Zhob River.	Availability of the Permit from Irrigation Department before project operation	Irrigation Department Design Consultant
Proper Dam site selection and its land acquisition	Design failure Social issues Relocation of assets	The site selection of dam should be with to the area geology and topography as these plays important role for the sustainability of project. The Design Engineers must also add all features for safety of the workers during operation and maintenance. Special considerations will be made for the selection of dam site to ensure proper land acquisition justified to all stakeholders.	Feasibility report (Specifically alternative analysis section) Establishment of Grievance Redressal Mechanism Availability of complete records with Revenue Department	Land Revenue Department Irrigation Department
Route Selection (Alignment) of Proposed New Canal and its Land Acquisition	Social issues Relocation of assets	Irrigation Department and Land Revenue Department to ensure that the Land Acquisition Act 1894 procedures are being followed. Address communities' grievances on priority basis.	Establishment of Grievance Redressal Mechanism Availability of complete records with Revenue Department	Land Revenue Department Irrigation Department

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		Special considerations will be made for the selection of routes for both main canal and right & left canals which ensure proper distribution of water for all, alignment must be avoided from any controversial land, and alignment selection must be justified to all stakeholders		
Water rights issues in the area	Social issues	<p>Proper water distribution through warabandi system, engaging water user associations and Irrigation department. Warabandi system is a rotational method for distribution of irrigation water, with fixed time allocations based on the size of landholdings of individual water users within a watercourse command area. It presupposes an overall shortage of the water supply. The primary objective of the method is to distribute this restricted supply in an equitable manner over a large command area.</p> <p>The traditional water rights should be considered and will need to be minutely considered while carrying out the detail designs.</p>	<p>Design report will clearly indicate water rights areas and water allocation. Subsequent development of Chakbandi (command area mapping for each tertiary watercourse) by Irrigation Department clearly identifies water rights holders and size of their lands</p> <p>Open access to Warabandi list and its implementation schedule to ensure fairness in water distribution, i.e. each farmer gets entitled share in hours per week</p>	Land Revenue Department Water User Associations Irrigation Department
Design Works Construction of Dam, New Canal and Other Irrigation Structures as per Proper Engineering Standards	In case of design failure system will be collapsed	The project should be designed as per applicable national / international engineering standards. Moreover, the project should also be reviewed by the design consultant at the detail design	Design review report	Detailed Design Consultant

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		stage.		
Dam Reservoir Sedimentation	System sustainability	Watershed management and erosion control measures have been included as an integral component of the project to control the reservoir sedimentation.	Design report	Feasibility Design Consultant
Public disclosure of final design	Social issues	Continued stakeholder engagement and timely public disclosure.	Minutes of meetings of stakeholders consultation	Feasibility Design Consultants Irrigation Department
Coordination with all relevant departments for NOCs	Delay in project implementation & cost overruns	Continued stakeholder engagement and proper coordination with relevant departments for timely approvals.	NOCs from relevant departments	Feasibility Design consultants Irrigation Department
Construction of Metaled Road	Delay in project implementation & cost overruns	Design team should make this activity as a part of feasibility report and a proper design of the track will be executed	Design report	Feasibility Design Consultant
Risk due to Natural Hazards i.e. earthquakes and flooding etc.	System sustainability	Design engineer should ensure that seismic design of dam, spillways, reservoir and other allied and irrigation structures to be carried out as per international engineering standards Flood protection bunds has been included as an integral component of the project to control the damages occurred by floods	Design report	Feasibility Design Consultant
B. Implementation & Construction Phase				
B1. Implementation and Contractor Mobilization Phase				
Social Disturbance due to Poor Expectation	Social issues	The project proponent should make formal arrangement for continued	Record register of all the issues and rational	Irrigation Department

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
Management		<p>communication and engagement with local stakeholders, through the BIPD during construction activities.</p> <p>BIPD will formally keep in record all the issues and rational expectations desired by the local public in a register, to ensure that they are duly addressed and fulfilled by the end of the Project.</p>	expectations desired by the local public.	
Public Utilities	Social issues	Incorporate technical design features to minimize effects on public utilities and all public utilities likely to be affected by the proposed project need to be relocated well ahead of the commencement of construction work and Contractor to obtain NOCs from concerned Departments	Design report	Feasibility Design Consultant ESMMC Contractor
Continued stakeholder engagement	Social issues	Proponents to establish an environmental & social cell responsible for stakeholder engagement and timely information dissemination	Minutes of meetings of stakeholders consultation Dissemination material	Contractor ESMMC
Construction contractor mobilization and establishment of campsite and machinery/ equipment Yard	Communicable Diseases	<p>Arrange to run an active campaign, in the labor camp, to make people aware of the cause, mode of transmission and consequences of HIV/AIDS;</p> <p>Strengthen the existing local health & medical services for the benefit of labor as well as the surrounding villages;</p>	Training records Health and safety manual	Contractor

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		<p>Ensure cleanliness and hygienic conditions at labor camp by ensuring proper drainage and suitable disposal of solid waste. Inoculation against Cholera will be arranged at intervals recommended by Health Department; and</p> <p>Keep all the camps, offices, material depots, machinery yards and work sites open for the inspection of health and safety measures and related documents.</p>		
	Security and Safety Risks	<p>Frequent consultation with local community leaders should be carried out to ensure that any social frictions are identified and resolved before they become inflamed.</p> <p>Control of public access to the site along with regulations aimed at safeguarding workers.</p> <p>Liaise with local communities and initiate and support a public awareness program, particularly targeted at children, about the risks and dangers of large construction sites</p>	<p>Minutes of meetings of community consultation</p> <p>Dissemination material</p>	Contractor
	Lifestyle and Culture	Timely and full public consultation and announcement of mobilizing equipment;	<p>Minutes of meetings of community consultation</p> <p>Labor cultural training records</p>	Contractor

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		<p>Establishment of formal links with affected communities; Seek assistance from and cooperation with local NGOs; Familiarize outside laborers on local etiquettes;</p> <p>Local labor should be employed for construction works. A dedicated quota (50%) of unskilled jobs should be allocated for the nearby villages; and</p> <p>Water supply and sanitation facilities, Contractor's workforces should exacerbate the existing shortages and environmental hazards; contractor should primarily seek their own sources of water in due distance (min. 1 km) from local user's wells.</p>	<p>implementation of policy on local employments Employment record</p>	
	<p>Changes in land use pattern Influx of external work force Social conflicts</p>	<p>Select campsite in view of the cultural norms of the area to avoid undue interference of the Construction contractor's staff with the local residents. Approval of campsite will be taken as per attached approval form in Annexure 19.</p> <p>Give priority employment to local residents.</p> <p>The land shall be rented for the camp site and equipment yard.</p>	<p>Monthly rent receipts. Development & implementation of policy on local employments Employment record</p>	<p>Construction Contractor Monitoring by Supervision Consultant and Reporting to ESMMC</p>

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
	Workshop facilities may spread oils & chemicals	<p>Disposal of used oil and chemical waste in accordance with MSDS.</p> <p>Efficient Use of Chemicals. Good housekeeping practices at workshop areas.</p> <p>Mixing of waste into fresh water sources shall not be allowed.</p>	Visual inspection	Construction Contractor Monitoring by Supervision Consultant and Reporting to ESMMC
	Deterioration of air quality due to machinery & equipment	<p>Proper engine tuning of machinery/equipment to meet National Environmental Quality Standards of Pakistan limits for air quality Annexure 5</p> <p>Water should be sprinkled where needed and appropriate, particularly if the campsite is near the communities;</p> <p>During windy conditions stockpiles of fine material will be wetted or covered with plastic;</p> <p>PPEs such as dust masks will be made available to the construction workers at the site to avoid potential health hazards;</p> <p>Idling of delivery trucks or other equipment will not be permitted during periods of unloading or when they are not in active use;</p>	Monitoring shall be done on stack of machinery and equipment. The parameters required to be monitored are Smoke, SO _x , CO, VOCs and NO _x . Evidence of measurement records.	Construction Contractor Monitoring by Supervision Consultant and Reporting to ESMMC

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		<p>In no case, loose earth will be allowed to pile up along the approach roads;</p> <p>All vehicles and other equipment's used during construction will be properly and regularly tuned and maintained;</p> <p>All permanently deployed vehicles exhausts will be monitored against NEQS;</p> <p>The possibility of excessive dust generation may be reduced by adopting the best construction practices, precautions such as periodic watering, covering of construction material and usage of low emission equipment's during construction.</p> <p>Although blasting is not planned currently in any project activity, however at any latter stage during construction, blasting may be required for quarrying or any other activity. A blasting management plan has been attached as Annexure 15. Which need to be implemented by construction contractor.</p>		
	Noise	<p>Noise reduction devices on high noise equipment</p> <p>Regular inspection, maintenance and</p>	<p>Monitoring compliance to NEQS Annexure 5 for noise (SRO 72 (KE) / 2009)</p> <p>The sampling shall be done</p>	<p>Construction Contractor</p> <p>Monitoring by Supervision</p>

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		<p>lubrication of the construction vehicle and equipment.</p> <p>Use of PPEs by the workers</p> <p>Avoid night time activity</p>	<p>twice on monthly basis at 7m distance from the source. The duration of sampling shall be 24 hours @ 15 seconds interval over 15 minutes every hour (averaged)</p>	<p>Consultant and Reporting to ESMMC</p>
	Soil contamination due to solid waste disposal of camp site	<p>Ensure proper disposal of camp site waste at designated disposal sites according to waste management plan attached as Annexure 20.</p> <p>An impervious liner shall be laid to waste sites before the dumping of solid waste. The approval for impervious liner shall be granted by Supervision Consultant on a form attached in Annexure 19.</p> <p>Good housekeeping practices within the camp site.</p> <p>Disposal of campsite waste near residential colonies or in agricultural fields shall not be allowed.</p> <p>Construction work will not be carried out during heavy monsoon rains;</p> <p>Clearance waste and construction debris should be sent to designated disposal site while waste from equipment</p>	<p>Visual inspection</p> <p>Solid waste management plan</p> <p>Photographic records</p>	<p>Execution by Construction Contractor</p> <p>Monitoring by Supervision Consultant and EMMP implementation reporting to ESMMC</p>

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		<p>cleaning and maintenance should be segregated and stored in color coded containers, these can be resold or reprocessed. No accumulation of solid waste at site shall be allowed; Avoid Vehicular traffic on unpaved roads as far as possible;</p> <p>Vehicles and equipment shall not be repaired in the field;</p> <p>If unavoidable, impervious sheathing shall be used to avoid soil and water contamination;</p> <p>Solid waste should be disposed of at designated places and contractor to obtain NOC from district governments for disposal of any material in existing disposal points; and</p> <p>Contractor to prepare a primary and secondary solid waste collection system within the premises of contractor camps and get approved by BIPD.</p>		
	Water contamination	Proper sewerage disposal arrangements to be provided such as septic tank and soaking pits for camps.	Monitoring compliance to NEQS Annexure 5. of sanitary wastewater generated from Camp Site. Waste management plan in place Photographic record	Construction Contractor Monitoring by Supervision Consultant and EMMP implementation

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
				reporting to ESMMC
	Loss of vegetation	<p>The construction crew shall use LPG as cooking fuel. Use of fuel wood shall not be allowed.</p> <p>Although as per impact assessment Sri Toi specifically represents dry arid alpine terrain, with marginal vegetation cover-mainly comprising of shrubs. No tree species were recorded during the transact survey. The construction activity will have no adverse impact on the flora of the project area. However, if any possibility of such practice may arise, following mitigation measure shall be adopted:</p> <p>Tree cutting to be done only when absolutely necessary, with prior approval as per form given in Annexure 19.</p> <p>Compensatory tree plantation in consultation with Forest department. Removal of one (01) tree should be compensated by plantation of ten (10) trees as per Forest (Amendment) Act 2010.</p>	<p>Use of LPG cylinders at campsite</p> <p>Tree cutting approvals</p> <p>Pictorial evidence of compensatory tree plantation</p>	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.
	Deterioration of Fauna	A 'no-hunting, no trapping, no harassment' policy will be strictly enforced;	Training records; Camp rules.	Construction Contractor Monitoring by Supervision

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		Trading of wild animals or birds by project personnel will also be prohibited; and Wildlife protection rules will be included in the Camp Rules.		Consultant and reporting to ESMMC.
	Health and Safety issues	Protective fencing around the camps. Firefighting equipment at the camps. Firefighting training to the camp staff. First aid facility should be in place. An ambulance should be available at site for 24 hrs. Safety precautions shall be taken to transport, handle and store hazardous substances. Contractor to prepare OHS plan and get it approved by Supervision Consultant.	Use of personal protective equipment Health & safety plan in place	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.
Transportation of construction material	Soil erosion and contamination	Avoid vehicular traffic on unpaved roads as far as possible. Vehicles and equipment shall not be repaired in the field and all the repairing work will be done at designated workshop facilities. Construction material should be covered while transportation.	Log of vehicle and equipment repairs	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		If unavoidable, impervious sheathing shall be used to avoid soil and water contamination.		
	Air pollution	Minimize operation of vehicles and machinery close to the water channels, water reservoir. Vehicles shall be kept in good working condition and properly tuned, in order to minimize the exhaust emissions	Route maps of vehicle movement Log of vehicle maintenance	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.
	Noise pollution	Vehicles to have exhaust mufflers (silencers) Nighttime traffic shall be avoided near the communities. Inform local population beforehand if nighttime traffic is unavoidable.	Log of vehicle movement time Visual inspections of the vehicles	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.
	Health and Safety issues	Road signage fixed at appropriate locations Train all drivers on defensive driving Low vehicle speeds 15 km/hr near / within the communities.	Visual inspections Training record	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.
B2. Construction Phase				
Excavation, backfilling and compaction works	Soil erosion	Prepare material borrowing and disposal plan Avoid cultivation fields for borrowing material to the extent possible Obtain written consent of the land	Evidence of plan in place. Photographic record	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		owner for material (soil) borrowing Keep photographic record (before, during, after) for borrow and disposal areas. Leveling of borrow sites.		
	Water availability for construction works	BIPD should make arrangements to supply water during construction for drinking as well as construction purposes Alternately the contractor shall procure water bowsers and store water on site for drinking and construction purposes	Permit of water supply Contract agreement with water suppliers	Irrigation Department Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.
	Site overburden	Consider wind direction while selecting sites for stock piles. Keep Stockpiles of overburden covered. Ensure proper disposal of construction waste at designated disposal sites. Take approval for selection of solid waste disposal site if landfill is not available from Supervision Consultant on the form attached in Annexure 19 . An impervious liner shall be laid to waste sites before the dumping of solid waste. The approval for impervious liner shall be granted by supervision consultant on a form attached in Annexure 19 .	Visual inspections Monitoring Particulate Matter PM ₁₀	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		<p>It will be ensured that no soil is left unconsolidated after completion of work;</p> <p>Photographic record will be maintained for pre-project, during-construction and post-construction condition of the sites;</p> <p>Prepare material borrowing and disposal plan by the contractor.</p>		
	Borrow pit	<p>Possible natural areas with a high elevation will be demarcated and used for borrowing earth material.</p> <p>Strip and stockpile the top 300 mm of the plough layer for redressing the land where the use of agriculture land is unavoidable.</p> <p>Where deep ditching is to be carried out, the top 1 m layer of ditching area will be stripped and stockpiled. The ditch will be initially filled with scrap material from construction and then leveled with the stockpiled topsoil.</p> <p>Ditches or borrow pits that cannot be fully rehabilitated will be landscaped.</p> <p>Land owners will be compensated according to the terms of lease agreement.</p>	Monthly rent receipts.	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		The approval forms are attached as Annexure 19.		
	Damage to infrastructure	All damaged infrastructure shall be restored to original or better condition.	Visual inspections Photographic records Infrastructure restoration records	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.
	Sites of Historical, Cultural, Archeological or Religious Significance	<p>Proponent and the Supervision Consultant to ensure that the construction staff is educated about the location and importance of the cultural sites that exist in the Project Area.</p> <p>Contractor to ensure that these sites are not affected by the construction related activities. These aspects will be included in the trainings to be conducted for the contractor's staff.</p> <p>Stop the work immediately in case of chance find of any sites or artifacts of historical, cultural, archeological or religious significance. Chance Find Procedure, attached as Annexure 21. and Antiquities Act 1975 should be followed.</p> <p>No disturbance to Graveyards during the construction activities.</p>	<p>Evidence of training provided to contractor staff.</p> <p>Evidence of maps in place with these sites shown.</p> <p>Records of appropriate action taken in case of chance find.</p> <p>Photographic record of chance find.</p>	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.
	Noise pollution	Noise reduction devices on high noise equipment	Monitoring compliance to NEQS Annexure 5. for	Construction Contractor

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		Regular inspection, maintenance and lubrication of the construction vehicle and equipment Use of PPEs by the workers Avoid night time activity	noise (SRO 72 (KE) / 2009) The sampling shall be done twice on monthly basis at 7m distance from the source. The duration of sampling shall be 24 hours @ 15 seconds interval over 15 minutes every hour (averaged)	Monitoring by Supervision Consultant and reporting to ESMMC.
	Air pollution	Proper engine tuning of machinery/ equipment to meet National Environmental Quality Standards of Pakistan limits shall be ensured. NEQS for ambient air quality is attached as Annexure 5 . Water should be sprinkled where needed and appropriate, particularly at work sites near the communities.	Monitoring shall be done on stack of machinery and equipment. The parameters required to be monitored are Smoke, H ₂ S, SO _x , CO, VOCs and NO _x . Evidence of measurement records.	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.
	Health and Safety issues	Demarcation tapes to be installed around the construction site to avoid any unauthorized entry Personal protective equipment should be made available at site and the usage of the PPEs should be ensured. Health & safety plan should be prepared by contractor and get it approved by Supervision Consultant	Use of personal protective equipment Health & safety plan in place	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.
	Blockage of access due to	A bypass route should be constructed at the project site to divert the through	Traffic diversion plan	Construction Contractor

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
	earth works and stockpiling of excavated material	<p>traffic, thus avoiding the public traffic passing through the site.</p> <p>A traffic diversion plan should be formulated by the Contractor and shall be approved by the Supervision Consultant.</p>		Monitoring by Supervision Consultant and reporting to ESMMC.
Construction of Dam, new canal and irrigation structures	Water availability for construction works	<p>BIPD should make arrangements to supply water during construction for drinking as well as construction purposes</p> <p>Alternately the contractor shall procure water bowsers and store water on site for drinking and construction purposes</p>	Permit of water supply Contract agreement with water suppliers	Irrigation Department Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.
	Noise pollution	<p>Noise reduction devices on high noise equipment</p> <p>Regular inspection, maintenance and lubrication of the construction vehicle and equipment</p> <p>Use of PPEs by the workers</p> <p>Avoid night time activity</p>	Monitoring compliance to NEQS Annexure 5. for noise (SRO 72 (KE) / 2009) The sampling shall be done twice on monthly basis at 7m distance from the source. The duration of sampling shall be 24 hours @ 15 seconds interval over 15 minutes every hour (averaged)	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.
	Air pollution	Proper engine tuning of machinery/ equipment to meet NEQS of Pakistan limits shall be ensured. NEQS for ambient air quality is attached as Annexure 5.	Monitoring shall be done on stack of machinery and equipment. The parameters required to be monitored are Smoke, H ₂ S, SO _x , CO, VOCs and NO _x .	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		Water should be sprinkled where needed and appropriate, particularly at work sites near the communities.	Evidence of measurement records.	
	Health and safety issues	Demarcation tapes to be installed around the construction site to avoid any unauthorized entry Personal protective equipment should be made available at site and the usage of the PPEs should be ensured. Health & safety plan should be prepared by contractor and get it approved by Supervision Consultant	Use of personal protective equipment Health & safety plan in place	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.
	Blockage of access due to construction works	A bypass route should be constructed at the project site to divert the through traffic, thus avoiding the public traffic passing through the site. A traffic diversion plan should be formulated by the contractor and shall be approved by the Supervision Consultant.	Traffic diversion plan	Construction Contractor Monitoring by Supervision Consultant and reporting to ESMMC.
C. Operation & Maintenance Phase				
Unavailability or improper distribution of irrigation water in the area	Social issues	Agreements between different communities/tribes and farmer organizations will lead to undisputed water distribution. Irrigation schemes may function smoothly in normal conditions and	Agreement between parties Training records	Irrigation Department Water user association and farmer organizations

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		<p>circumstances but do face problems during extraordinary situations, i.e. when flow is higher or lower than normal. From the outset water management rules and regulations must incorporate ways to tackle such issues as water scarcity and surplus flows.</p> <p>Local water user associations and groups need to be trained and involved to operate the canals, channels, gates, inlets, outlets and other structures. This needs to be done on collaborative basis with irrigation and agriculture department where communication system among farmers, water user association and department is assured.</p> <p>Farmers in downstream areas should be compensated in case they lose their water rights.</p> <p>Discourage spate agriculture.</p>		
Breaching of Dam, Canal and Structures	Fatal accidents System sustainability	<p>BIPD should ensure the design review during operation phase by panel experts</p> <p>BIPD to monitor the system regularly.</p> <p>Include Capacity building of the communities in the O&M activities.</p>	Monitoring reports Visual Inspection	Irrigation Department

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		<p>Liaise with the communities to identify potential weaknesses in the system that could cause breaches.</p> <p>A training program should be executed by BIPD for locals with special emphasis on evacuation at emergency conditions.</p> <p>Emergency response plan for Dam and canal breach shall be followed, which is attached as Annexure 16 of this report</p>		
Use of irrigation water for drinking purposes	Health issues	<p>Train local community on safe drinking water</p> <p>Coordinate with Local Government to install small filter plants at suitable locations for potable water</p> <p>Place warning and information signs about dangers of using irrigation water for potable purposes</p> <p>Local Government to assure potable Water quality as per WHO/ GOP standards.</p> <p>Turbidity and free residual chlorine tests shall be regularly performed.</p> <p>Arsenic will be tested as per WHO/GOP standards.</p>	WHO/ GOP Drinking Water Standards	Local Government

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		Keep continuous check on the site by employing security professional to check and shun the water usage (for potable purposes) by local public.		
Ground water contamination in command area	In case of improper drainage ground water will be contaminated	Periodic maintenance of drainage structures; and Ground water monitoring wells should be established in command area to monitor the salinity of ground water.	TDS limits of ground water shall not exceed TDS limits of supplied irrigation water or ambient ground water TDS.	Irrigation Department
Disposal of waste (connection of waste streams) in the canal	Health issues	Proper monitoring of canals alignment and disconnect all identified waste streams Arrange awareness programs for the local public to educate them about the harms caused by disposal of waste into canals; Labelled sign boards to avoid entry of waste disposal;	Visual inspection Monitoring and training records	Irrigation Department
Enhanced / Induced Use of Fertilizers and Pesticides	Banned fertilizer and pesticides will cause health issues	Concerted efforts by the department of agriculture to disseminate information regarding sustainable use of fertilizers will help in keeping the use at an optimal level	Visual inspection Monitoring records Market survey for availability of AN and CAN fertilizers	Agriculture Department

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
	Contamination of fresh water through surface runoff	Ammonium Nitrate (AN) and Calcium Ammonium Nitrate (CAN) fertilizers will not be allowed Use of restricted pesticides identified by WHO shall not be allowed Proper drainage system		
Increase of agricultural lands	Loss of pastoral lands	One aspect that will need to be monitored is that additional area under cultivation should be used for crops suitable to the overall climatic conditions of the area and farmers should follow the pattern as given in Agriculture Report of this Project; and. Increase in the cultivated area will also mean reduction in pastoral lands. However, the livestock would still benefit by using farm residue and mostly by availability of fodder crops. The Irrigation department (Project Proponent) will work with the Agriculture department to ensure that stall feeding practices take root for livestock, so that the remaining pastoral lands are available for the wild animals.	Monitoring records	Agriculture Department Forestry Department Wildlife Department
Periodic cleaning and maintenance of the system	Solid waste generation	The proposed project is an integrated irrigation program. The proponent will also facilitate it to become an integrated community development program	Periodic cleaning records Visual inspection	Irrigation Department Water User Association

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		<p>through formal structure made by BIPD and through the community engagement. Timely and correct sharing of information will enable other line departments to implement their own development schemes in the area;</p> <p>The BIPD will develop and implement a proactive maintenance plan for the proposed project, with predefined periodicity;</p> <p>Monitoring results;</p> <p>Ensure proper disposal of waste at designated landfill/disposal sites; and Efficiency of the system will be at its best by adopting proper maintenance activities such as silt removal and bed scratching at periodic intervals..</p>		
Community Participation for management and operation of the irrigation system	<p>Social issues</p> <p>System sustainability</p>	<p>Ensure community participation in management and operation of the irrigation system; by implanting O & M manual for Farmers' management of Irrigation System prepared as a separate document for Sri Toi Irrigation Project;</p> <p>Training of related communities; and</p> <p>Interaction of FAO with the rest of community is recommended throughout the Project implementation. Moreover,</p>	<p>Training records</p> <p>Community participation records</p>	<p>Irrigation Department</p> <p>Water User Association</p>

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		any change in the design or structure or operation if incurred, it must be done in consultation with the local public.		
Disruption to Public and Wildlife	Social issues Conservation issues	Design has already provided cattle drinking troughs at different intervals and pedestrian bridge for canal crossing approximately at 500 m interval. BIPD to ensure the proper maintenance of aforementioned structures. Watershed management activities on the catchment and stream bank will be afforested. Agricultural advisory services will be started to grow organic vegetables and crops. Biological control of pests will be adopted through agriculture department support. As dam will be constructed, with the coordination of Forest and wild life and conservation organization, environmental awareness regarding hunting control will be raised.	Monitoring and maintenance records	Irrigation Department Wildlife Department
Health and Safety	Vector borne diseases (e.g. malaria) Drowning issues	A training program will be organized by BIPD at community level for health and safety practices adoption and ensure the community participation. This program should be instigated through the local schools to warn of these dangers to children. Proper medicines should be available in nearby BHUs. By adopting the aforementioned training on	Training records Community participation records	Irrigation Department

Activity	Potential Impact	Mitigation Measures	Implementation Indicators	Party(ies) Responsible for Implementation
		<p>health and safety, the impact would be finally of low significance.</p> <p>Team members of HSE shall be deputed to prohibit swimming in dam, spillway or dykes. Warning signs shall also be posted for public awareness.</p>		
Risk due to Natural Hazard i.e. Flooding	System sustainability	Emergency Response Plan for Flood Protection Bund will be followed which is attached as Annexure 18 of this report.	Emergency Response Plan	Irrigation Department

8.9 Environmental Monitoring Plan

519. Importance of “monitoring” cannot be over-emphasized since it provides timely and useful information to the project management, implementation agencies and the policy decision makers. Conceptually, “monitoring” means to check and assess, on a regular basis, the status of the project activities and realization of various developmental targets during operation and maintenance. It helps in timely identification / analysis and removal of the bottlenecks and expediting actions. In fact, project monitoring is a tool to serve the interests of the project planners, executors and operation managers, as they share common concern for timely corrective measures.

8.9.1 Monitoring Strategy

520. Under the proposed monitoring strategy, it is recommended that ESMMC (BIPD) should be responsible for all the monitoring activities. All the findings and results in the form of an annual monitoring report will be finally passed on BEPA Officers. The monitoring program has been designed carefully considering the identified impacts (**Chapter-7**) and some additions or deletions may be taken up in this program after learning lessons from one-year operation of the project through Change Record Register. **Table 48** provides environmental monitoring schedule for construction and operational stages of Sri Toi Project.

Table 35: Environmental Monitoring Plan

Sr. No.	Receptor/Item	Location	Monitoring Mechanism	No. Frequency and Parameters	Executor
1.	Water Resources/Water Quality	<ul style="list-style-type: none"> Just downstream of the off-take of proposed Sri Toi Water Storage Dam 	<ul style="list-style-type: none"> Discrete grab sampling and laboratory testing of water samples. 	<ul style="list-style-type: none"> Quarterly (construction) Bi-annually (operation) 5 points <p>Parameters:</p> <ul style="list-style-type: none"> pH Temperature Electrical Conductivity, EC Dissolved Oxygen, DO Turbidity Total Dissolved Solids, TDS Total Suspended Solids, TSS Calcium, Ca^{+2} Magnesium, Mg^{+2} Sodium, Na^{+} Potassium, K^{+1} Sulphates, SO_4^{-2} Carbonate, CO_3^{-2} Bicarbonate, HCO_3^{-} Chloride, Cl^{-} Nitrate, NO_3^{-} Nitrite, NO_2^{-} Total phosphate, TP BOD₅ COD Oil and Grease Metals (Fe, Mn, Zn, Pb, Si, Cd, Hg, As and Ni) Chromium 3+ and 6+ 	<p>HSE Department (Construction)</p> <p>BIPD (Operation)</p>

Sr. No.	Receptor/Item	Location	Monitoring Mechanism	No. Frequency and Parameters	Executor
				<ul style="list-style-type: none"> Pesticides-Diazin-10G/Diazol/10G, Nuvacron 40 SCW, Manlozeb (80%) and Chlorothalonil)** Total Coliforms 	
2.	Soil Erosion/ Soil Pollution	<ul style="list-style-type: none"> Equipment washing yards; Spillage points of fuel, chemicals and lubricants; Borrow and quarry areas; Main canal ROW; Storage pond areas; and Effluent treatment areas. 	<ul style="list-style-type: none"> Visual observations; and Discrete grab sampling and laboratory testing 	<ul style="list-style-type: none"> Bi-annually (construction) Approximately 6 points Annually (operation) approximately 4 points Parameters: Oil and grease, chlorides, and metals. 	HSE Department (Construction) BIPD (Operation)
3.	Dust Emissions	<ul style="list-style-type: none"> Camp sites; Borrow areas; 	<ul style="list-style-type: none"> Visual checks 	<ul style="list-style-type: none"> Monthly (construction) where construction is in progress 	HSE Department (Construction)
4.	Noise Pollution	Same as above	<ul style="list-style-type: none"> Noise level meter 	<ul style="list-style-type: none"> Monthly (construction) where construction is in progress 	HSE Department (Construction)
5.	Fumes and gases	<ul style="list-style-type: none"> Emissions from silencers of heavy machinery, trucks and other vehicles; and Batching plants. 	<ul style="list-style-type: none"> LANCOM-III emissions monitoring system; and Monitoring of ambient air quality in ppb using impinge, and also perform ambient air monitoring in sensitive receptors as well if complaints related with deterioration of ambient air quality are received 	<ul style="list-style-type: none"> Quarterly (construction) approximately 15 points Monitoring shall be done on stack of machinery and equipment as well as ambient air quality (if complaints received). The parameters required to be monitored are Smoke, SO_x, CO, VOCs, SPM and NO_x. 	HSE Department (Construction)
6.	Sediment	<ul style="list-style-type: none"> Dam reservoir 	<ul style="list-style-type: none"> Grab Sampling 	<ul style="list-style-type: none"> Annually (operation); 	BIPD

Sr. No.	Receptor/Item	Location	Monitoring Mechanism	No. Frequency and Parameters	Executor
				<ul style="list-style-type: none"> Grain Size Analysis; and Quantity. 	
7.	Solid Wastes	<ul style="list-style-type: none"> Construction activities cleaning and maintenance of the system Campsites. 	<ul style="list-style-type: none"> Visual checks Periodic cleaning records 	<ul style="list-style-type: none"> Quarterly (construction); Bi-annually (operation). 	HSE Department (Construction) BIPD (Operation)

8.10 Planning for Implementation of EMP

8.10.1 NOC and Other Approvals

EPA Approval Process

544. The EIA report duly reconciled with BIPD is to be submitted to BEPA for obtaining No Objection Certificate (NOC). A demand draft of PKRs. 30,000/- has to be deposited along with the report by the Proponent to EPA Balochistan for conducting a Public Hearing. The approval from BEPA (NOC-No Objection Certificate) for the Project is mandatory requirement before its commencement.

8.10.2 Stakeholder Coordination

545. Notwithstanding the efforts so far put in for public participation, this activity will have to be pursued through the forthcoming implementation phases of the project. In particular, the focus will be on the improvement and modification of the proposed intervention designs.

546. Participation mechanisms facilitate the consultative process and include information sharing and dissemination, disclosure, and participation of affected people and other stakeholders in the project related activities. In the peculiar social set-up of the Project Area, it is also important to involve the religious leaders as representatives of the public as well as part of effective communication process. They can provide a very effective medium to bring information to the affected male population through Friday prayers. Local business community, specially the affected one, should also be brought into the process of awareness and participation.

547. The related institutional arrangements should also be in place for continuous consultation throughout the process of planning and implementation.

548. During construction, BIPD will have to implement both EMP. For EMP, an exclusive Environmental & Social Management and Monitoring Cell (ESMMC) will be established. Project Information Centre will be also established for liaison with key stakeholders through continuous process of information disclosure, consultation and participation.

8.10.3 Trainings

549. In order to raise the level of professional and managerial staff, there is a need to upgrade their knowledge in the related areas. An environmental and social training and Technical Assistance (TA) program is to be carried out before the implementation of the project. Contractor's environmental awareness and appropriate knowledge of environmental protection is critical to the successful implementation of the EMP because without appropriate

environmental awareness, knowledge and skills required for the implementation of the mitigation measures, it would be difficult for the Contractor(s) workforce to implement effective environmental protection measures. A suitable training program is proposed to train the Contractor(s) staff who will be involved in the Construction Phase and the professional staff from the proponent involved at the operational stage of the project.

550. The training consultant will organize training courses for Proponent and Contractor staff to train them in specialized areas such as air and noise pollution monitoring and water quality monitoring etc. The details of this training program are presented in **Table 49**.

Table 36: Personnel Training Program

Training Provided by	Contents	Trainees	Duration
Training consultant organizations specializing in environmental management and monitoring Training Consultant will be Supervision Consultant	Short seminars and courses on: Environmental laws and regulations, daily monitoring and supervision	<ul style="list-style-type: none"> • Irrigation staff • Contractor project staff • Project implementation staff 	1 day
Training consultants/ organizations specializing in social management and monitoring	Short seminars and courses on: Social awareness	<ul style="list-style-type: none"> • Project staff dealing in Social/lands matters 	1 day
Training consultants/ organizations specializing in Occupational, health and safety issues	Short lectures relating to Occupational Safety and Health	<ul style="list-style-type: none"> • Contractor's staff 	2 days

8.10.4 Communication & Documentation

551. Communication and documentation is an essential feature of EMP. The key features of such mechanism are:

☐ Data Recording and Maintenance

552. All forms to be used for recording information during the environmental monitoring will follow a standard format which will correspond to the data base in to which all the gathered information will be placed. Check boxes will be used as much as possible to facilitate data entry. Checklist of Mitigation Measure Record as **Annexure 22**. Tracking system will be developed to file the implementation of mitigation measures on a weekly basis.

❑ Database

553. The database may include the following information:

- Training programs;
- Staff deployment;
- Non-compliance;
- Corrective actions
- List of environmental data and
- List of environmental data to be maintained:
 - Soil and land pollution
 - Disposal of excavated silt and earth
 - Disposal of waste
 - Water resource
 - Fuel oil and chemical spills
 - Vegetation record
 - Noise pollution
 - Air and dust pollution
 - Socio-economic data

❑ Meetings

554. The following environmental meetings during the project will take place. Primary meeting for setting out the requisite end frame sounding for the regular meetings. Scheduled meetings between Contractor and Supervising Consultants.

555. The purpose of the meeting will be to discuss the conduct of the operation, non – compliances noted by the consultant's environmental team and measures for their remedy. The meeting will be recorded in the form of a daily/monthly environmental report.

❑ Social Complaint Register

556. The Supervising Consultant (SC) and ESMMC will maintain a register of complaints record from local communities and measures taken to mitigate these concerns.

❑ Photographic Records

557. Contractors, SC and ESMMC will maintain photographic records during the implementation of the project. As a minimum, the photographic records will include the site photographs, all the roads, camp sites and monitoring activities etc.

8.11 Grievance Redressal Mechanism

558. This section describes mechanism to receive and facilitate the resolution of affected persons' concerns and grievances. It explains how the procedures are accessible to aggrieved party (AP) including women. A grievance mechanism will be available to allow an AP appealing any disagreeable decision, practice or activity arising from land or other assets compensation. APs will be fully informed of their rights and of the procedures for addressing complaints whether verbally or in writing during consultation, survey, and time of compensation. It is preferred that APs/local community should submit their complaints/ concerns and issues formally and accordingly the project staff will enter the complaint on Community Complaint Register (CCR) comprising of a minimum information such as the name and address of complainer, description of complaint, action taken, status of resolution of complaints and other necessary information/ record and reasons; in case the issue is not resolved. Proper consideration will be given to avoid the grievances rather than going through a redress process.

559. A Grievance Redress Committee (GRC) will be established at both project and field level. GRC at project level will include the Project director, representative of PIU/ BIPD, Social Safeguards staff of BIPD, representatives of APs/ or local community and representatives of concerned FO (if any).

- The GRC at project level will include the following members:
 - i). PD (Balochistan Irrigation and Power Department)
 - ii). Representative (Project Implementation Unit)
 - iii). Representative of AP / FO

560. This GRC will work both at the project and field level. The District level BIPD staff will inform the aggrieved party about GRC and mechanism by registering their concerns at concerned office. The complaints will be registered by maintaining community complaints register (CCR), where the name & address of complainer, date, description of complaint and action taken will be entered.

- The GRC at field (District) level will include:

- i). Executive Engineer / Sub-Engineer
- ii). Social Mobilizer
- iii). Patwari (land record keeper)
- iv). Representative of AP/ FO

Table 37: Community Complaints/ Grievance Redress Process

Land Compensation Issues	Other Items Compensation Issues
<ul style="list-style-type: none"> First, complaint resolution will be attempted at site (field level) through the involvement of the PIUs/ informal committee/ and or concerned FO (if any). 	<ul style="list-style-type: none"> First, complaints resolution will be attempted at site (field level) through the involvement of the PIUs/ informal committee/ and or concerned FO (if any).
<ul style="list-style-type: none"> If unsettled, a grievance can then be lodged to the DO (Revenue)/ LAC who has 14 days to decide on the case. 	<ul style="list-style-type: none"> If no solution is reached, a grievance can be lodged to GRC. The GRC will provide the decision within 3 weeks of registering the complaint.
<ul style="list-style-type: none"> If no solution is reached, a grievance can be lodged to GRC. The GRC will provide the decision within 3 weeks of registering the complaint. 	<ul style="list-style-type: none"> If the grievance redress system does not satisfy the DPs, they can pursue further by submitting their case to the appropriate court of law.
<ul style="list-style-type: none"> In case, the grievance redressal system does not satisfy the DFs/ DPs, then they can pursue further by submitting their case to the appropriate court of law as per the process set out in Section 18 to 22 of the LAA 1894. 	

8.12 Environmental Management Cost

561. The budget presented in **Table 51** and **Table 52** will include estimates for the cost of mitigation measures, staff employed for implementation of the EMP, tree plantation, and technical assistance.

Table 38: Cost for Contractor

Sr. #	Description	Unit Cost/Month*
1	Laboratory Analysis Cost	125,000
2	Contractor Environmental Engineer (each contractor)	80,000

** based on unit parameter testing and sampling cost for air, water and noise.*

Table 39: Cost for Proponent

Sr. #	Description	Unit Cost*
A	During Construction Period	
1	Laboratory Analysis Cost	100,000/Quarter
2	Supervision Consultant/Environmental Officer	150,000/Month
3	Third Party Monitoring	500,000/Quarter
4	Training on EMP	100,000/day
B	During Operation & Maintenance Period (for initial three years)	
1	Laboratory Analysis Cost	50,000/Six Months
2	Training & Community Engagement Cost	50,000/Month
3	Third Party Monitoring	300,000/ Six Months

* based on unit parameter testing and sampling cost for air, water and noise.

8.13 Change Management

562. The EIA and the EMP have been drawn up during the Feasibility Stage of the project. However, these are dynamic documents and it is foreseen that during the detailed design stage the documents may be updated and the EMP will be refined. The refinement of the EMP will need to take account of the results of the monitoring of air, noise and water quality. In addition, any major changes in the design of the project will need to be reviewed in the light of possible environmental impacts and if necessary then any additional mitigation and enhancement programs be added to the EMP. During the construction phase of the project, monitoring will need to be accompanied by a rapid feedback decision taking system that allows any corrective action to be taken if things are not as predicted. The whole environmental management system is a dynamic process that has to be responsive and also anticipate conditions.

563. Specific actions that will need to be made include the following:

- At the detailed design phase, the EMP should be updated and refined to take into consideration changes in the design. This work will be carried out by Consultants who will also be responsible for the updating the EIA report;
- Once a Main Contractor has been appointed then a meeting will need to be held between the proponent of the project, the Supervisory Consultants and the contractor to clearly define the environmental management responsibilities of each party. The detailed nature of the EMP will need to be discussed and agreed, including a matrix of items and responsibilities related to the timing of the construction works and the contracts;
- Based upon the discussions during the meeting, a Change Report will be collectively

produced which will include any recommended modifications needed to the EMP;

- The Change Report will be submitted to the relevant department for final approval and form part of the EMP; and
- All relevant project personnel will be given information of the required changes to the EMP.

9 CONCLUSIONS AND RECOMMENDATIONS

564. This section presents the major conclusions and key recommendations of the EIA study.

9.1 Findings

565. This study was carried out at the planning stage of the project. Predominantly primary and secondary data and site reconnaissance were used to assess the environmental impacts. The potential environmental impacts were assessed in a comprehensive manner. The report has provided a picture of all potential environmental impacts associated with the sub-projects, and recommended suitable mitigation measures.

566. There are some further considerations for the planning stages such as submission of EIA report to BEPA for grant of No Objection Certificate for the proposed Sri Toi Water Storage Dam and Irrigation Project under Balochistan Environmental Protection Act 2012.

567. Land Acquisition will be involved and forms the subject of a separate study report under this project. Reader is directed to LARP prepared separately under this proposed project.

568. Construction of Sri Toi dam is going to bring positive changes in the area in terms of availability of water, cultivation of crops, establishment of new settlements and improvement in the standard of life of the inhabitants of the area.

569. Availability of irrigation and agriculture would support livestock growth and in due course of time would enable farmers to diversify in areas of dairy production.

570. The project will generate employment opportunities for local laborers during all three phases of project. The Project will positively contribute in improving the carrying capacity of biological environment and overall improvement of the ecosystem.

571. Household income will increase substantially with irrigation improvement measures owing to availability of water for irrigation, crop yields, increase in the number of animals, and availability of other occupational opportunities.

572. **Changes in the flora and fauna of the area:** The construction of Sri Toi dam and the resultant agriculture crop cultivation over an area of 9,951 acres will bring very drastic changes in the flora and fauna of the area. Water storage in the dam body will attract water birds especially those migrating from Siberia to warm area during winter. Depending upon the size of the water body, it serves the purpose of a wetland. Similarly, the natural vegetation present in the command area and the faunal population dependent upon the flora, will also be removed for bringing the area under cultivation. Therefore, the agriculture and fodder crops introduced

in the area will not only change the vegetation structure but will also attract new fauna. Bringing command area under-cultivation is thus going to completely change the vegetation and related faunal species, which may have beneficial impacts upon the overall ecosystem.

573. In the post-BWRDP scenario, surface water availability in the basin will be around 457 MCM. With the proposed Sri Toi water storage dam and irrigation system the net withdrawal will be around 179 MCM; therefore, balance water available will be around 278 MCM. This is sufficient for maintaining environmental flows and continue to contribute inflows to the Gomal Zam Dam without causing any ecological problems.

574. **Change in the water table:** Water for crop production and drinking purposes is extracted from the ground. -Tube wells, diesel operated engines and Karez system are used by the community members for this purpose. Due to relatively good rainfall in the area and better porosity in the soils, a large portion of the run off infiltrates and percolates in the ground. It is because of this very reason that the water table in this part of the province has not been depleted to the extent as in the arid and hyper-arid areas. The availability of irrigation water to crops will help in maintaining and rise of water table. In future it is expected that water storage in the dam will not only help in raising the water table in the project area but the adjacent areas will also get benefitted in terms of water availability. Recharge of water table in the proposed command and adjacent area would greatly reduce the risk during years of below average rainfalls and droughts through pumping ground water for crop cultivation.

575. The adverse environmental impacts from the project will mostly take place during the construction stage. Some adverse impacts are also anticipated during the operation phase. The impacts are likely to be similar at most locations and impacts have been reviewed in the relevant section of this EIA report. Moreover, implementation of the proposed mitigation measures will ensure the impact significance remains low during the construction and operation phases.

576. Adverse environmental impacts during the construction phase are related with the establishment of campsite which are temporary and can be minimized with better management. Construction worker camps will not necessarily be based on the scale of the works needed. If for some unforeseen reason a larger workforce is needed, the construction camp will not be located in settlement areas or near sensitive water resources and will be provided with lavatories. Local employment will be preferred (especially for unskilled jobs) to avoid cultural conflicts.

577. **Increase in the population:** Implementation of project and cultivation of 9,951 acres of land with agriculture and horticultural crops will attract a large number of individuals to the area for performing different functions in the area. Following the golden rule of division of Labor, the area will prove an empty niche for individuals related to a number of trades/skills ranging from tenancy to masons and motor mechanics, who will come and engage in their

related trades to earn livelihoods. Demography of the area will change drastically resulting in a large population which will start exerting pressure on the available resources. Taking into account the increase in population, who will need all the basic necessities of life, it is important that the town planning should also be given due attention with the passage of time to avoid pollution and other such environmental problems/issues. In case the growing population pressure in the area is not attended properly, it will give rise to many issues ranging from the need for basic necessities of life to conflicts on resources. Population increase is thus very important factor that needs to be taken care of from the very beginning otherwise it may nullify the benefits of projects.

9.2 Recommendations

9.2.1 Physical

578. Careful planning and management is recommended to avoid air pollution and generation of solid waste during construction phase especially during storage & transport of overburden soil.

579. The arid climatic conditions at the proposed project area and frequent drought cycles in Balochistan, requires that the farmers cultivate low delta crops especially in the horticulture sector such as grapes, almonds, pomegranate and olives.

580. Based on the adaptation measures suggested in the Climate Change Study, the following adaptation measures were included in the design of sub-projects:

- Provision of control gates/breast wall arrangements in the intake structures to have better control on diverted flows during excessive rainfall/flood events expected due to Climate Change.
- Increase in the capacities of surface irrigation network to provide additional flows to the farmers in the command area so that they can increase the cropping intensity and leading to enhanced income at the farm level. This adaptation measure was adopted in all the sub-projects.
- Design of spillways for possible maximum floods to manage the risks of extreme flood events.
- Adoption of land use practices which can also survive under both the wet and dry conditions like forest plants, shrubs and forages. Shortage of fuelwood is common in most of the areas and province imports fuelwood from other provinces. This is also a gender support adaptation, as women are solely responsible for the collection of fuelwood. This is the most important adaptation, as farmers are most vulnerable to the extreme events instead of structures, so that adaptations in land use would ultimately reduce the risks of flood and droughts on the livelihood of farming community.

581. Soil and water are the most precious assets a farmer has at the farm level. Both of these are considered as the key element in all the production systems related to farming/agriculture.

582. Water rights are equally distributed among the agriculturists according to the land holdings. The FOs in the sub-project areas have not been actively and need to be strengthened. The Agriculture Extension Department in Balochistan can play a vital role in enhancing the cropping intensity of the proposed sub-project area with timely knowledge of best agricultural practices.

9.2.2 Biological

583. The district also falls in the route of migratory birds but there is no designated protected area in the district. Among wildlife, Cranes are highly important, as these are hunted and trapped in large numbers in the district. Since, there exists no protected area in the district; therefore, the protection of resident wildlife and safe resting grounds for migratory birds are not available at present.

584. The proposed project does not interfere with any ecological parameters, however, can be seen as a positive contributor in improving the carrying capacity and overall improvement of the ecosystem.

585. Sri Toi like the whole district geography is typical of a mountain eco-system represents a typical pastoral dependence and rain fed agriculture. The habitat of the project area and its surroundings are broadly categorized as Hills, Foothills, plains and stream beds. Sri Toi specifically represents dry arid alpine terrain, with marginal vegetation cover, mainly comprising of shrubs, no tree species was recorded during the field visit.

586. The type of rangeland present in the district is classified as Suleiman Mountain Ranges. It has species like: *Stipa pennata*, *Pennisetum orientalis*, *Chrysopogon aucheri*, and *Cymbopogon* sp. etc. The productivity is good with average productive capacity of 250 kg /hectare. The rangelands in the district belong to communities living around them. Due to communal ownership, usually these are accessible to all members of the community and also to nomads passing through the area on their traditional routes of migration to new areas.

587. Wildlife habitat type is Steppic Forest in Intermediate Latitude. There are no historical bench marks to determine the status of wildlife in the area. However, according to the community the number of wildlife species has declined; which could aptly be attributed to casual attitude for hunting and habitat degradation.

588. Baseline faunal survey recorded the occurrence of a total Seven mammal species, of which confirmed the occurrence of 3 species fox, wolf and Hyena through direct evidences

like (pug marks, pelts, faces, territory marking signs and interviews with local residents. The Balochistan Black Bear, Suleiman Markhor and Afghan Urial, which was reported to occur in the past, are now apparently extinct. Cape hare was found very common in the entire area during survey. A total 07 Cape hare were counted during the survey. For the determination of population status of carnivores, nights walks were arranged. In the plains the survey team used vehicle and search lights. After seeing the eyes of carnivores in high powerful lights, noted the eye colors and consulted the literatures. In foothills, used search light in same way. One Indian gray wolf, 2 red fox, 3 Asiatic jackals and one Indian Crested Porcupine were sighted. While indirect observations were made on the droppings, foot prints of several carnivore species such as striped hyena, Jungle cat, afghan hedgehog, Caracal and Indian gray wolf. Skin of Panther observed in a house, using for prayers.

589. Direct sight techniques like ground nests searching and stand watch techniques were used for this survey. 16 species of birds observed in the area. Chakoor and Seesee partridges were found very common throughout the area. The birds were mostly observed near water points. 2 small flocks of Chakoor and see partridges were observed in the area. Hunters to trap eagles were observed on three different locations with hunting materials.

590. The survey team observed lizards in six different locations. At one location hunted Afghan Tortoise shell was observed. Many snake species are reported from the area. Due to hibernation period, no snake species observed in the present survey while 2 lizard species observed in the survey, Clif rcer (*Coluber rhodoracus*) and Agama (*Agama spp.*) are available in everywhere.

591. Sri Toi represents an ephemeral system; therefore, it does not offer a consistent condition (with flowing water during flood season only) for aquatic life to flourish, therefore no aquatic fauna (e.g. fish) was listed and observed during the field visit. However, during the post-BWRDP scenario, the storage dam will act as a storage pond for aquatic life to sustain.

592. There are no notified protected areas present in the project vicinity. Approximately more than 200 km south of the project area is Tor Ghar Community Game Reserve in District Qila Saifullah game reserve.

9.2.3 Social

593. During the execution of this study, consultations with relevant government officials, academia, NGOs and local community have been conducted to gain their perceptions of the project and ascertain the nature and scope of local participation in project planning and implementation.

9.2.4 Agriculture

594. Farm forestry should be promoted at Sri Toi area which can bring three-fold benefits for the farmers. Trees would not only fetch good revenues for the farmers but would also add to soil fertility on the farm level. Further some of the trees would also help in providing fodder to the livestock, while fruit of few trees such as mulberry and fig would supplement family nutrition.

595. Agro-silvo-pastoral system an integrated approach in which where majority of farmers have small land holdings for crop production along with livestock and trees on the same piece of land; maximizes the productivity of land. Project area has a good potential to support models of Agro-silvo-pastoral systems.

596. Farmers of the area have low knowledge on modern agriculture practices hence they need capacity building. For capacity building of farmers, informal methods have proved more effective than the formal class room lectures. Similarly, the practical demonstration of practices, tools, varieties etc. have shown better efficiency in terms of learning and application of these techniques. For the capacity building of farmers of the proposed command area, the modality of Farmer Field School (FFS) should be used.

597. **Farmer's Field School an important technique for capacity building of farmers:** Farmers of the area though have got some knowledge on the various agriculture practices, still for introduction of new varieties, tools and technologies they need some kind of capacity building/exposure. For this purpose, it would be much better that for capacity building of farmers of the proposed command area, the modality of Farmer Field School (FFS) should be used. FFS can help in dissemination of information on new technologies, varieties etc. FFS once organized can be used by the different agencies, NGO, companies dealing with the agriculture crop production for capacity building, promotion of products etc.

598. **Proper demarcation and preparation of land:** At present the proposed project area is lying in the form of a barren piece of land. The area belongs to Ahmed Khel sub-tribe of Mandokhel tribe and has not been put to settlement so far. The first step in bringing the area under cultivation is to conduct the settlement of the entire area. The settlement should follow the preparation and levelling of land for agricultural crop production. For land levelling proper techniques should be employed to allow for proper flow and drainage of water. Preparation and levelling of land should be followed by lay out for canals and distributaries, this will contribute to an efficient irrigation system, which is a pre-requisite for good agricultural crop production.

9.3 Conclusions

599. Environmental study criteria adopted for this study has been carried out for all three phases of each project components. These three phases considered are as follows:

- Impacts during Planning and Design Phase;
- Impacts during Construction Phase; and
- Impacts during Commissioning & Operation Phase.

600. Following is the conclusion statement of the study on the basis of environmental assessment carried out in this report:

601. “The Project was categorized as “Category A” Project due to following reasons:

- It is a greenfield Project;
- The adversity of impacts on the various environmental receptors (e.g. aquatic environment) was unknown at the initial stage due to absence of any baseline data. Such type of projects can sometimes bring significant negative changes in the physical, biological and socio-economic environments; and
- A storage dam of this magnitude (with a height of 66 meters) also requires preparation of an EIA study as per national environmental regulations (Pakistan EPA Review of IEE and EIA regulations, 2000).

602. However, after the detailed impact assessment activity, it is concluded that Project will bring mostly positive changes in physical, biological and socioeconomic environments. Some activities under this project have been identified to cause low to high environmental negative impacts and their mitigation measures have been prescribed. Proper and timely execution of these measures will reverse most of the negative impacts in the long term. Overall, the project causes higher positive impacts under the physical, ecological and socio-economic criterions and should be approved for implementation.”