

# Initial Environmental Examination (DRAFT)

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April 2015

## IND: Orissa Integrated Irrigated Agriculture and Water Management Investment Program: Tranche 2

Kansbahal Subproject  
(Tranche-2 Preparation)

IEE & Public Consultation Report  
(compliant with ADB Safeguard Policy Statement 2009)

Prepared by Department of Water Resources (DoWR), Project Management Unit (PMU) for the Asian Development Bank.

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**Department of Water Resources (DoWR)  
Project Management Unit (PMU)**

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**Orissa Integrated Irrigated Agriculture and  
Water Management Investment Programme (OIIAWMIP)  
( ADB Loan No. 2444 and OFID Loan No. 1251-P)**

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**Kansbahal Subproject  
(Tranche-2 Preparation)**

**Initial Environmental Examination (IEE)  
& Public Consultation Report  
(compliant with ADB Safeguard Policy Statement 2009)**

**August 2014**

**assisted by  
Institutional Strengthening and Project Management Consultants (ISPMC)**



**Hydrosult, Division of SNC- Lavalin Inc.**

**in association with**

**Sutra Consulting Pvt. Ltd., SBH Consultants Pvt. Ltd and N.K. Buildcon Pvt. Ltd**

## **PREFACE**

This “IEE & Public Consultation Report” for the proposed Kansbahal Subproject is intended to comply with the prerequisites for Preparation of Tranche-2 subproject of the OIIAWMIP.

This document, initially drafted during OIIAWMIP (Project 1, Tranche-1) preparations, is updated and revised to comply with ADB Guidelines related to the Safeguard Policy Statement 2009. This Report supersedes the Report on IEE & Public Consultation prepared for the proposed Subproject under ADB TA - 4814-INDIA during May 2008 by STUP Consultants and as well as draft report prepared during June 2012 and subsequent comments made during 21<sup>st</sup> May 2014. The necessary comments and suggestions given by ADB were incorporated.

A tabular guidance on the responses and compliance with the above mentioned ADB comments/requirements is presented on the following pages.

This Report supersedes the Report on IEE & Public Consultation prepared for the proposed Subproject under ADB TA - 4814-INDIA during May 2008 by STUP Consultants.

**August 2014  
ISPMC**

**(“Compliance to ADB Comments Dated 21<sup>st</sup> May 2014” table to follow this page)**

## Compliance to ADB Comments, Dated 21 May 2014 for Kansbahal Subproject

Reference	Comment Number	ADBs Comments	EAs Response
<b>CHAPTER EXECUTIVE SUMMARY</b>			
Section 1 para I Pg i	<b>NMA 1</b>	Please give the name in full at first mention of acronym	Where ever necessary acronyms elaborated refer Pgi to viii and list of abbreviations also added after contents
Section 2, 1 Para iii Pg i	<b>NMA 2</b>	What is CTA	Component Technical Assistance incorporated refer para ii
Section 5.4 Para viii, Pg iii	<b>NMA 3</b>	What is CD	Cross drainage structure refer para vii bullet 5
<b>CHAPTER I – INTRODUCTION</b>			
Para 3 Pg 1	<b>NMA4</b>	Some comment I made for Macchagaon-contractor is not an implementing agency.	Revised refer Para 3
Para 7 Pg 2	<b>NMA5</b>	Has this been confirmed by DOE?	As per EIA notification The expansion and modernization of existing projects or activities listed in the Schedule to this notification with addition of capacity beyond the limits specified for the concerned sector, project or activities which cross the threshold limits given in the Schedule, after expansion or modernization require environmental clearance hence these sub projects are not referred to Dept. of Environment
<b>CHAPTER II</b>			
Section 4 Para 16 Pg 6	<b>NMA6</b>	Please refer to my comments provided for Macchagaon –same corrections to be applied for.	Revised refer Para 12 some content deleted & 21, OSG replaced with Government of Odisha
<b>CHAPTER III</b>			
Section11 Para 98 Pg 25	<b>NMA7</b>	Canals or Embankments?	Its canals & embankments refer Para 97pg. 25
<b>CHAPTER IV</b>			
Para 1 Pg 29	<b>NMA8</b>	Same comment I given in my previous IEE on rather old data	Updated with latest available data refer

Reference	Comment Number	ADB's Comments	EAs Response
			Table 10, 14, 15, 16, 17, 18, 24, 25, 26, 28 Pg 29 to 50
<b>CHAPTER V</b>			
ParaF, Section 187 Pg 51	<b>NMA9</b>	Are we legalizing encroachments? Has Govt. agreed to this?	As per the recent assessment of the SIO & R & R Specialist there are no encroachment in the sub projects hence Para 185 bullet 4 Pg53
Para G, Section 189 Pg 52	<b>NMA 10</b>	Are we going for any work on the Dam? I thought not.	No work on the dam revised the Para 188 bullet 2 Pg. 54
		Similar comment of Machhagaon	Repetition deleted refer revised Para 199 subsection 11 last bullets Pg 57
			Revised Para 205 bullet 2 & 3 Pg. 60
			Revised Para 214 bullet 7 & 8 Pg. 63
Para M .Section 224. Pg 62	<b>NMA11</b>	?	Revised refer Para 217 bullet 2 Pg.64
			Revised Para 218, 219, 224 Pg 64
<b>Chapter IV</b>			
Para B Section 235. Pg 65	<b>NMA 12</b>	This should be moved to end where you discuss disclosure.	Para shifted to disclosure refer revise Para 236 & 237 Pg 72
Para C (i) Section 238 Pg 66	<b>NMA13</b>	If households in 6 locations didn't know the project, then how did \$ 100feel it was beneficial suggest you say majority of households.	Revised Para230 bullet 2 Pg.67
			Revised Para 235 as per similar comment made in other IEE reports comments Pg. 71
<b>Chapter - VII</b>			
Para D, section 251 Pg.73	<b>NMA14</b>	Will you also have a IP specialist?	No Vulnerable Groups Specialist of ISPMC will look in to IP issues
Para D, section 251 Pg.73	<b>NMA15</b>	What reports will the consultants review? Or they will be tasked with preparing monitoring reports?	Checking of Contractors Monthly reports and helping SIO in preparing Monitoring reports
Para E Section 253 Pg 74	<b>NMA 16</b>	Suggest you to give reasons why this was not done and also state the EARF is now being revised to reflect the new structure.	Incorporated see section E and Para 247

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**List of Abbreviations**

\$	US. Dollar
%	Percentage
ADB	Asian Development Bank
C	Centigrade
CAD	Command Area Development
CCA	Cultural Command Area
CFO	Consent for Operation
CFE	Consent for Establishment
CPCB	Central Pollution Control Board
CTA	Component Technical Assistance
Cu.mecs	Cubic meters
D.S.L	Dead Storage Level
DFO	Divisional Forest Officer
DG	Diesel Generator
DOWR	Department of Water Resources
DPR	Detailed Project Report
Dy.SIO	Deputy Sub project Implementation Officer
E	East
EARF	Environmental Assessment & Review Framework
EC	Environmental Clearance
EHS	Environment, Health and Safety
EIA	Environment Impact Assessment
EMP	Environmental Management Plan
ERM	Extension, Renovation and Modernization
FB	Foot Bridge
FGD	Focus Group Discussion
F.R.L	Full Reservoir Level
Ft	Feet
Gol	Government of India
ha	Hectares
Ham	Hectare Meter
HMP	Hot Mix plant
HR	Head Regulator
IEE	Initial Environmental Examination
IND	India
IS	Indian Standard
ISPM	Institutional Strengthening and Project Management
IUCN	International Union for Conservation of Nature and Natural Resources
IWRM	Integrated Water Resources Management
KM/ km/ Km	Kilo meters
KVA	Kilo - Volt - ampere
l	Litres
LA	Land Acquisition
LAA	Land Acquisition Act
M	Meters
M <sup>3</sup> / cu.m	Cubic Metre
MFF	Multi-tranche Financing Facility
MFI	Multilateral Financing Institutions
Mg	Milli grams
mm	Millimeters
MoEF	Ministry of Environment & Forests
N	North
NAAQS	National Ambient Air Quality Standards
NABET	National Accreditation Board for Education and Training

NABL	National Accreditation Board for Testing and Calibration Laboratory
NBSS	National Bureau of Soil Survey
NBSS&LUP	National Bureau of Soil Survey and Land use Planning
NGO	Non Governmental Organization
NIC	National Informatics Centre
NRRP	National Rehabilitation and Resettlement Policy
NWP	National Water Policy
O&M	Operation and Maintenance
OIIAWMIP	Orissa Integrated Irrigated Agriculture and Water Management Investment Program
OM	Operation Manual
O&M	Operation and Maintenance
OP	Operational Policies
OSPCB	Odisha State Pollution Control Board
PA	Protected Areas
PF	Protected Forest
PIM	Participatory Irrigation Management
PMU	Project Management Unit
PP	Pani Panchayat
PPE / PPG	Personnel Protective Equipments / Personnel Protective Gears
PPME	Project Performance Monitoring and Evaluation
PPTA	Project Planning and Technical Assistance
PRR	Powered Road Roller
PUC	Pollution under Control Certificate
RD	Reduced Distance
REA	Rapid Environmental Assessment
RF	Reserved Forest
RoW	Right of Way
RPM	Respirable Particulate Matter
R & R	Resettlement & Rehabilitation
SC	Schedule Caste
Sec	Seconds
SIO's	Sub- Project Implementation Officers
SOI	Survey of India
SPCB	State Pollution Control Board
SPS	Safeguard Policy Statement
ST	Schedule Tribes
SRC	Special Relief Commissioner
WMM	Wet Mix Macadam
WUAs	Water Users Association

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## **EXECUTIVE SUMMARY**

### **1. PROJECT BACKGROUND**

- i. The “Orissa Integrated Irrigated Agriculture and Water Management Investment Program” (OIIAWMIP) is an initiative by the Department of Water Resources (DoWR) of the Government of Odisha. It is intended to undertake the improvement of irrigation service delivery with **Pani Panchayat** (PP) empowerment and to enhance the productivity and sustainability of irrigated agriculture, thereby contributing to rural poverty reduction by increasing rural economic growth in the four northern river basins (Brahmani, Baitarani, Burhabalanga, and Subrenerekha river basins and a part of Mahanadi Delta areas. The Government of Odisha had obtained a **multi-tranche financing facility**(MFF) loan from the **Asian Development Bank**(ADB), titled MFF N0. 0022 and Loan No. 2444 IND(**India**). The loan includes funds for upgrading or undertaking **extension, renovation and modernization** (ERM) work in 6 major, 9 medium and 4 creek irrigation projects. The Kansbahal sub-project was classified as category B under ADB’s Safeguard Policy Statement, 2009.
- ii. The **Initial Environment Examination** (IEE) is normally part of the Appraisal Report. However, for the Kansbahal Sub- project, an IEE was prepared during **Component Technical Assistance**(CTA) period.

### **2. METHODOLOGY**

- iii. The general methodology adopted to accomplish the Initial Environmental Examination includes:
  - Review of legal and statutory requirements;
  - Review of feasibility study;
  - Preliminary reconnaissance to identify environmentally sensitive issues relating to the subproject and base line conditions;
  - Collection of Primary and secondary data;
  - Stakeholders Consultations;
  - Identify and assess the potential impacts of the subproject on the base line conditions and recommend mitigation measures to offset the identified adverse impacts;
  - Formulate Environmental Management Plan including review of Institutional set up and
  - Capacity Building.

### **3. DESCRIPTION OF THE PROJECT**

- iv. The Kansbahal medium irrigation sub-project is one of the sub-projects that have been proposed under the OIIAWMIP. Kansbahal subproject is in Brahmani basin with an earthen dam and distribution (canal) system. It has been constructed across the nallah Badjore a branch of Sankh river which is tributary of Brahmani basin near Kadambahal village, Rajghanpur Block of Sundergarh district in the north west of Odisha State.
- v. The Kansbahal subproject was initiated in the year in the year 1981 – 82, later obtained clearance from Central Water Commission, Govt. of India in the year 1987. The forest clearance was obtained from Ministry of Environment and Forest, Govt. of India through letter No.8- 41/ 87 FC dated 23 -07-1990 and first year of reservoir fill

took place in the year 1994 (DPR June 2010). Kansbahal Medium Irrigation scheme is in Rajgangpur Block, Sundargarh District in the North West of Odisha State. The dam is at latitude 22°10'46" N, and longitude 84°39'17" E falling under Survey of India Toposheet F 45G12, Scale 1:50,000 near Kadambahal village of Rajghampur block. The scheme is in the Brahmani river basin in the North Western Plateau agro-climatic zone of Odisha.

- vi. The subproject was designed for a gross command area of 7,212 ha, the original designed culturable command area (CCA) is 5050 hectares (ha) and CCA reduced to 4730 ha mainly due to conversion of cultivable land to homestead land and use of land for industrial purposes and also due to non construction of water courses in the entire designed command area. Out of which during kharif 2870 ha gets assured irrigation, 1440 ha is partially irrigated and deprived area under irrigation is 420 ha. During Rabi 742 ha is given full irrigation, 870 ha partially and 280 ha is deprived (DPR June 2010). The dam consists of a Homogeneous rolled fill earth dam of 1075 meters (m) in length, 28 m in height from deepest bed level of the river. The ogee shaped gravity type spillway has 5 No.s of radial gates to discharge with original length of 36.5 m and later extended to 87.02 m. The crest level of the Spillway is 222 m, fitted with 5 Nos of Radial Gates of size 12 m x 6 m having flood discharge capacity of 1745 Cumecs and its live storage capacity of 28.72 M. m<sup>3</sup>. The entire command area is irrigated over both sides of the canal. The distribution system consists of 2 distributaries (includes left and right main canal is considered as Main distributaries, 4 minors and 33 sub-minors). The total length of the distribution system, including the Left Main Canal (LMC) & Right Main Canal (RMC), is 92.931 Kilometer (Km).

#### **4. SCOPE OF WORK**

- vii. The Initial Environment Examination (IEE) has been prepared for Kansbahal subproject which covers:
- Renovation and modernization of the canal system by regulators, without increasing the command area. This entails the restoration back to the designed command area, without extending and widening the canal systems, and minimizing the losses by repairing the existing structures, and if necessary, the construction of additional structures as per the field requirement. Improvement of horizontal and vertical drains of the dam and construction of new causeway on approach road at down stream of spillway channel.
  - Bringing the canals to the original design section and providing necessary lining or guard walls as necessary and site conditions in the left and right main canals, distributaries and minor and sub-minor to arrest the present seepages as well as canal breaches caused by shrinkage and cracking of embankments.
  - Improving hydraulic performance of main canals (distributaries), checking for prism shape and stability, and also works to reduce rainfall runoff erosion of sediment into the canals.
  - Remodeling of existing Hydraulic control structures for improved flow control and flow measurement along the left and right bank main canals and to off-taking minors and sub-minors canals.
  - Construction of new cross drainage (CD) structures and repair of existing cross drainage structures to avoid water logging and properly designing drainage inlets to minimize entry of sediment into the canals.

- Providing additional new bridges and repairing the existing ones for improved access across canals.
- Renovating the outlets of the main canal, distributaries, minor and sub-minors.
- Improving the service banks of left main canal approx. length of 21.5 km and right main canal to a length of 4.52 km.
- Providing some tube wells along the entire length of left and right main canal, distributaries, minors and sub-minors was kept to provide water during canal closure period.

## **5. ENVIRONMENTAL CATEGORY OF THE PROJECT**

- viii. This sub- project is classified as “**Category B**” as per Asian Development Bank’s Safeguard Policy Statement, 2009. This project is one of the sub-projects of the CTA, which were prepared earlier. This sub-project does not have any major environmentally sensitive issues within the existing project area. There are no wild life sanctuaries nor national parks, eco-sensitive zones, protected monuments, endangered or exotic species of plants are present in the region, except movement of wild elephants in the catchment area. Although expansion and modernization of existing sub-projects (Irrigation / River valley) may involve Ministry of Environment and Forests (MoEF) clearance, the present sub-project does not extend to additional command areas; hence, no clearance is required. Since the project components include mainly renovation works, with no extension and widening of the canal system, the impact on natural resources is negligible, temporary and mitigable.

## **6. PROJECT ALTERNATIVES**

- ix. The project has little or no scope for alternatives in terms of locations, as it is an existing project and the scope of the present project is to improve the performance of an existing system without increasing the command and to cater to the needs of the people. The originally designed areas will be improved, through the rehabilitation of sections of the canals and by modernizing the system with regulators, minimizing the losses by repairing structures and constructing additional structures as per requirements. The investment costs are largely for the rehabilitation and upgrading of the existing systems. As the original design appears to be adequate, alternative solutions for rehabilitation are not foreseen at this time.

## **7. CLEARANCES REQUIRED FOR THE SUBPROJECT**

- x. After reviewing the various applicable environmental acts and statutes, as applicable to Government of India, Govt. of Odisha and ADB some of the clearances that are to be obtained by subproject implementation officers( SIO) / Contractor are:
- a. **Permission from State Forest Department** - In the sections of the canal where it passes through the reserved forest areas, Sub project Implementation Officer(SIO)/ DoWR shall obtain necessary permission for undertaking renovation / repair of the canals before initiating the civil works. To the possible extent tree cutting shall be avoided. if any trees need to be cut it shall be done after taking permission.
  - b. **Consent from Odisha State Pollution Control Board(OSPCB)** - All the construction contractors should obtain consent under the water and air act from Odisha State pollution control board before commencement of construction work for the plant and machinery (Hot Mix, Wet mix macadam (WMM), Batching, Crusher, Diesel Generator greater than 15 kilo-volt –ampere(KVA) they establish for the project if they are procuring from the vendor, the contractor should ensure that the vendors has the requisite consent from the State Pollution Control Board of Odisha.

The list of crushers whose consent has been given by OSPCB, Rourkela, Sundergarh district as on October, 2011 is enclosed as Annexure 2.

**c. Permissions from Department of Mines and Geology :**

- i. Contractor would obtain permission for transporting the soil from the Department of Mines and Geology or local bodies as applicable, along with the mutual agreement with the land owner in case of private lands.
- ii. Contractor would obtain permission for extracting boulders before quarrying; if the extraction of the boulder is being procured from the existing quarry/supplier, it shall be ensured that, the requisite license/ lease has been obtained from the concerned Authority.
- iii. Contractor would obtain permission for extracting sand before quarrying ; if the extraction of boulder is being procured from the existing quarry/supplier, it shall be ensured that the requisite license/ lease has been obtained from the concerned Authority.

**d. Permission from Commissioner of Explosives** - If the Contractor stores diesel or stores blasting materials he has to obtain permission or if procuring or executing through vendors he must ensure that the vendor has obtained permission.

**e. Permission from District Health Officer** - Contractor would obtain permission for establishing labour camps.

**f. Pollution under Control Certificates** - Vehicles and machineries engaged in the construction of the project will comply with the Motors Vehicle act and will be required to obtain pollution under control certificate.

**8. BASELINE ENVIRONMENTAL STATUS**

xi. The baseline environmental overview is as follows :

- a. **Topography**- The elevation in the project command area varies from 200 to 413 m; the highest contour is 413 m near the dam as per SOI Toposheet F45G12 & F45G11. The topography of the area is varying indicating high, medium and low lands. The general slope is varying towards north and east i.e. towards Sankh River.
- b. **Climate**. Historic rainfall data recorded at the dam site from 1996 to 2006 show a mean monsoon and annual rainfall of 1,113 mm and 1,240mm respectively. About 90% of average annual rainfall occurs during the monsoon period from June to October; 7% (88mm) during the non-monsoon months of February to May; and 3% (40mm) during the post monsoon period from November to January. Temperature variations are pronounced with minimums of 6°C to 22°C and maximums of 36°C to 48°C.
- c. **Geology & Soils** - The sub project areas are largely covered with Igneous Sedimentary and Metamorphic rocks. The Igneous rocks comprise Granite, Grano-Diorite Pegmatite type. The sedimentary rocks are largely alluvium in nature. The metamorphic rocks comprise khondalite, Charnokites and unclassified Crystallines. The sub project area falls in low damage risk zone.  
The sub project area covers five soil types in Rajgangpur block: (i) Black Soil (2%); (ii) Red Soil (32%); (iii) Sandy Soil (5%); (iv) Sandy Loam (24%); and (v) other types (37%).
- d. **Landuse** - The landuse of the subproject area, the dam, catchment area is surrounded by Kumaria reserved forest, Jambua reserved forest and Chudia reserved forest while the left canal system pass through mostly agricultural lands, waste lands like rocky outcrops or uncultivable waste lands, and small local nallas, crosses state highway and railway crossing. Two minors of left main canal Badnuagaon minor -1 RD 360m to 400 m and Badnuagaon minor -2 reducing

distance(RD) 720m to 750 m pass adjacent to the village forest on the right side. While the right main canal also originates in the reserved forest RD 0 to 100m falls in the Kumaria RF and passes through mostly agricultural lands, waste land or unculturable waste lands, local nallas and crosses village roads etc.

The project sites are not located in areas prone to water logging, salinization and flash floods.

- e. **Agro-climatic condition** - The Kansbahal subproject and Sundergarh district falls in the North-Western Plateau' Agro-Climatic Zone of Odisha. The district is primarily an agricultural district but rich in forest, mineral deposits and large scale industries like Rourkela steel plant, cement and fertilizer industries
- f. **Water Resources** - The water quality of the Kansbahal subproject is not monitored. The Kansbahal dam catchment area is forest land. It is likely that water quality of this river is very pristine, apart from some erosion, as there are no pollution sources in its catchment area as it is mainly a forest area. Groundwater resources in Rajgangpur Block were assessed in 1999 at 3,752 hecta-meters(ham), of which 12% is utilized for irrigation, and 9% for domestic and industrial purposes. There is potential for further groundwater development, particularly in the tail reach of the left main canal (LMC) where the water table is quite shallow (0-4m).
- g. **Biodiversity** - About 36% of the district is covered with dense forest and a long range of hills. The prevailing vegetation cover over the area is mainly of tropical dry deciduous forest [5B/C-1/C] as per the Champion and Seth (1968) "Classification of forest type of India". The dominant flora comprised generally the trees planted along canal side and road. Some of these trees may be required to be felled during the canal rehabilitation and construction work. The common trees observed are presented in Table 20. Within the Malidih reserved forest (RF) (200 m from Barenugaon), Ramlata RF (within 1 km of Kadambahal village) the major tree species are Sal (*Sorea robusta*), Mahua (*Madhuca indica*), Ashan (*Terminilia tomentosa*), Kendu (*Diospyros melanoxylon*), and Sirish- Chakunda (*Albizia lebbek*)..  
There are no government notified core habitations like elephant reserves or sanctuaries with in the area of influence of the project area. However the forests of the area has wild fauna like elephants, deer, bear, monkeys, squirrels, crow, sparrow, parrot and fowl etc. As per the Red Data Book Elephant is the endangered species and Black Bear is under Vulnerable category and the rest of the wild animals are of least concern status.
- h. **Demography** – The sub project area entirely falls under Rajganpur Block covering 24 numbers of villages covering 9 PPs having approximately 6658 number of beneficiaries from the project. The percentage of **Scheduled Caste** (SC) population is around 13.70 % and **Scheduled Tribes** (ST) population is around 73.62%.

## **9. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES:**

- xii. The potential positive and negative impacts were identified in relation to design, construction and operation for the proposed renovation works. The negative environmental impacts, both direct and indirect, associated with the project location and mitigative measures, and the impacts arising due to the construction phase of the project will be temporary and short term in nature.
- xiii. The direct and short term impacts concern the implementation stage of the ERM works which can be mitigable with **environmental management plan**(EMP) implementation. Mitigation reduce measures have been developed to reduce all negative impacts to acceptable levels. Special measures like identification of forest areas, potential farmers willing to give earth for borrow areas in private land and protection and safety measures for workers have been addressed in the EMP.

## **10. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION**

- xiv. In the most recent notification of the Ministry of Environment and Forests of 14 September 2006, (referred to in section III E of this IEE) modernization of irrigation projects does not require Public Consultation. However, Public Consultation and Information Disclosure is an essential element of the ADB Safeguard Policy Statement 2009, and included in the internal project procedures. The process of stakeholder, public consultation as well as outcome of consultations and information disclosure adopted for the subproject have been presented.
- xv. The subproject stake holders of the project include:
- Project benefitted communities or stakeholders or Pani Panchayat members,
  - Institutional stake holders such as **Pollution Control Board** (PCB), government institutions like Water Resource Department, State Pollution Control Board, Forest Department, Fisheries department, revenue etc.,
- xvi. The consultation and discussions were held with groups of beneficiaries during initial field visits and the preparation of feasibility studies for the core sub-projects. During these discussions, the scheme was discussed with groups of beneficiaries, typically 10 to 20 persons in size, and their views sought on key issues including (i) anticipated effects of the proposed scheme improvement, (ii) the extent and nature of changes in land use that may occur with improved supplies of irrigation water (iii) presence of any sites of archaeological or cultural importance (iv) land stability in the around the existing scheme and (v) potential land use conflicts. Focus group discussion for individual village and household surveys were conducted in selected villages to understand the present problem of irrigation system.
- xvii. The Institutional stake holders that were consulted were: Divisional Forest Office, Rourkela, State Pollution Control Board, Regional Office, Rourkela, District Fisheries Department, Sundergarh, etc.,. The feedback and suggestions obtained from these departments were used in screening the subproject and planning the activities.
- xviii. Summary findings of Consultation sessions with benefited communities are:
- Villagers will cooperate in all aspects for implementation of the prestigious project
  - They will accommodate the short term impacts during construction phase
  - They need real help from government side for regular testing of agricultural soil and irrigation water
  - Environmental awareness program will be required for non use of banned pesticide as well as personal safety during application of pesticide
  - Non availability of the canal water during construction work- villagers requested planning of construction work during lien period when irrigation water not much required
  - Introduction of organic manure, bio-fertilizer and vermi-compost will be required. Farmers have no knowledge on beneficial effect of utilization of bio-fertilizer
  - Minimization of conflict among water users through PP intervention
  - Necessity of permission from forest for felling of plantation trees
  - Solving of drainage problem particularly at head part

## **11. GRIEVANCE REDRESS MECHANISM**

- xix. The grievance mechanism for the subproject has been developed and discussed in the IEE report.

## **12. ENVIRONMENTAL MANAGEMENT PLAN (EMP)**

- xx. The EMP consists of the following features : (i) Institutional arrangement required for the subproject; (ii) staffing requirement for EMP implementation; (iii) Reporting System and the responsibilities of different institutions involved in EMP implementation (iv) Environmental management plan with the check list of anticipated impacts and suggested mitigation measures and the responsibility of different institutions and also stages of implementation (v) Suggesting Environmental monitoring plan with showing locations of monitoring, frequency and stage of monitoring; (vi) performance indicators for the subproject (vii) Environmental Monitoring and Management Costs and (viii) Capacity building requirements.

## **13. RECOMMENDATION**

- xxi. Recommends the subproject to be rated Category B for the following reasons: (i) There are no significant adverse impacts associated with this project in the local environmental condition due to construction and operation of the project. Instead the project is expected to improve irrigation facilities and enhance economic growth of the area; (ii) Increased irrigation will also help in planting of more trees thereby increasing the environmental conditions of the area adding to the greenery and general aesthetics of the area; (iii) The indirect benefits of the project will be lowered levels of out migration as the communities will have more opportunity of securing income from within the village; (iv) There will be growth in living standard of people, which will encourage proper education, social awareness, health facility and prosperity amongst the people; (v) The IEE clearly states in its findings that there will be no significant impact in the local environmental condition due to construction and operation of the project and preference shall be given to the local labour for carrying out the work.

**Mitigation** - Any impact associated with the project activities will be minor in nature and will be restricted only during the construction phase of the project. The dam, catchment area is surrounded by Kumaria reserved forest, Jambua reserved forest and Chudia reserved forest Two minors of left main canal Badnuagaon minor -1 RD 360m to 400m and Badnuagaon minor -2 RD 720m to 750 m pass adjacent to the village forest on the right side and the right main canal also originates in the reserved forest RD 0 to 100m falls in the Kumaria RF, so adequate preventive measures need to be observed such as not establishing construction camps/ plants and material in these areas.

- xxii. The SIO in the past had acquired private lands for borrow areas which may be utilized for some quantity of earth and even SIO in consultation with water users associations (WUAS) are in the process of identifying potential borrow areas in private land, these will also help in reducing the impact on forest land due to borrowing earth. Contractor may be required to abide by regulations pertaining to "sensitive / restricted" areas as well as by observing decent working practices (strict monitoring in not cutting any trees for fire wood in the forest areas, not hunting any wild life) and providing facilities at construction camp.

## **14. CONCLUSION**

- xxiii. The IEE has assessed potential environmental impacts associated with the subproject. There are no adverse impacts that are significant and complex in nature expected from implementation of this subproject.

- xxiv. The subproject is expected to improve the existing degraded irrigation infrastructure and will be put to beneficial use to the society. This will boost agriculture growth in the area and will bring prosperity to the region.
- xxv. By improving the irrigation infrastructure economic disparity between head end and tail end users will be reduced.
- xxvi. The potential adverse impacts are minimal as no additional land is required, and the impacts that may arise with construction and operation and small portion of the canal system close to forest can be mitigated through stringent monitoring and adopting strict construction practices by the Contractor and WUAs and implementing the suggested EMP measures.
- xxvii. IEE assessment confirmed the subproject Category B classification and will not require detailed EIA to be undertaken except obtaining required permits and certification as suggested in the IEE report.

## **I. INTRODUCTION**

### **A. OVERVIEW**

1. The Asian Development Bank (ADB) has agreed with national and state governments to fund the project in Odisha, which will include support for irrigated agriculture development and integrated water resources management with a loan of \$189 million in the form of a sector loan to utilize multi-tranche financing facility (MFF). The Government of India is promoting state-level sector reforms through its National Water Policy (NWP) 1987 and 2002, which advocates **participatory irrigation management (PIM)** and **integrated water resource management(IWRM)** to promote and sustain more efficient water use.
2. To support the process, in the late 1990s, the Government of Odisha has gradually developed the policy, planning and institutional basis for the irrigation and water resources. Specific steps taken include (i) promulgation of the State Water Policy and State Water Plan adopting Participatory Irrigation Management (PIM) and Integrated Water Resources Management (IWRM) principles, (ii) establishment of a legal framework for WUAs, (iii) substantial increase in the water tariff and O&M financing, and (iv) capacity strengthening of the Department of Water Resources (DoWR).
3. As an effort towards attaining these objectives ADB will assist the State through Multi-tranche financing facility "Orissa Integrated Irrigated Agriculture and Water Management Investment Program (OIIAWMIP) to be implemented under Several tranches. The project has a wider objective to improve the irrigation service delivery with Pani Panchayat (PP) empowerment to enhance the productivity and sustainability of irrigated agriculture, thereby contributing to rural poverty reduction by increasing rural economic growth and reduce poverty in the four northern river basins (Brahmani, Baitarani, Burhabalanga, and Subrenerekha river basins) and a part of Mahanadi Delta areas. The executing agency is the Department of Water Resources (DoWR). **The DoWR, Odihsa will be the implementing agency and the projects are operated through a Project Management Unit (PMU), and the works will be outsourced to private contractors selected under National Competitive Bidding.**
4. The project will assist in preparation of operation plans and procedures and an improved canal operation PME system to provide canal managers with (minimal) data. Assistance for O&M, and regular training, will continue during and after system ERM to facilitate adoption of improved procedures by both the DoWR managers and Pani Panchayts (PPs).
5. The major components of the OIIAWMP include:
  - the rehabilitation of irrigation systems within five major river basins, namely the Subernarekha, Burhabalang, Mahanadi, Baitarani and Brahmani covering a total area of 300,407 ha;
  - supporting the practical implementation of integrated water resources management using a river basin approach;
  - strengthening the capacity of irrigation water delivery agencies;
  - promoting participatory irrigation management through water user association;
  - Supporting improvements in the quality of and access to agricultural support services.

6. This report investigates the environmental impacts associated with one such intervention: the rehabilitation of a medium flow irrigation scheme: **Kansbahal**, located in Sundergarh District. The scheme benefits 24 villages approx covering Rajganpur block with 9 Pani Panchayats (PPs). There are a number of government welfare schemes operating in the project villages. Access of households to the Midday Meal (which is provided to primary school children) scheme is high 53%. Access and rating of other welfare schemes was low, so impact is probably limited. Indira Awas Yojana is a central government program providing assistance for house construction for below poverty line (BPL) households. Swarna Jayanti Swarojgar Yojana (SJSY) provides assistance (loans) for self employment to BPL households. Other schemes, which have overall access of 35% of households were schooling for scheduled tribes, Pradhan Mantri Gram Sadak Yojana (Prime Ministers road scheme), and others.

## **B. PURPOSE OF THE REPORT**

7. Kanbahal medium irrigation system (with an earthen dam and distribution (canal) system) is one of the sub-projects to be funded under Tranche -2. The project will include the rehabilitation and resectioning of an existing medium canal irrigation scheme. The Initial Environmental Examination (IEE) report investigates the environmental impacts based on the preliminary design and estimates. It is mandatory that the sub-project considered for implementation complies with all relevant environmental requirements of the Government of India, the State Government of Odisha, and ADB's safeguard Policy Statement (SPS) 2009. The Environment Impact Assessment (EIA) Notification of 2006, Govt. of India is the basis for environmental assessment. The expansion and modernization of existing projects or activities listed in the Schedule to this notification with addition of capacity beyond the limits specified for the concerned sector, project or activities which cross the threshold limits given in the Schedule, after expansion or modernization require environmental clearance. As this sub-project involves renovation of the existing canals to its original designed capacity, repair of existing structures and construction of some new additional structures (Village Road Bridges, Bathing ghats etc) are involved in the project without increase in the command areas or no new canal are proposed, so doesn't require any environmental clearances.

## **C. THE STUDY METHODOLOGY**

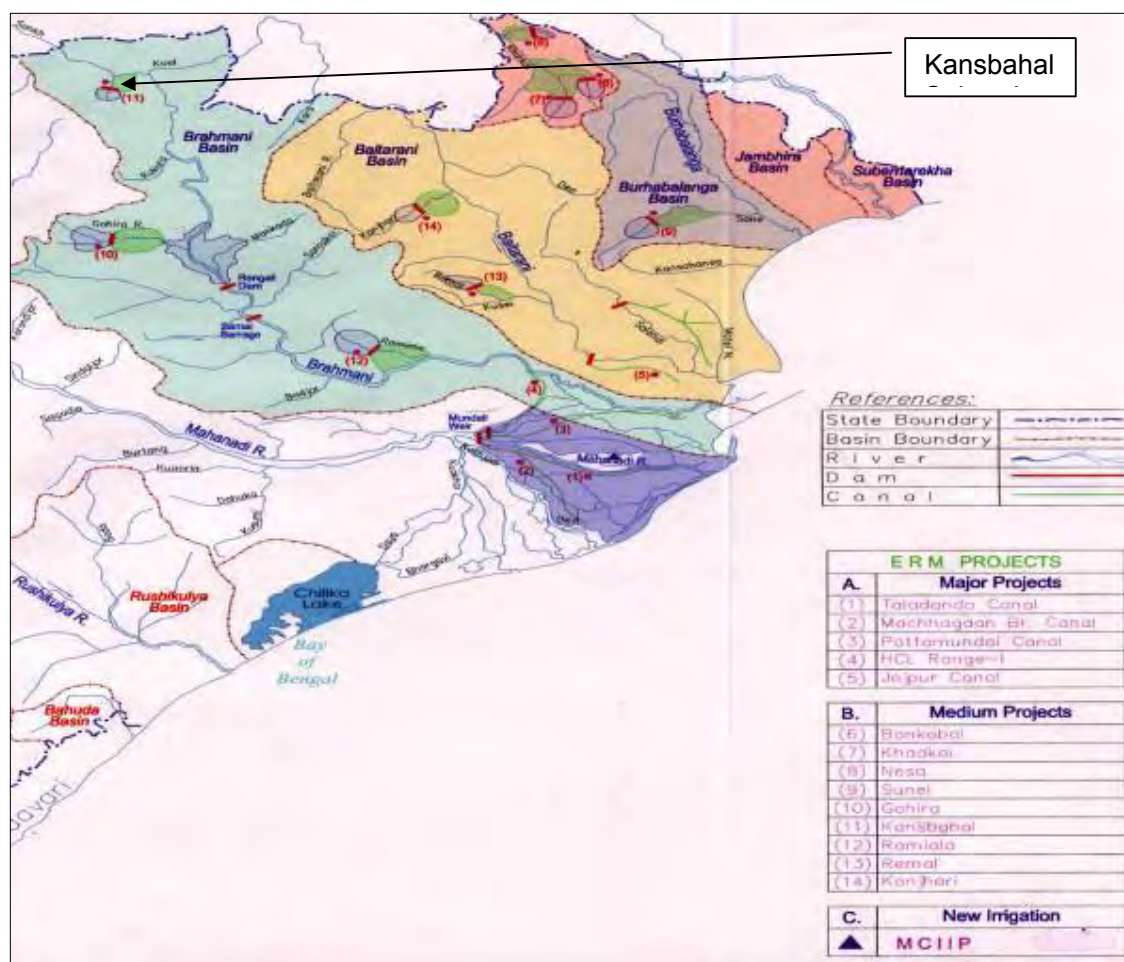
8. The IEE was prepared based on the detailed screening and analysis of all environmental parameters, field visits to the project site to assess the present condition of the system and level of intervention required. The data to establish baseline environmental status of the project was collected from various secondary sources like published literature, reports, official web sites and meeting with the key personnel. Public consultation was undertaken at six villages in the project area. The villages were selected in such a way that they were chosen to be representative of the head, middle and tail end of the project to get views of the project affected community. An environmental management plan is included to mitigate the adverse impacts of the project.

## **D. PROJECT LOCATION**

9. Kansbahal irrigation subproject is a medium category irrigation scheme in Brahmani basin with an earthen dam and distribution (canal) system. It has been constructed across nallah Badjore a branch of Sankh river which is a tributary of Brahmani basin in Rajgangpur Block, Sundargarh District in the North West of Odisha State. The Kansbahal subproject was initiated in the year 1981 – 82, later obtained

clearance from Central Water Commission, Govt. of India in the year 1987(DPR Kansbahal, June 2010). The forest clearance was obtained from Ministry of Environment and Forest, Govt. of India through letter No.8- 41/ 87 FC dated 23 -07-1990 and first year of reservoir fill took place in the year 1994. Kansbahal Medium Irrigation scheme is in Rajgangpur Block, Sundargarh District in the North West of Odisha State. The dam is at latitude 22°10'46" N, and longitude 84°39'17" E near Kadambahal village of Rajganpur block. The scheme is in the Brahmani river basin in the North Western Plateau agro-climatic zone of Odisha. The District headquarters at Sundargarh is 81km from the dam site, and the steel city of Rourkela is 32km away. The main railway line passes through the scheme. The scheme's location is shown on Figure 1 and the index map is enclosed as Annexure -1.

Figure 1: Sub-project Location



## **E. STRUCTURE OF IEE REPORT**

10. In line with the ADB's SPS 2009, the IEE report has 10 chapters. The details are as:

1. **Executive Summary:** The section deals briefly with the critical facts, significant findings and recommendations.
2. **Chapter 1: Introduction** This chapter describes with overview of the project, purpose of the report, study methodology and project location
3. **Chapter 2: Policy, Legal and Administrative Frame work for Environment Management** chapter provides environmental management and protection policies, regulations as per the Ministry of Environment, Govt. of India, Govt. of Odisha and ADB environmental policies and the required clearance for the subproject.
4. **Chapter -3: Description of the Project** This chapter briefly describes the present condition of the various structures under the **Kansbahal** irrigation subproject and a description of the proposed engineering recommendations.
5. **Chapter 4: Description of the Environment.** The section includes baseline conditions for the physical and natural environment, socio economic and demographic profile of the project area. The data presented in the report is gathered from secondary sources.
6. **Chapter 5: Anticipated Environmental Impacts and Mitigation Measures** Chapter describes the extent of the impacts of the project activity on the existing environment. The focus of section is on the adverse impacts however the beneficial impacts are also reported in this chapter.
7. **Chapter 6: The Information Disclosure, Consultation and Participation** chapter gives information on consultation, stages and levels of consultation process and findings of the public consultation conducted in six villages as part of the project.
8. **Chapter 7 Grievance Redress Mechanism** Chapter provides the proposed mechanism for grievances.
9. **Chapter 8: Environmental Management Plan** Chapter describes the measures recommended for mitigating the adverse impacts arising out of the project. This chapter also emphasizes on the roles and responsibilities, regular monitoring activities, supervision and reporting of monitoring of various environmental components during different phases of the project.
10. **Chapter 9** Gives findings and recommendations of the IEE study.
11. **Chapter 10** includes the conclusion of the IEE study.

## **II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK**

11. The environmental management and protection policies, regulations and administrative framework governing the project are reviewed in this section. The review includes sector-specific environmental policies and regulations of the Government of India, State Govt of Odisha, ADB's Safeguard Policy Statement, June, 2009, and the administrative framework of various agencies, such as the Ministry of Environment and Forest (MoEF), the Pollution Control Boards and other bodies associated with the implementation of the proposed subproject.

### **A. MANDATORY REQUIREMENTS (FUNDING AGENCY)**

#### **1 Asian Development Bank's Safeguard Policy Statement (June 2009)**

12. The following are the requirements under Asian Development Bank's safeguard policy.

#### **2 Environment Categorization**

13. Under ADB's Safeguard Policy Statement 2009, ADB uses a classification system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Projects are assigned to one of the following four categories:

- Category A:** Projects with potential for significant adverse environmental impacts which are irreversible, diverse, or unprecedented. An environmental impact assessment (EIA) is required to address significant impacts.
- Category B:** Projects judged to have some adverse environmental impacts, but of a lesser degree and or significance than those of category A projects. An initial environmental examination (IEE) is required to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
- Category C:** Projects unlikely to have adverse environmental impacts. No EIA or "IEE is required, although environmental implications are still reviewed.
- Category F1:** Projects are classified as category F1, if they involve a credit line through a financial intermediary. The financial intermediary must apply an environmental management system; otherwise all subprojects will result in insignificant impacts.

#### **3 Environmental Management Plan**

14. It addresses the potential impacts and risks identified through the process of environmental assessment and the level of details and complexity of the EMP. It identifies impacts and risks and the priority measures and actions that will commensurate with the project.

#### **4 Public Disclosure**

15. The IEE summary will be translated in to local language and disclosed to Water Users Association (WUA) level. The copy of the full IEE will be available with subproject Implementation Office (SIO) and Project Management Unit (PMU) and will be made available for the stakeholders as and when asked for. A copy of the IEE Summary will be disclosed through the DOWR website and in ADB website as well.

## **B. MANDATORY REQUIREMENTS (NATIONAL)**

### **5 Environmental Regulatory and Policy Framework for Subproject Selection**

16. The environmental regulations of the Government of India have laid out various policy guidelines, acts and regulations pertaining to the sustenance of environment. The acts that are applicable to this project are summarized in the sections below.

### **6 Constitutional Provisions**

17. The Constitution of India, in Article 48, of Directive Principles of the State, states that “the state shall endeavour to protect and improve the environment and to safeguard forests and wildlife of the country”. Further Article 51-A (g), of fundamental duties, emphasizes that, “It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures”. These two provisions of the constitution are the guiding principles for the environmental legislation in India.

18. The Government of India has laid down various policy guidelines, regulations, acts and legislations pertaining to the sustainability and protection of the environment and its various components. The statutory requirements for the proposed subproject are discussed briefly in the following paragraphs.

### **7 The Environment (Protection) Act, 1986 and the Environmental Impact Assessment Notification, 14th September 2006**

19. The Environmental (Protection) Act, 1986 is the umbrella legislation providing for the protection of the environment in the country. This act provides the Environment (Protection) Rules, which were formulated in 1986. The Environmental Impact Assessment Notification, 1994 and the various amendments thereto have been notified under this act. The Ministry of Environment and Forests (MoEF) has enacted a new notification under the Environmental Protection Act, 1986 related to environmental clearance (EC) of the developmental projects with effect from September 14, 2006.

20. According to this notification, developmental projects are classified as category A and Category B based on their size, nature, location and possible environmental impacts. All the projects included in Category A require environmental clearance from the MoEF, Government of India. The list of projects or activities requiring environmental clearance and their categorization is given in the schedule of this notification. According to this notification, expansion and modernization of existing projects or activities listed in the schedule to this notification with addition of capacity beyond the limits specified for the concerned sector, project or activities which cross the threshold limits given in the Schedule after expansion or modernization requires environmental clearance.

21. During discussions held with officials of the department of environment and forests **Odisha State Government** (OSG). The state department of environment (DOEn) is of the view that new irrigation projects encompassing a command area less than 500 ha need not require EC. In view of this all the new major, medium and minor projects that are likely to increase the command area more than 500 ha and will need an EC from the SEIAA and projects whose command area increases equal to or more than 10,000 ha will need an EC from the central government.

22. This Kansbahal sub-project is an existing medium irrigation subproject where renovation of existing canals to its original designed capacity, repair of existing structures and construction of new additional structures like village bridges, etc are involved in the project activities. Since no new canals and no additional command area is being

increased under this sub-project so doesn't require environmental clearance as per the provisions of EIA notification 2006.

## **8 The Water and Air (Prevention and Control of Pollution) Acts**

23. The Water (Prevention and Control of Pollution) Act, 1974 resulted in the establishment of the Central and State level Pollution Control Boards, (CPCB and SPCB) whose responsibilities include managing water quality and effluent standards, as well as monitoring water quality, prosecuting offenders and issuing licenses for the construction and operation of developmental projects requiring water as a resource. The Air (Prevention and Control of Pollution) Act, 1981, empowers the SPCBs to enforce air quality standards set by the CPCB.
24. During the construction phase of the project, if plants like concrete mixing plants, hot mix plants, crushers, diesel generators etc are installed., will require consent {consent for establishment (CFE) and consent for Operation (CFO)} from the Odisha State Pollution Control Board(OSPCB) pursuant to the Water (Prevention and Control of pollution) Act of 1974, The Water Cess Act of 1977 and the Air (Prevention and Control of Pollution) Act of 1981.
25. This consent will be taken by the construction contractor. If the contractor is procuring the material from the vendors, he must ensure that the vendor's have consent from the OSPCB. This would be applicable to all the major, medium and minor sub projects of this loan programme.

## **9 The Hazardous Waste (Management and Handling) Rules, 1989**

26. The Central Government formulated these rules under the Environment (Protection) Act, 1986. Under Section 7 of these rules it is required that the operator or occupier of a facility dealing with hazardous waste ensures that hazardous waste is packaged in a suitable manner for storage and transport and that the labeling and packaging shall be easily visible and be able to withstand physical conditions and climatic factors.
27. Bituminous and other materials used in construction are considered as hazardous in nature. Section 9 of these Rules also requires that in case of an accident during transportation of hazardous wastes, the operator or occupier of a facility shall immediately report to the SPCB in the prescribed form. This statute applies to the contractor's if they are involved, in handling (including storing) and transshipment of hazardous bituminous materials during construction or black topping of the project dam roads.

## **10 The Forest (Conservation) Act, 1980**

28. The Forest (Conservation) Act, 1980 pertains to the cases of diversion of forest area for non-forestry use. The forest management rules, 2003 provide the guidelines for conversion of forest land for non-forest purposes. According to these rules the process of obtaining forest clearance under the new amendment varies with the legal status of the forestland to be diverted. There are two types of forests namely, reserved and protected, whose forest land can be diverted for non forest purposes. Reserved Forest (RF) is an area notified under the provisions of the Indian Forest Act or the State Forest Acts, with a full degree of protection. In Reserved Forest, all activities are prohibited unless permitted. Protected Forest (PF) is an area notified under the provisions of Indian Forest Act or the State Forest Acts with a limited degree of protection. In Protected Forests all activities are permitted unless prohibited specially through a notification. It also restricts felling of trees and regulates diversion of forestland for non-forest use.

**a In the case of Reserved Forest**

- (i) If the area of forests to be cleared or diverted exceeds 40 ha then prior permission will be granted by MoEF, GOI, New Delhi.
- (ii) If the area of forest to be cleared or diverted is between '5 to 40' ha, then the case would be put to the state advisory committee for consideration. The committee after studying the case will make its recommendation to the MoEF, GOI for formal approval.
- (iii) If the area of forest to be cleared or diverted is below or equal to 5 ha, then the MoEF regional office is empowered to give the approval.
- (iv) If the area to be clear-felled has a forest density of more than 40%, permission to undertake any work is needed from the Central Government, irrespective of the area to be cleared.

**b. In the case of Protected Forest**

29. The MoEF regional office is empowered to accord Forest clearance for an area up to 5 hectares, which is to be cleared.

30. The procedure for getting the forest clearance is as follows:

- (i) The user agency will submit an application to the District Forests Officer (DFO) seeking conversion of forest land for non forests purpose.
- (ii) The DFO will scrutinise the application and forward it to the state conservator of forests (CFO) with his recommendations.
- (iii) The state forest department will estimate the cost of compensatory afforestation as twice the cost of area likely to be submerged/ acquired and suggest the user agency to deposit this amount to the state forests department.
- (iv) The state forests department will also identify the land for compensatory afforestation and submit the application along with a compensatory afforestation plan to the Secretary MoEF, Government of India.
- (v) The expert committee scrutinizes the application and state government's proposal for compensatory afforestation. If required, the committee will also under take site visits.
- (vi) The committee accords approval provided the application and compensatory afforestation proposals are satisfactory
- (vii) The state government submits the compliance report stating the status of implementation of compensatory afforestation plan and conditions given in MoEF's first stage clearance.
- (viii) After review of the compliance report MoEF accords formal forest clearance.

31. This sub-project is an existing project involving forest areas, it was initiated in the year in the year 1981 – 82, later obtained clearance from Central Water Commission, Govt. of India in the year 1987. The forest clearance was obtained from Ministry of Environment and Forest, Govt. of India through letter No.8- 41/ 87 FC dated 23 -07-1990 and first year of reservoir fill took place in the year 1994. So, SIO has to obtain permission for renovating of the canal for the sections passing through the reserved forest from State Forest Department before initiating the works. However, there are some trees on the canal embankments i.e. within ROW if any tree need to cut under unavoidable situation, then SIO should obtain permission for tree cutting from State Forest Department.

## 11 The Wild Life (Protection) Act, 1972

32. The Wildlife (protection) Act, 1972 has allowed the government to establish a number of National Parks and Sanctuaries over the past 25 years, to protect and conserve the flora and fauna of the state. The act will be applicable to this project if the command area of any sub project encroach any National Park or Sanctuary wh houses habitats of wild animals. The wild life sanctuaries and national parks in the river basins under consideration are given in Table 1below. This sub projects identified for tranche -2 funding do not fall within these Protected Areas (Pas).

Table 1 **List of National Parks and Sanctuaries in OIIAWMP Area**

Sl. No.	Name of the Protected Area (PA)	Area Sq. km.
<b>National Parks</b>		
1.	Bhitarkanika	145.00
2.	Similipal	845.70
<b>Sanctuaries</b>		
1.	Bhitarkanika	672.00
2.	Similipal	2200.00
3.	Satakosia Gorge	795.52
4.	Hadagarh	191.06
5.	Khalasuni	116.00
6.	Kuldiha	272.75
7.	Gahirmatha (Marine)	1435.00

(Source: Wild life, Odisha, Forest Department, Government of Orrisa, 2004)

No wildlife sanctuaries or protected areas are present near to the subproject.

## 12 The Motor Vehicles Act, 1988

33. In 1988, the Indian Motor Vehicles Act empowered the State Transport Authority (usually the Road Transport Office) to enforce standards for vehicular pollution and prevention control. The authority also checks emission standards of registered vehicles, collects road taxes, and issues licenses. In August 1997, the Pollution Under Control Certificate (PUC) programme was launched in an attempt to crack down on the vehicular emissions in the States. Since this act is applicable for all states, this will be applicable for this project.

34. All the vehicles that will be used in construction of the subprojects will have to comply with the PUC norms set down under this act.

## 13 The Ancient Monuments and Archaeological Sites and Remains Act, 1958

35. According to this Act, the area within the radii of 100 meters (m) and 300m from the "protected property" are designated as a "protected area" and "controlled area" respectively. No development activity (including building, mining, excavating, blasting) is permitted in the "protected area" and development activities likely to damage the protected property are not permitted in the "controlled area", without prior permission of the Archaeological Survey of India (ASI), if the site/remains/ monuments are protected by ASI. The likely subprojects command area does not have any protected property and therefore, this act will not be applicable for the project. However, there may be a possibility that artifacts of coins, structures, fabrics or any other archaeological relics may be identified during the construction phase. If such a situation would arise this Act would then apply. However, in case of chance finds, the contractors will be required to follow a protocol; as defined in the Environmental Management Plan.

**14 Land Acquisition and Resettlement & Rehabilitation:**

36. The following acts and policies would be applicable to the sub-projects under OIIAWMIP.

**i. Land Acquisition Act, 1894 (LAA-1894)**

37. In India, compensation for land acquisition (LA) and resettlement assistance for project-affected people is governed by the Land Acquisition Act (LAA), 1894 which has been amended from time to time. Under the Land Acquisition Act of 1894, compensation is paid only to the legal titleholders and does not provide any compensation package to the non-titleholders like encroachers, squatters etc. LAA, as amended in 1984 provides the legal framework for land acquisition for a public purpose in India. It enables the State Government to acquire private lands for a public purpose, and seeks to ensure that no person is deprived of land except under the Act.

**ii. National Rehabilitation and Resettlement Policy, 2007 (NRRP-2007)**

38. The National Rehabilitation and Resettlement Policy, 2007 (NRRP-2007) was adopted by the Government of India in 31<sup>st</sup> October, 2007 to address development-induced resettlement issues. The policy provides for the basic minimum requirements, and all projects leading to involuntary displacement of people must address the rehabilitation and resettlement issues comprehensively. The State Governments, Public Sector Undertakings or agencies, and other requiring bodies shall be at liberty to put in place greater benefit levels than those prescribed in the NRRP-2007. The principles of this policy may also apply to the rehabilitation and resettlement of persons involuntarily displaced permanently due to any other reason.

**iii. The Orissa Resettlement and Rehabilitation Policy, 2006**

39. The State Government of Odisha in 2006 have framed and adopted a comprehensive resettlement and rehabilitation policy named "The Orissa Resettlement and Rehabilitation Policy, 2006" in order to ensure sustained development through a participatory and transparent process. It shall apply to all those projects, for which acquisition of private land under Land Acquisition Act, 1894 or under any other law's for the timebeing in force or proclamation inviting objections in case of Government land is notified. This shall also be applicable to all projects for which land is acquired through negotiation under the provisions of this Policy

40. The subproject Kansbahal does not require additional land only existing acquired land is being utilized. There are no encroachments in the form of structures in the acquired land.

**iv. Involuntary Resettlement Policy of Asian Development Bank**

41. The Safeguard Policy Statement (2009) of Asian Development Bank's (ADB) is being followed for preparing this resettlement plan. The main objectives of the ADB policy include:

- to avoid involuntary resettlement wherever possible;
- to minimize involuntary resettlement by exploring project and design alternatives;
- to enhance, or at least restore, the livelihoods of all affected persons in real terms relative to pre-project levels; and to improve the standards of living of the affected poor and other vulnerable groups

42. This sub-project Kansbahal doesn't require any land acquisition but there are some encroachments which would be surveyed and addressed separately in the Resettlement Report.

#### **15 Public Liability Insurance Act, 1991**

43. This Act provides for public liability insurance for the purpose of providing immediate relief to the persons affected by an accident occurring while handling any hazardous substance and for matters connected therewith or incidental thereto. The transportation of hazardous substances by vehicle use is also included. This statute would apply on the implementers of the Project.

#### **16 Central Pollution Control Board (CPCB)**

44. It is a statutory authority attached to the MoEF located at New Delhi. The main responsibilities of CPCB include the planning and implementation of water and air pollution programmes; advising the Central Government on water and air pollution programmes; setting air and water standards and co-ordinating with the SPCBs.

#### **17 Odisha State Pollution Control Board (OSPCB)**

45. The OSPCB is the government agency responsible for ensuring the compliance to relevant standards related to discharges in the environment. The activities of the OSPCB include, planning and executing state level air and water quality initiatives; advising the state government on air, water and industry issues; establishing standards based on National Minimum standards and enforcing and monitoring of all activities within the state under the Air Act, the Water Act and the Cess Act.

#### **18 Applicability of International Environmental Agreements**

46. In addition, international conventions such as the International Union for Conservation of Nature and Natural Resources<sup>1</sup> (IUCN), Convention on Migratory Species of Wild Animals (CMS)<sup>2</sup> and Ramsar Convention on Wetlands of International Importance<sup>3</sup> are applicable for selection and screening of sub-projects under restricted / sensitive areas. India is a party to these conventions

#### **19 Odisha State Legislations and Acts and Other relevant Guidelines/ Standards**

47. Over and above, the project also gives due importance to the Indian standards, norms, guidelines and management procedures related to canal or irrigation projects such as IS 4701 reaffirmed 1995 i.e. Code of Practice for Earth work on canals and IS 4839 (part -1)1992, etc.
48. The Government of India in the Ministry of Labour & Employment have enacted the Building and Other Construction Workers (Regulation of Employment and Conditions of Service of the Buildings and other Construction Workers and to provide their safety, health and welfare measures. To enforce the same the Government of Odisha has formulated rules namely the Orissa Building and other Construction Workers (Regulation of Employment and conditions of Service) Rules, 2002. As per the act Government has

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<sup>1</sup> The IUCN provides Red List of Threatened Species which provides comprehensive information on the global conservation status of plants and animal species. The IUCN Red List is applicable for assessing global risk of extinction for species world over. The objective of the list is to highlight and convey the need for species conservation issues to public, policy makers and researchers

<sup>2</sup> CMS also known as Bonn Convention, recognized that states must be the protectors of migratory species that live within or pass through their national jurisdictions, and aim to conserve terrestrial, marine and avian migratory species through out their ranges. Migratory species threatened with extinction are listed on the Appendix I of the Convention. The signatories have to strive towards protecting these species.

<sup>3</sup> The convention on Wetlands of International importance ( Ramsar Convention) provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources, As per this there are 25 designated wetlands in India, Chilka in Orissa is one among them

to deposit 1 % cess of the cost approved as per the tendered notification. The amount needs to be deducted from the bill at the time of making payment to the contractor.

49. According to the Child Labour Act, children at the age of 14 to 18 years, if employed shall not be engaged in hazardous working conditions.

50. The constitution of India has provisions for ensuring the health and wellbeing of all employees need to be protected and the state has the duty to ensure protection. For this sub-project, the mitigation measures were based on the World Bank Environmental, Health and Safety (EHS) Guidelines.

## **20 Orissa minor mineral concession Rules 1990 amended 2004**

51. As per the act, no person shall undertake any quarrying operations for the purpose of extraction, collection and /or removal of minor minerals except under and in accordance with terms and conditions of the quarry lease, permit and / or auction sale, various rules which are important and relevant to the project activities are stated below:

- Extraction, collection, and / or removal of minor minerals by a person from his own land for normal agricultural operations or other bonafide domestic consumptions shall not be construed as quarrying operations.
- The government may have restrictions in granting a quarry lease; for an area upto 5 Ha, the permit and lease should be obtained from Tahasildhar, Revenue Department, Govt. of Odisha and above 5 Ha, from the Sub-Collector, and in the case of Forest Lands, it should be from Divisional Forest Officer and for the Minor minerals other than those specified in item I(1) of Schedule III, regardless of location, from the Mining Officer and Deputy Director of Mines, Department of Steel & Mines.
- Chapter II section 14 sub. Section 8 states the conditions of quarry lease; it states that the lease shall not carry on or be allowed to be carried out on , any quarrying operations at any point with in a distance of: (a). One hundred meters from any railway line, national highway, state highway or any reservoir; or (b) with in a distance of 50 meters from any tank, canal, road (other than National or State highways) except under and under in accordance with the permission of the Collector.
- Section 21 and 23 states lessee shall ensure major erosion and observe all such environmental safeguards as provided in the act and in case of granite quarry, proper reclamation should be done with plantation.
- It also states if the land leased out is a private land, the lessee shall pay a reasonable compensation, as agreed upon between the lessee and the owner of the land.
- It also states that the depth of quarry below the surface shall not exceed six meters

## **C. CLEARANCES REQUIRED FOR THE SUBPROJECT**

52. After reviewing the various applicable environmental acts and statutes, as applicable to Government of India, Govt. of Orissa and ADB some of the clearances that are to be obtained by SIO / Contractor are:

- **Permission from State Forest Department** - In the sections of the canal where it passes through the reserved forest areas, SIO/ DoWR shall obtain necessary permission for undertaking renovation / repair of the canals before initiating the civil works and to the possible extent tree cutting shall be avoided, if any trees need to be cut it shall be done after taking permission.
- **Consent from Odisha State Pollution Control Board** - All the construction contractors should obtain consent under the water and air act from Odisha State pollution control

board before commencement of construction work for the plant and machinery (Hot Mix, WMM, Batching, Crusher, Diesel Generator greater than 15 KVA) they establish for the projector if they are procuring from the vendor, the contractor should ensure that the vendors has the requisite consents from the State Pollution Control Board of Odisha. The list of crushers whose consents has been given by OSPCB, Rourkela as on October, 2011 is enclosed as Annexure 2.

- **Permissions from Department of Mines and Geology :**

- i. Contractor would obtain permission for transporting the soil from the Department of Mines and Geology or local bodies as applicable, along with the mutual agreement with the land owner in case of private lands.
- ii. Contractor would obtain permission for extracting boulders before quarrying; if the extraction of the boulder is being procured from the existing quarry/supplier, it shall be ensured that, the requisite license/ lease has been obtained from the concerned Authority.
- iii. Contractor would obtain permission for extracting sand before quarrying ; if the extraction of boulder is being procured from the existing quarry/supplier, it shall be ensured that the requisite license/ lease has been obtained from the concerned Authority.

- **Permission from Commissioner of Explosives** - If the Contractor stores diesel or stores blasting materials he has to obtain permission or if procuring or executing through vendors he must ensure that the vendor has obtained permission.
- **Permission from District Health Officer** - Contractor would obtain permission for establishing labour camps.
- **Pollution under Control Certificates** - Vehicles and machineries engaged in the construction of the project will comply with the Motors Vehicle act and will be required to obtain pollution under control certificate.

### **III DESCRIPTION OF THE PROJECT**

#### **A. TYPE AND NEED OF THE PROJECT**

53. Kansbahal irrigation subproject is a medium category irrigation scheme in Brahmani river basin with an earthen dam and distribution (canal) system. It has been constructed across nallah Badjore a branch of Sankh river which is a tributary of Brahmani basin is in Rajgangpur Block, Sundargarh District in the North West of Odisha State. The Kansbahal subproject was initiated in the year 1981 – 82, later obtained clearance from Central Water Commission, Govt. of India in the year 1987. The forest clearance was obtained from Ministry of Environment and Forest, Govt. of India through letter No.8- 41/ 87 FC dated 23 -07-1990 and first year of reservoir fill took place in the year 1994. The dam is at latitude 22°10'46" N, and longitude 84°39'17" E near Kadambahal village of Rajghampur block. The scheme is in the Brahmani river basin in the North Western Plateau agro-climatic zone of Odisha. The District headquarters at Sundargarh is 81km from the dam site, and the steel city of Rourkela is 32km away. The main railway line passes through the scheme. The scheme's location is shown on **Figure 1 and Annexure 1.**
54. There are two DoWR section offices within the scheme's boundaries, at the dam site and at Ranibandha. The Sub-division office at Kalunga is 12km from the dam site, and the Division office is in Sundargarh.
55. The subproject was designed for a gross command area of 7,212 ha , the original designed cultivable command area is 5050 ha at CCA reduced to 4730 ha mainly due to conversion of cultivable land to homestead land and use of land for industrial purposes and also due to non construction of water courses in the entire designed command area. Out of which during kharif 2870 Ha gets assured irrigation, 1440 Ha is partially irrigated and deprived area under irrigation is 420 Ha. During Rabi 742 Ha is given full irrigation, 870 Ha partially and 280 Ha is deprived (DPR Kansbahal, June 2010).
56. Cropping is dominated by rice in Kharif and a variety of crops including pulses, vegetables and paddy in Rabi. Small-scale conjunctive use and pumping from the canal is used for vegetables. Canal water is mostly used for rice paddy.
57. The old canal system has not been renovated since long except some minor repair out of O & M grant. The paucity of funds stands a bar in taking up major renovation work. Lack of maintenance and renovation causes uneven & ill distribution of water, thus affecting the efficiency of irrigation. The constraints in the present system are:
- Dispersive friable soils in head-middle reaches, and black-cotton-like soils prone to cracking and swelling in middle-tail reaches of the LMC
  - . Poor water use efficiency goes hand in hand with poor equity of distribution.
  - No cross regulators along the 23.4km long LMC, and deteriorated head regulators to minors and sub-minors with no gates, or gates in poor condition.
  - Inadequate bank widths and back slopes in some canal reaches requiring embankment strengthening.
  - Erosion from prism side slopes into canal, particularly in deep cut reaches. Also rainfall runoff breaching canal embankments bringing sediment into the canal.
  - Loss in prism shape with localized widening. Also due to incoming sediment and prism / bank erosion loss in canal long section slope. These effect canal carrying capacity.
  - Local drainage congestion due to inadequate cross drainage.
  - Blockage and water losses at some siphons.
  - A large number of (unauthorized) off takes lead directly from the main canals.

- No flow measurement except at the reservoir.
- Deterioration of some bridges and need for additional bridges.
- Poor access along some canals.

## **B. CATEGORY OF THE PROJECT**

58. This subproject is an existing medium irrigation project, does not have any major environmentally sensitive issues within the existing project area. No wild life sanctuaries, eco-sensitive zones, protected monuments, endangered or exotic species of plants except presence of elephant in the catchment area or movement of elephants in the catchment area only. Since the project components include only renovation work, no extension and widening of canal system, impact on natural resources is negligible, temporary and mitigable. Hence this project is classified as category B as per ADB's Safeguard Policy Statement 2009.

## **C. SCOPE OF WORK**

59. The difficulties inherent in operating and maintaining the existing system, coupled with no major rehabilitation or upgrading since original construction, has resulted in siltation of canals, slipping of banks, damage of structures requiring repair and reconstruction. Due to the increasing population and increased habitation has led to additional demand for bridges and outlets. So rehabilitation of Kansbahal irrigation system is essential to reduce the conveyance losses and transmission losses in the canal and facilitate irrigation for the people of Rajghampur.

## **D. DESCRIPTION OF SUBPROJECT COMPONENT**

60. Kansbahal irrigation scheme was constructed over a long period from 1981 to 1996. Its principal components are: (i) an earthen dam forming a reservoir; (ii) a gated spillway; (iii) Left main canal (LMC) 23.385km long; and (iv) Right main canal (RMC) 5.82km long; (v) off-taking minors and sub-minors.

61. The original design was a 5,050ha CCA comprising 3,890ha commanded by the LMC and 1,160ha by the RMC. The planned irrigated crop areas were 4,615ha in Kharif and 2,900ha in Rabi.

62. Due to industrial and housing development the CCA has reduced to 4,730ha and comprises 3,650ha on the left bank and 1,080ha on the right bank.

### **1. Reservoir, Dam and Spillway**

63. The dam and spillway were constructed from 1981 to 1993. The earthen dam was constructed across Badajore nala comprises homogeneous earth-fill with a vertical sand chimney, horizontal graded filters and a rock-toe. The length of the earthen dam section is 1075 m, RD 0-383m and RD 453 to 1,050m. The 70m long spillway is located in between two canal system, The salient features of the dam is shown in Table 2.

64. The maximum height of the earth dam is 28.0m and the top width is 6.00m. The top bank level (TBL) is +231.00. The crest level of the spillway is +222.00m. The ogee-crested spillway has five radial gates (12m x 6m). An asphalt road surface has been provided to the dam top. The upstream face of the dam is protected by rock riprap. The downstream slope has concreted drainage channels to lead off rainfall runoff. Some of these require minor repair.

Table 2: Salient Feature of Kansbahal Dam

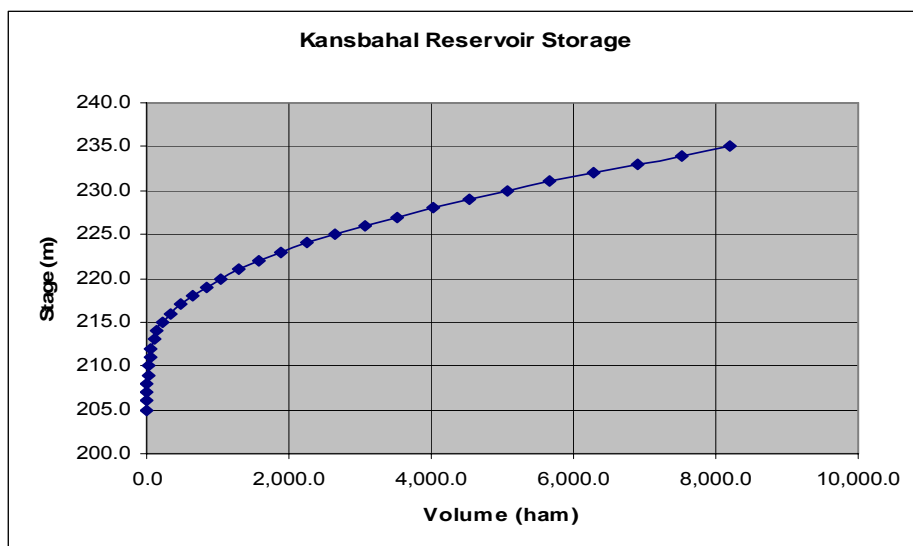
Sl. No.	Description	Dimensions
1.	Catchment Area	179 km <sup>2</sup>
2.	Live storage at FRL	28.72 Mm <sup>3</sup>
3.	Top bank level (TBL)	231.00 m asl
4.	Full reservoir level / Maximum water level (FRL = MWL)	228.00 m asl
5.	Dead storage level (DSL)	220.50 m asl
6.	Length of earth dam section	1075 m
7.	Length of spillway	70.00m
8.	Maximum dam height	28.00 m
9.	Top width	6.00 m

(Source: DPR June 2010, Kansbahal)

65. With its live storage capacity of 28.72Mm<sup>3</sup> Kansbahal is a “Medium” category reservoir. Design flood flows were based on the “Standard Project Flood”. In 1987 the SPF was re-examined by the State Project Planning cell adopting a storm of 48 hours and working out a hydrograph for a maximum precipitation of 729mm developed by Snyder’s synthetic hydrograph method. The recommended spillway design flood increased from 1,356m<sup>3</sup>/s to 1,745 m<sup>3</sup>/s.

66. With all five gates open the revised design flood of 1,745 m<sup>3</sup>/s passes with no increase in the design MWL of 228.0m. With one gate inoperative the MWL was exceeded by just 0.3m. Given the 3.0m available freeboard this is considered acceptable. The maximum observed spillway discharge was approximately 1,600m<sup>3</sup>/s on 17<sup>th</sup> September 1994. The reservoir level reached 228.30m, broadly confirming the flood routing exercise. Stage storage rating curve of Kansbahal dam is shown below in Figure 2.

Figure 2 Stage - Storage Rating Curve



## 2. Dam

67. The earthen dam was constructed across Badajore nala comprises homogeneous earth-fill with a vertical sand chimney, horizontal graded filters and a rock-toe. The length of the earthen dam section is 1075 m, RD 0-383m and RD 453 to 1,050m Spillway and Gates. The overall condition of the dam is good, no major repair is proposed the subproject except repair of longitudinal and horizontal drains, repair of parapet wall of

dam and construction of new causeway on approach road at downstream of spillway channel.

### 3. Spillway and gates

68. The Ogee shaped gravity type spillway has 5 radial gates, one of which leak badly and require replacement of seals. Their driving gears, starters and switch boxes require replacement. All radial gates and frames require protective paintings which would be undertaken by regular DoWR maintenance and repair funds. Protection to spillway right flank requires new construction of a guide wall to protect the right flank of the river under the subproject.

### 4. Head Regulators

69. The gates of both left and right head regulators of the main canal are in good condition regulating the flow perfectly, they do not require repair,

### 5. Distrubutary system

70. The irrigation system comprises two main canals, the Left Main canal (LMC) and the Right Main canal (RMC). The length of the left main canal is 23.424 km, supplies 13 minors and one sub-minor directly; however only three of these are strictly minors. The canal was designed as an unlined earthen channel for a full supply discharge of 3.70m<sup>3</sup>/sec at the head. As per classification of canals according to discharge, 3 minors and 11 sub-minors directly off take from the LMC. In addition there are 21 watercourses and 18 outlets along the LMC. Schematic layout of Kansbahal right and left main canals are shown in Figures 3 and 4.
71. The length of the right main canal is 5.80 km supplies 8 minors and 1 sub-minor directly, but only one of these is strictly a minor. The original design flow for the 5.82km long unlined right main canal was 1.10m<sup>3</sup>/s. There is a minor canal namely Killinga Minor off-taking at the tail and the remaining 7 are sub-minor canals. In addition there are nine watercourses.
72. The LMC and RMC are contour canals with no drop structures. There are also no cross regulators making any flow regulation difficult. There is one escape for the LMC.
73. Head regulators along the main canal comprise simple headwalls, originally mostly provided with lift gates. Few operational gates in good working condition remain.
74. Outlets along into watercourses comprise simple pipes.
75. There is no flow measuring structures. The accuracy of measured flows based on gate openings released to the LMC and RMC is not known. The salient feature of distribution system is given in **Table 3**.

**Table 3 Salient Features of Distribution System**

Description	Left Main Canal	Right Main Canal
Number of head regulator gates	2 service gates	2 service gates
Head regulator outlet(s)	1 conduit	1 conduit
Vents-No.x width x height	2x2.00 mx1.5m	2x1.50mx1.00m
Sill levels	220.40 masl	220.45 masl
Design discharge at head regulator	3.70 Cumecs	1.10 Cumecs

Description	Left Main Canal	Right Main Canal
Cultivable command area (CCA) Original	3,890ha	1,160ha
Current estimated CCA	3,650ha	1,080ha
Length of main canal	29.424 km	5.820 km
Canals off-taking from main canals	14	8
Length of minor / sub-minor canals <sup>1)</sup>	53.078 Km	10.709km
Number of field outlets <sup>1)</sup>	116	44
Average irrigation area per outlet	14.43	12.68

Source: DPR Kansbahal, June 2010)

76. The canals were originally unlined. Over the years concrete trapezoidal lining has been carried out in a few reaches. The lined lengths are less than 5% of the total.

Figure 3: Kansbahal Irrigation Scheme – Schematic layout of RMC system

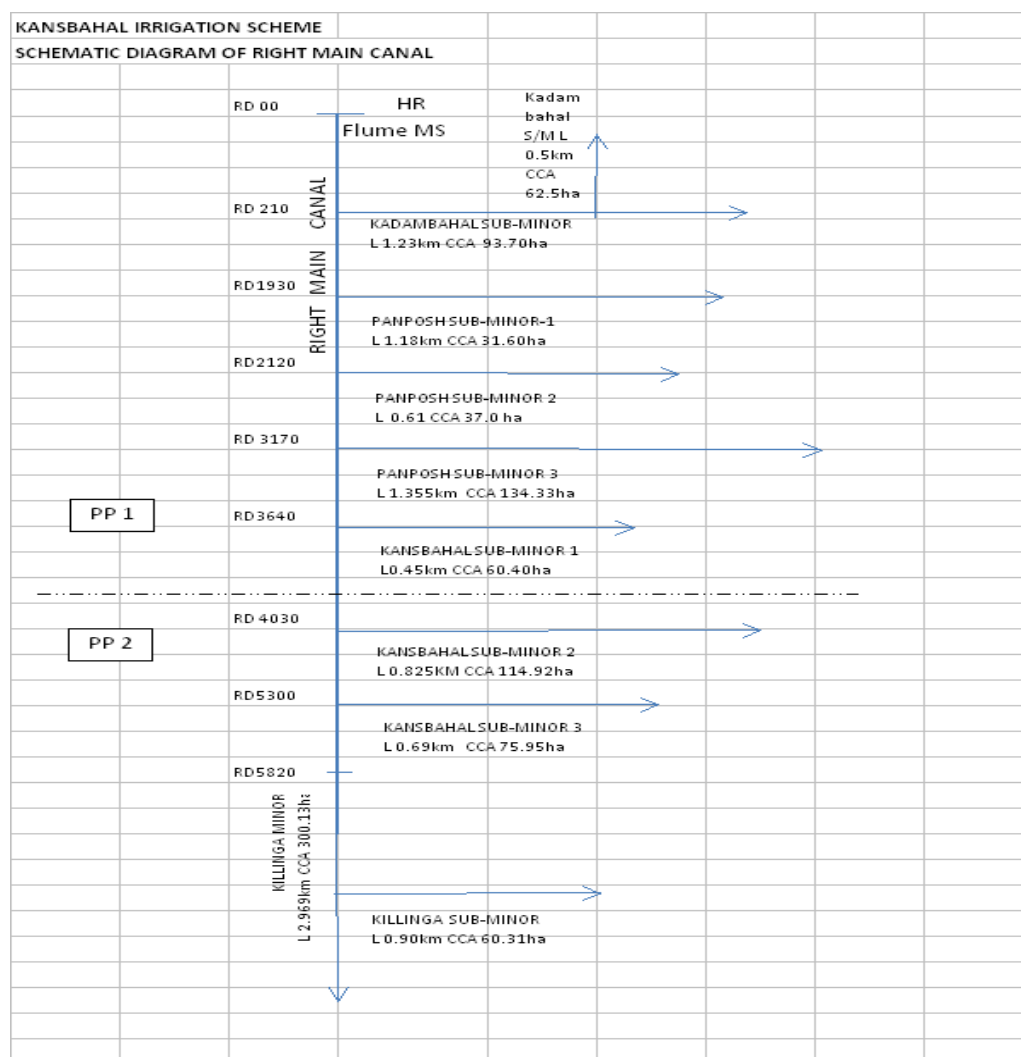
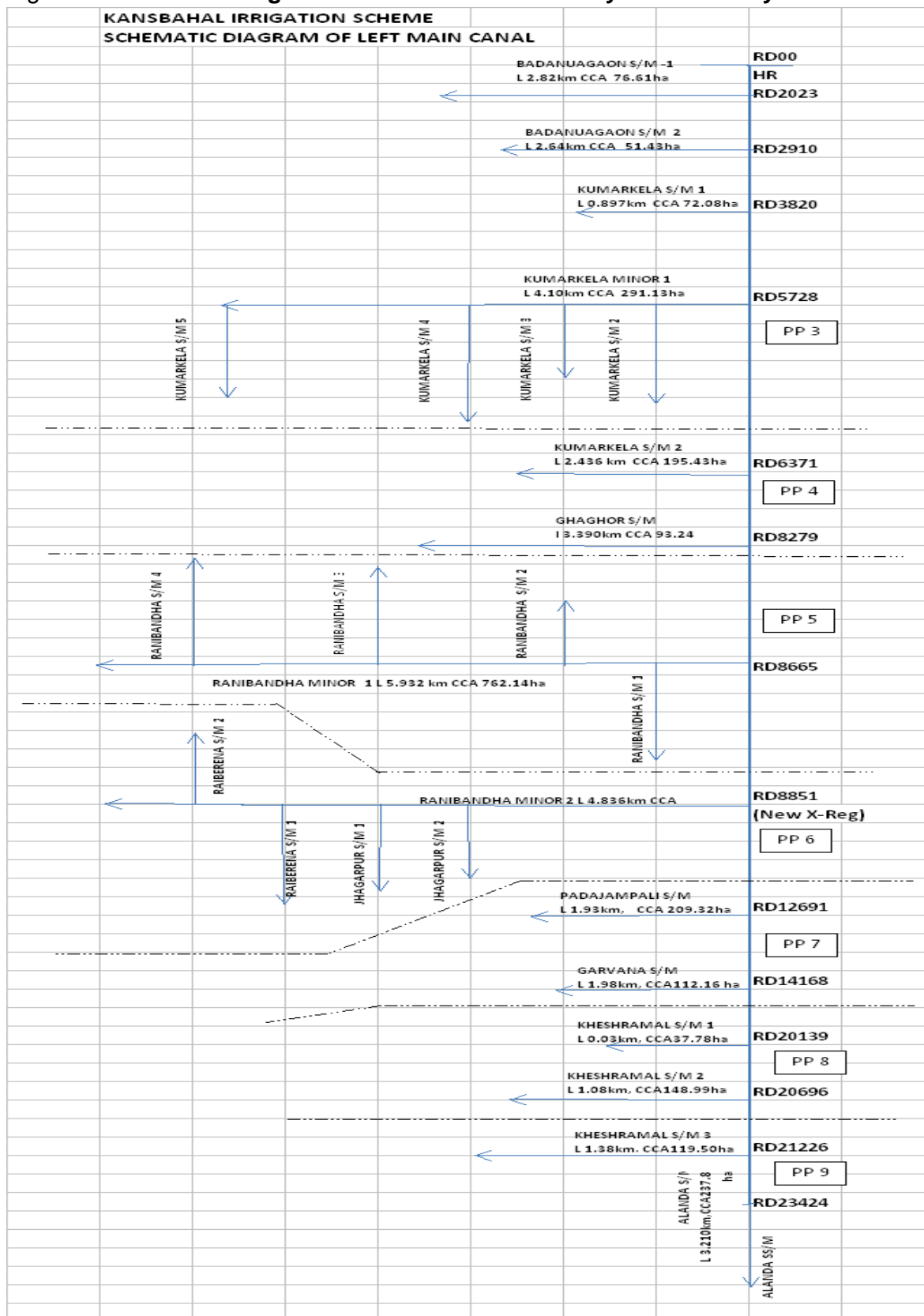


Figure 4: Kansbahal Irrigation Scheme – schematic layout of LMC system



## 6. Classification of Canals under OIIAWMIP

77. Classification of canals in accordance to discharge is necessary because: (i) the works and O&M of main, branch & distributary canals will remain the responsibility of the DoWR; While (ii) O &M of minors and sub-minor system will become responsibility of the PPs in accordance with the PIM Act, 2002 and Rules, 2003. Canal classification adopted under the OIIAWMIP is in Table 4.

Table 4 Showing Canal Categorization

No	Name of Canal	Category of Canal	Discharge (m3/s)	Typical Command Area (ha)	O&M Responsibility
Main System Infrastructure: O & M DoWR					
1	Varies: Main/ Branch/ Distributary	Main Canal/ Branch Canal	>10	15,000 to 40,000	DoWR ( Appex & Distributary Level PPs
2		Distributary	1.0 - 10.0	1,500 to 15,000	
Minor System Infrastructure: O & M (WUAs)					
3	Distributary/ Minor/ Sub-minor/ Water courses	Minor	0.2 – 1.0	250 to 1,500	PP Irrigator Group
4		Sub-minor/ Water Course	0.04 – 0.20	40 - 250 (Chak)	
On- farm System Infrastructure: O &M by PP ( Irrigator Group) ( Field system only to be developed if desired by PP for warabundi)					
5	CAD / Field Channels	Field Channels	0.030-0.040	30 – 40 ( Chak / Sub- Chak	PP Irrigator Group
6		Lateral Channel	0.010 – 0.030	2 to 8 ( Sub- Chak	Farmers

78. In the sub-project as per the above classification it has 2 distributaries (includes left and right main canal is considered as Main distributaries, 4 minors and 33 sub-minors.

## 7. Land use and Right of Way (ROW) of the canal system

79. The dam, catchment area is surrounded by Kumaria reserved forest<sup>4</sup>, Jambua reserved forest and Chudia reserved forest while the left canal system pass through mostly agricultural lands, waste lands like rocky outcrops or uncultivable waste lands, and small local nallas, crosses state highway and railway crossing. Two minors of left main canal Badnugaon minor -1 RD 360m to 400m and Badnugaon minor -2 RD 720m to 750 m pass adjacent to the village forest<sup>5</sup> on the right side.

80. While the right main canal also originates in the reserved forest RD 0 to 100m falls in the Kumaria RF and passes through mostly agricultural lands, waste land or unculturable waste lands, local nallas and crosses village roads etc.

81. The land acquisition has taken place, the approx. length of canal system passing through reserved forest is around 100m and through village forest is 60m length of the canal.

<sup>4</sup> Reserved forest is an area notified under the provisions of Indian Forest Act or the State Forest Acts, with a full degree of protection. In Reserved forest all activities are prohibited unless permitted by a government notification. .

<sup>5</sup> Village Forest is an area notified by State Government constituting any land at their disposal to be a village forest for the benefit of any village community or group of village communities, and may in the like manner vary or cancel such notification. It states land at the disposal of government include all unoccupied land, all temporarily occupied or occupied without permission whether assessed or un assessed, all communal forests but does not include land recorded in the name of any private person or institution in the record of rights in force which is prepared and maintained or is deemed to be prepared and maintained under the Orissa Survey and Settlement Act, 1958

The details of the canal system passing through different forest areas is presented in Table 5 and Table 6.

Table 5 Table showing Reserved Forest Area and acquired land

S.No	Canal name	RD (Canal / Site Location) in m		Length in m	Forest Type
		Start	End		
1	Right Main Canal	0	100	100	Kumaria Reserved forest 45 m width land acquired
	Total			100m	

( Source: SIO Records)

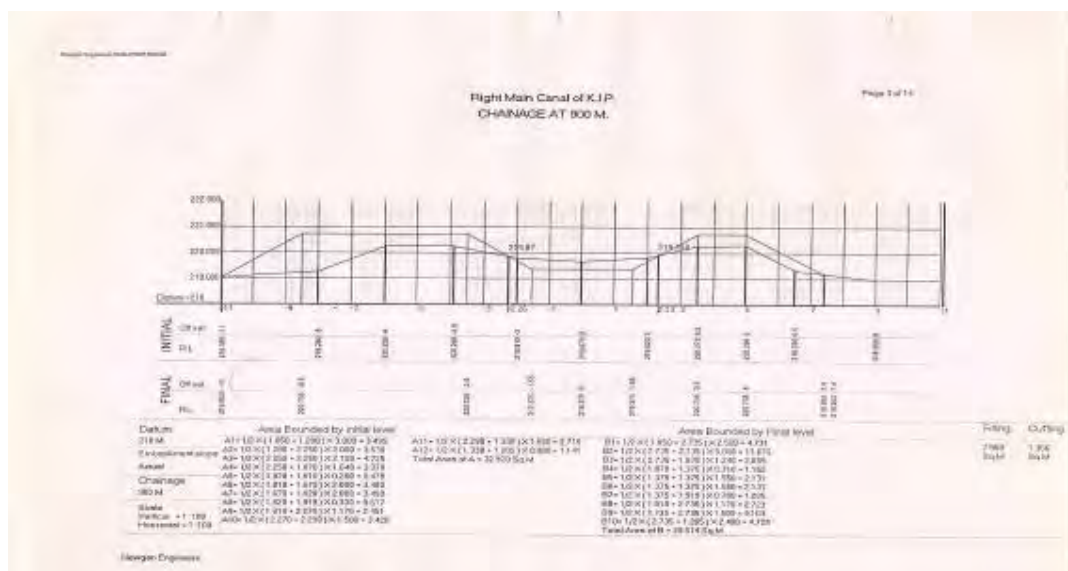
Table 6 Table showing Village Forest Area and acquired land

S.No	Canal name	RD (Canal / Site Location) in m		Length in m	Forest Type
		Start	End		
1	Badnuagaon minor -2	720	750	30	Badnuagaon village forest the width acquired is 24m passing through right side of the canal
2	Badnuagaon minor -1	360	400	40	Bhagattola village forest acquired land width is 24m passing through right side of the canal
	Total			70 m	

( Source: SIO Records)

82. The available acquired land in the main canal (left and right) i.e. Right of Way is ranging from 30 m to 45 m covering both the sides, in the minors its around 24 m covering both sides and in the sub-minors its around 20 m both the sides. No additional land acquisition is required. Resectioning of the canals has been proposed under this sub-project, for the left and right main canal the L.S and D.S yet to be approved by the Chief Engineer, Upper Mahanadi Basin, Burla, Sambalpur Dist ( As per SIO statement). The typical cross section of the right main canal at RD 0.900 Km proposed is enclosed in Figure 5.

Figure 5 Typical cross section of right main canal at RD 0.900 km



## 8. Left and Right Main Canal Structures

### a) Head Regulators

83. The left main canal head regulators in the head reaches are gated, but four towards the tail are un-gated. However the gates are damaged and mostly not operational. The head regulator masonry structures comprise a simple headwall in the canal prism controlling flow to a pipe culvert under the embankment. On the downstream side in the minor / sub-minor there is a similar masonry headwall. The headwalls largely need replacement.

84. The left main canal has 14 head regulators, all these regulators needs repair which are damaged and the right main canal has 7 number of head regulators out of which only 6 number has been proposed for repair in the preliminary estimate.

### b) Cross Regulators

85. At present there are no cross regulators either in the left main or in the right main canal, one new cross regulator is proposed at RD 8870 m of left main canal to regulate the flow and to maintain proper FSD.

### c) Cross Drainage (CD) Structures

86. The different CD structures in the left and right main canal are as follows:

#### i Canal Siphon

87. The canal siphons inspected one is leaking, and all need minor repair. The left main canal has 5 numbers of canal siphon at RD 1120m, 9922m, 14524m, 15624m and 17080m out of these only 1 number (RD 1120m) have been proposed for repair. The right main canal has 3 numbers at RD 390m, 1790m and 2960m out of these only two canal siphons (390m and 2960m) proposed for repair.

#### iii. Aqueduct

88. Aqueducts all are in reasonable condition except for leakage at joints The left main canal has 4 numbers of aqueducts at RD 5401m, 12031m, 16164m and 23399m out of these only 4 numbers are proposed for repair (RD5401m, 16184m 17630m and 23399

m). The right main canal has only one aqueduct at RD 4400m and this is proposed for repair.

#### iv. Drainage siphon

89. The cross drainage siphons are functional, the left main canal has 24 drainage siphons out of which only 5 is proposed for repair RD 915m, 6630m, 11622m 13036m, and 22290 m and one needs total reconstruction in the left main canal at RD 5780m to avoid ponding / water logging after railway crossing. The right main canal has 13 numbers of drainage siphons out of which only 2 numbers (RD 810m and 1550m) have been proposed for repair. Additional cross drainage and / or drainage inlet structures are needed along the main canal.

#### d) Escape

90. The left main canal has 1 escape at RD 5600 and this is proposed for minor repair and one new construction of escape at RD 7890m is proposed. In the right main canal there is no escape.

#### e) Bridges

91. The left main canal has 29 bridges out of which 2 are main district road bridges (RD 10410m and 12520m) and the rest village road bridges (VRB) out 27 VRB 15 VRB are proposed repair, in addition 5 numbers of new bridges are proposed at RD 750m, 6000m, 11500m, 19030m and 22900m. The right main canal has 7 number of VRB out of which 5 numbers have been proposed for repair and one new bridge at RD 3800m has been proposed. Village road bridges parapets are damaged and in some cases abutments and wing walls need repair.

#### f) Outlets

92. The left main canal there are 39 existing outlets out of which 33 numbers are proposed repair and in the right main canal there are 13 numbers of outlets out of which 6 numbers have been proposed for repair and only one new construction is proposed. The outlets need mostly reconstruction to facilitate proper distribution.

93. The total structures of the left and right main canal as per inventory, to be repaired and new construction proposed are given in the Table 7 below.

Table 7 Left and Right Canal System Structures

No.	Structures	Left Main Canal Structures			Right Main Canal Structures		
		As per Inventory	To be Repaired	New construction	As per Inventory	To be Repaired	New construction
1	Head Regulator	14	14	0	7	6	1
2	Canal Siphon	5	1	0	3	2	0
3	Aqueducts	4	4	0	1	1	0
4	Drainage Siphons	24	5	1	13	2	0
5	Bridges	29	15	5	7	5	1
6	Escapes	1	1	1	0	0	0
7	Cross Regulators	0	0	0	0	0	0
8	Combination Structures	0	0	0	0	0	0
9	Fall/Drop structures	0	0	0	0	0	0
10	Outlets	39	33	0	13	6	1
11	<b>Total</b>	<b>116</b>	<b>73</b>	<b>7</b>	<b>44</b>	<b>22</b>	<b>3</b>

( Source: Preliminary Estimate and DPR Kansbhal, June 2010)

## 9. Distribution System Structures

The left main canal (distributary) has number of 12 minors and 15 sub minors and right main canal (distributary) has 8 minors and 2 sub minors (not as per OIIAWMIP classification), the different structures present in the both the distribution system needs repair and the list of structures as per inventory, structures proposed for repair and new construction are shown in Table 8. The numbers of each category of structure in the Subproject are summarized below in Table 9.

94.

Table 8 Showing different structures of the distribution system

No.	Structures	Left Main Canal - Minors & Sub minors Structures			Right Main Canal - Minors & Sub minors Structures		
		As per inventory	To be Repaired	New construction	As per inventory	To be Repaired	New construction
1	Head Regulator	13	13	0	3	3	0
2	Canal Siphon	3	0	0	2	0	0
3	Aqueducts	2	0	0	1	0	0
4	Drainage Siphons	64	0	0	6	0	0
5	Bridges	51	24		17	3	0
6	Escapes	0	0	0	0	0	0
7	Cross Regulators	0	0	0	0	0	0
8	Combination Structures	0	0	0	0	0	0
9	Fall/Drop structures	127	43	0	45	16	0
10	Outlets	206	32	1	83	14	0
11	Total	466	112	1	157	36	0

( Source: Preliminary Estimate and DPR Kansbhal, June 2010)

Table 9 Categories and Numbers of Structures

No.	Structures	Entire Canal System (Left, Right, Minors and sub-minors)		
		As per inventory	To be Repaired	New construction
1	Head Regulator	37	34	0
2	Canal Siphon	13	3	0
3	Aqueducts	8	7	0
4	Drainage Siphons	107	8	1
5	Bridges	104	47	11
6	Escapes	1	1	1
7	Cross Regulators	0	0	1
8	Fall/Drop structures	172	70	0
9	Outlets	341	88	3
10	Total	783	258	16

( Source: Preliminary Estimate and DPR Kansbhal, June 2010)

## 10. Measuring Devices

95. In the minors and sub minors up taking from left and right main canal (distributary) a provision for installing 22 numbers of measuring devices has been proposed in the preliminary estimate.

## 11. Earth work and Turfing

96. Earth work in the left and right main canals, distributaries, minors and sub-minors would be carried out for resection of the canals. Most of the canal sections have eroded over period resulting in under section due to rain cuts and failure of slopes in many places; hence it is necessary to restore the canal banks to its design section. This involves filling of the earth material, the approx. quantities required in the left and right main canal is around 1.10 lakh cum and for distributaries, minors and sub-minors it requires approx 0.57 lakh cum including earth required for filling near the structures.

97. The canal and structure are very old and do not function properly. In many places, the Canal section has gone out of form. Widening of the canal section has resulted in a reduction of velocity of flow, which causes silt deposit in bed, and formation dunes that bar the bed. This ultimately results in poor performance of canal supply. The canals have been constructed with locally available soils. The canals & embankments have not been properly maintained in many places. All these have resulted in heavy seepage loss and the tail reaches were found to be deprived of water most of the time. So in order to bring back the canal to its design bed level requires desilting and cutting of canal bed. The approximate quantity of cutting would be around 0.39 lakh cum in the left and right main canal, and approx. 0.24 lakh cum in the distributaries, minors and sub-minors. The generated cutting earth material is purely silt and loose sandy soils which is not suitable for filling in the embankments hence it is not adjusted in the filling quantity.

98. Provision for compaction of the main canals has been built under the project by Powered Road Roller (PRR)/ Vibratory Roller and the ordinary compaction (HRR) to be done in distributaries, minor and sub-minors.
99. To protect the canal from erosion in the completed earth sections of the canals a provision for turbing has been made.

## **12. Canal Lining and Guard wall**

100. In the vulnerable reaches of the canals and upstream and downstream of structure and filling and cutting zones of the left and right main canal (distributary), a provision for lining approx. 5585 m and for minors and sub-minors 23995 m has been proposed in the preliminary estimate. Approx. 510 m of guard wall construction in the left main canal is built in the project to restrict the seepage for the main canal only.

## **13. Service Road**

101. A provision for improvement of service banks of left main canal approx. 21.5 km and right main canal 4.52 km is proposed under the subproject preliminary estimate.

## **14. Drilling Tube wells**

102. A provision for drilling of tube wells along the entire length of left and right main canal, distributaries, minors and sub-minors may be kept to provide water during canal closure period in the revised estimate.

## **15. Construction Materials**

103. The below are the list of provisional construction materials that the Contractor may need to procure for the sub-project. The preliminary estimate provides a provision to approximate carriage and conveyance of materials i.e. lead distance involved are given below and the quarry map showing the locations are shown in Annexure -3.
- Cement may be procured from Rajghampur the approx. average distance is 14 Km.
  - Steel may be procured from Rourkela approx. average distance is 40 Km
  - Steel (shuttering and centering) may be procured from a approx. distance of 40 Km i.e Rourkela.
  - Granite and other Stone products may be procured from the quarry at Gutidhara the approx. average distance is around 35 Km. In addition the tentative list of approved crushers ( State Pollution Control Board )available within the district as on October 2011 is enclosed as Annexure 2.
  - Sand may be procured from a distance of approx. 32 Km from River Sankh
  - Gravel may be procured from distance of approx. 26 Km from Chikatmati.
  - Bricks may be procured from a distance of approx. 19 km from Bilaigarh.
  - Earth generated from cutting shall not be utilized in filling. The required earth quantity shall be procured by the contractor from private lands as per the procurement procedures; the estimate has a provision for hiring borrowing / procuring earth from private lands. Borrow areas in forest areas shall be avoided and borrow areas shall be identified prior to implementation at proposal and after award of contract.

104. However keeping in view of the requirements of the IEE report a preliminary identification process has been carried out by SIO. The different options of procuring earth suggested by SIO are as: Option 1. Kansbhal subproject has 22.18 acres in Kadambahal village, Rajghanpur Village( Plot no.39, 43, 45, 46, 47,51, 52,53, 54,55, 56, 57, 58, 60, 61, 125, 126, 127, 134, 135, 136, 536 and 537 of acquired private land for borrow areas in the year 1986 which may be utilized for some quantity after taking permission from SIO manager. Option 2. Some potential farmers who are willing to give earth from their own lands are being identified by WUAS which can be utilized by the contractor for borrow areas, the potential list of farmers / PPs are enclosed as Annexure 4, the potential farmers list may be handed over to the contractor after the agreement. Option 3. Enquiry with the local revenue department by the SIO manager has revealed there are some government revenue lands in the Rajghanpur block which the Contractor can take temporary lease after award of Contract and can be utilized for borrowing earth. These potential locations shall be verified for the suitability of the material by the SIO staff and the list of potential sites will be provided to the Contractor. As per the contractual conditions an agreement with the land owner will be reached by the contractor and he will also ensure to take the necessary permission for operating these borrow areas from the revenue authority like temporary lease etc. The necessary royalty would be deducted by the SIO staff from the Contractor. Contractor would try to procure earth within a lead of 5 Km of the canal system in small quantities.

#### **16. Disposal of Debris & Spoil**

105. The material generated from dismantling old structures would be reused to the possible extent. Any materials like wood or iron would be taken in to the dead stock of water resources department and auctioned by the competent authority.
106. The generated cutting material is very small quantity found to be silty and sandy not suitable for filling the embankments hence the unsuitable material shall be utilized in the spoil banks of the existing main canals and in the low lying sections of the canal bank within the available ROW after toe line, a provision for turbing the spoil banks to avoid the erosion is recommended / suggested. However, if any additional material is generated it would be disposed by identifying a suitable places like old borrow areas, quarry sites and low lying govt. land by taking appropriate permission from the SIO and competent authority. The silt shall be tested for heavy metals and pesticide residues also before disposal and some quantities can be distributed to the adjacent farmers by involving PP.

#### **17. Drainage System**

107. With its undulating topography, reasonable land slopes and network of natural drainage channels and nullahs draining north and east to the Sankh river, improvements to the drainage system mostly comprise addressing bottlenecks and localized drainage congestion caused by the left and right main (contour) canals.
108. Four aqueducts along the LMC and one aqueduct along RMC pass over larger nullahs. For small cross flows 24 drainage siphons have been provided along LMC and 12 along RMC. For all canals there are 107 cross drainage siphons.
109. Despite the number of cross drainage structures, drainage inflows into the left and right main canals occur, bringing sediment, damaging canal embankments and effective

prism slopes. A combination of additional cross drainage structures and drainage inlet structures are required, along with stone pitched bunds to guide flows to these structures.

**18. Flood Embankments**

110. There is no flood embankment in the command area of the subproject.

**19. Roads**

111. The double lane asphalt Rourkela to Sundargarh highway pass east-west through the command area. From this highway lead morum surfaced village roads, as well as a few single lane asphalt roads, north and south in the command area. The canal service roads also act as a communication facility within in the command area. Gravel and WBM surfacing of the earthen left and right bank main canal embankment to facilitate both inspection and access are proposed under the subproject.

**20. Plantation**

112. To increase the aesthetic value of the area and also to compensate any tree loss that may arise due to unavoidable tree cutting, the subproject is built with a provision for 400 trees plantation in the area i.e. along the canal system.

**21. Implementation Arrangement**

113. Detailed Survey, Design and estimates for the sub-project shall outsourced and will be carried out by a Consulting Firm through PMU in consultation with SIO staff.
114. Procurement of civil works for the sub-project related to main canal, distributaries and minors shall be divided into different contract packages and tendered. Water Resources Department through PMU in consultation with the concerned C.E's/ S.E/E.Es as per the provisions of OPWD code and in line with ADBs procurement policy shall call for tenders and through national competitive bidding, different contractors shall be selected and they will be executing the civil works under the supervision of respective Subproject Implementing Officers (SIOs).
115. For sub-minors execution of civil work shall be carried out by different Water Users Associations (PPs) of the respective subproject through an agreement between SIO and SIO / Executive Engineer of the respective sub-project.
116. Onfarm Development Works (OFD)
117. The onfarm development works include watercourses, field channels and field drains. In the traditional system of irrigation the responsibility of distribution system ends at outlet. So distribution of water beyond the outlets remains the responsibility of the farmers. OFD works under Kansbahal sub-project command area had been contemplated to be taken up separately insteps by Command Area Development (CAD) wing of Water Resources Department separately in consultation with the farmers of the concerned WUAs. The CAD water management activities will be funded by the OSG through the centrally sponsored program (CSP) for CAD works without availing OIIAWMIP funds main canal bank are proposed.

## IV DESCRIPTION OF THE ENVIRONMENT

### A. PHYSICAL RESOURCES

#### 1. Climate

##### i. CLIMATIC ZONE

118. The scheme is within the 'North-Western Plateau' Agro-Climatic Zone, characterized by a hot and moist sub-humid climate.
119. Agro-climatic conditions suitable for growing paddy rice, pulses, oil seeds, maize, fibre crops, vegetables, and wheat and spice crops. Most of these are part of the current cropping pattern. Potential new or expanded crops include: certified seeds, seasonal flowers, vegetables (capsicum, bitter gourd, sweet corn, baby corn), potato, onion, spices, maize, groundnut, mustard, sunflower, wheat, improved cultivars of green gram and black gram and sugarcane. These would benefit from improved irrigation supplies allowing earlier sowing (from 15th June) and harvesting of paddy, input supply and agricultural extension. Wheat is grown, but could be improved. Proximity to urban centers like Kansbahal, Rajgangpur and Rourkela provides market opportunities.

##### ii. RAINFALL

120. Historic rainfall data recorded at the Rajghampur block where Kansbahal sub project is located shows average rainfall of 1210 mm and the year wise rain fall for the block between 2004 to 2013 is shown in Table 10. While for dam site from show a mean monsoon and annual rainfall of 1,113 mm and 1,240mm respectively. About 90% of average annual rainfall occurs during the monsoon period from June to October; 7% (88mm) during the non-monsoon months of February to May; and 120mm 3% (40mm) during the post monsoon period from November to January.
121. The average number of rainfall days in a year is 75, and varied from 59 to 94 between 1996 and 2006. In the monsoon months the number varied from 55 to 78 days, and in the non-monsoon months from 3 to 13 days.
122. For probabilities of non-exceedance of 75%, 50%, and 25% annual rainfall was 2,100mm, 1,586mm and 1,170mm indicating a wide variation from year to year. Annual rainfall for 9 out of 11 years was below the 50% probability of exceedance level.

**Table 10 : Kansbahal Rainfall Data 2004 - 2013**

YEAR	Jan	Feb	Mar	Apr	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2004	0	18	0	44	0	92.6	289.4	452	70.4	87	0	0	1053.4
2005	24	6	23	3	20.6	241.6	237.9	158	136.4	0	0	0	850.5
2006	0	0	37.6	0	89.9	136.4	388.2	450.8	119.9	21	0	0	1243.8
2007	0	46	0	0	16.4	124.4	408.7	648.2	297.2	12.2	67	0	1214.9
2008	0	0	3.4	3	0	328	483.2	312.4	255	14	0	0	1399
2009	0	0	0	0	103.1	118.2	348.6	330.4	99.2	88.4	21.8	0	1109.7
2010	0	10	0	0	35.4	74.8	266.2	355.5	123.3	78.4	4	50	997.6
2011	0	9.6	0	69	54	168.8	276.2	373.8	723.6	23.6	0	0	1698.6
2012	25.8	11.2	0	0	0	237	141	549.2	141.4	12	78	14	1209.6
2013	7.4	0	0	94.6	6	294.9	523	0	208.6	187	0	0	1321.5

(Source: Special Relief Commissioner, Bhubaneswar)

123. Variations from year to year as well as from month to month are highly erratic. Without irrigation crops frequently suffer drought. This can occur even in years where total rainfall is close or above average due to non-timely rainfall, or extreme rainfall events with heavy rain falling in just a few days. For example, from 1961 – 2000 Odisha experienced 14 droughts. This was mostly due to the erratic nature of rainfall in these years. For example in 2004, monsoon rainfall at the dam site was 781mm (70% of the average of 1,113mm) but monthly deviations were: June 75mm (33% of average), July 171mm (56%), August 308mm (95%), September 169mm (88%), and October 58mm (92%).

## 2. Temperature and Humidity

124. Temperature variations are pronounced with minimums of 6oC to 22oC and maximums of 36oC to 48oC. Minimum temperatures occur in Rabi from December to February. Maximum temperatures occur in the summer, in April, May and June prior to the onset of the monsoon.
125. Relative humidity peaks in the monsoon from July to September at 70-83%, and is lowest in the summer in April at 30-50%. Kansbahal temperature and relative humidity is depicted in Table 11

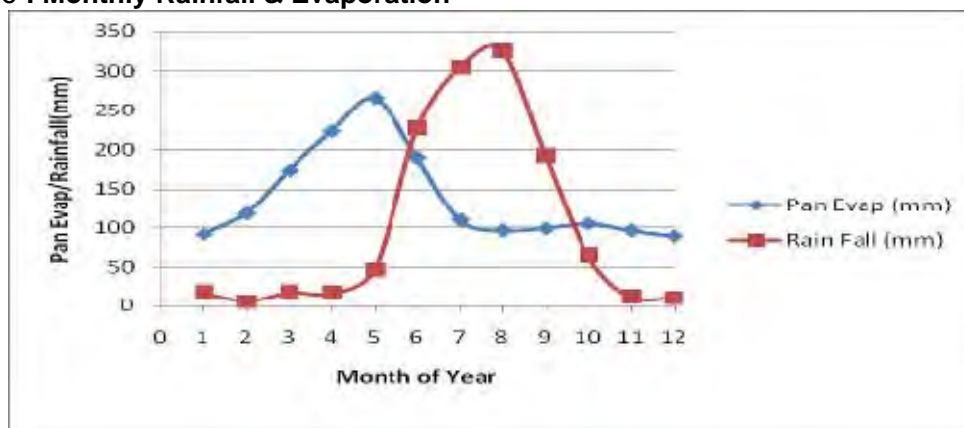
Table 11      **Kansbahal Temperature & Relative Humidity**

Month	Monthly Temperature in °C		Monthly Mean Relative Humidity in %	
	Maximum	Minimum	At 8.30 A.M.	At 17.30 P.M.
January	38	6	67	44
February	38	9	59	33
March	43	13	48	29
April	46	18	46	24
May	48	20	55	32
June	47	20	70	57
July	38	20	83	76
August	36	22	86	82
September	37	20	83	77
October	36	16	75	65
November	36	10	71	57
December	36	7	72	52

## 3. Evaporation

126. Class A pan evaporation data is available for Jharsuguda and has been used to estimate crop water requirements. Rainfall at the dam site and evaporation is shown below. Evaporation is well above rainfall during Rabi but less in Kharif.

Figure 6 : Monthly Rainfall & Evaporation



#### 4. Physiography and Drainage

127. Scheme elevation varies from 195 to 225masl. Overall slope is from the reservoir south of the command, north and east towards the Sank river. The right main canal command and upper part of the left main canal command (PPs 1, 2 &3) drain north, while the middle and lower parts of the left main canal commands (PP 4-9) drain north and east.
128. The Badjore nullah flows from the reservoir and bisects the left and right bank commands. Tributaries of the Badjore drain the upper and middle parts of the left main canal command (PPs 3, 4 and 5). The tail of the left main canal command (PPs 6, 7, 8 & 9) drain into the Pichhra nullah, joining the Badjore just before it flows into the Sankh river downstream of Mandira reservoir. The Badjore then flows north and east to join with the Koel river becoming the Brahmani. The river then flows south and east towards Rangoli reservoir and eventually the Bay of Bengal.
129. Typical ground slopes in the command area are 0.5% to 2%.
130. Land distribution categorized by elevation / topography indicates high, medium and low lands are in proportions 24%, 64% and 12% respectively. The higher lands tend to be well drained with lighter soils, while the low lands along the nullahs are susceptible to water logging following heavy rainfall and comprise heavier soils.
131. Land elevation controls feasible cropping patterns. High and medium land permits short and medium duration high yielding varieties of paddy, vegetable crops and maize in Kharif, and light and medium duty commercial crops in Rabi. Land preparation and planting of paddy rice requires substantial pre-irrigation. Low-lying lands accounting for 12% of the command area are suitable for long duration paddy rice; both transplanted and broadcast, and can to some extent rely on rainfall for land preparation/planting. Limited canal water limits HYV cropping in high and medium lands, 88% of the command area. Farmers can grow rice paddy of 100 to 110 days duration in the high lands and up to 135 days duration in the medium lands; the high lands become free in October and the medium lands in October-November for follow on Rabi crops.

#### 5. Soils

132. The Agricultural Technology Management Agency (ATMA), Sundargarh has identified, in consultation with scientists of OUAT based on altitude, soil type, rainfall, irrigation, topography and existing farming practices, five soil types in Rajgangpur block:. (i)

Black Soil (2%); (ii) Red Soil (32%); (iii) Sandy Soil (5%); (iv) Sandy Loam (24%); and (v) other types (37%).

133. For the command area soil texture classes comprise mostly sandy loams to silty clay loams (84.8%), with 12.7% lighter sandy loams / loamy sand, and just 2.3% (sandy) clay loams.
134. Analysis of soil samples indicates neutral to mildly alkaline soils (PH values 6.6 to 7.5) except for slightly acidic soils covering about 200ha.
135. Indicative water holding capacities and infiltration rates for these soils are shown in Table 12. About 72% of the command area soils are moderately fine with water holding capacities of about 16%. Discussions with farmers growing rice on low-lying land indicated infiltration rates of about 2.5mm/day (0.1mm/hr).

**Table 12 : Indicative Soil Water Holding Capacity & Infiltration Rates**

	Soil Texture Group	Extent (% of CCA)	Typical Water Holding Capacity (%)	Infiltration Rates (mm/hr)
1	Moderately Coarse (sandy loam, fine sandy loam)	13	-	Typ. 13.3
2	Medium (loam, silt loam, silt)	15	8.2 to 13.9	1.4 to 4.3
3	Moderately Fine (sandy clay loam, clay loam, silty clay loam)	72	15.8 to 16.8	1.0 or less

136. Availability of organic nitrogen is mainly low, phosphorous and potassium is medium. Soils are suitable for most crops. Soil reaction and nutrient availability in Subproject is depicted in Table 13

**Table 13 : Soil Reaction and Nutrient Availability in Subproject Area**

Soil reaction (% of area)			Nutrient availability		
Acid	Neutral	Alkaline	Nitrogen	Phosphorus	Potassium
72	28	0	Low	Medium	Medium

( Source: Mitra, G.N et al: Macro and Micro Nutrient Soils of Odisha. Published by IFFCO, December 2002).

## 6. Geology

137. The sub project areas are largely covered with Igneous Sedimentary and Metamorphic rocks. The Igneous rocks comprise Granite, Grano-Diorite Pegmatite type. The sedimentary rocks are largely alluvium in nature. The metamorphic rocks comprise khondalite, Charnokites and unclassified Crystallines.

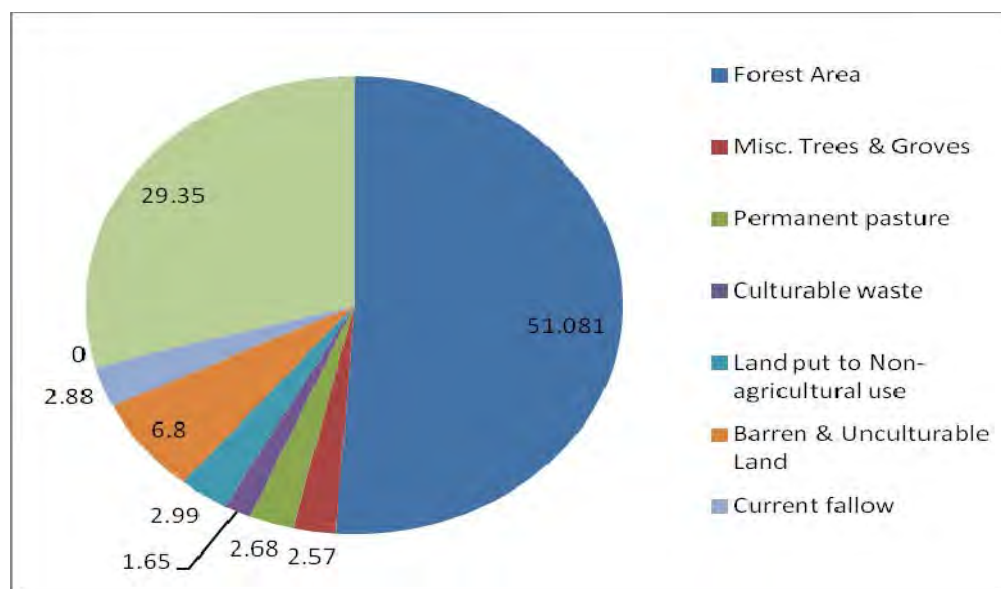
## 7. Land use

138. Land utilization statistics 2009- 2010 of Sundergarh district is shown in Table 14 and Figure 7 In Sundergarh district 51.081% are under forest as per Odisha Agriculture Statistics 2009-2010 of Directorate of Agriculture & food production, Odisha , Bhubaneswar.

Table 14 : **Land Utilization statistics in Sundergarh District**

Pattern of land utilization	Area in ha.	Area, %
Forest Area	496000	51.081
Misc. Trees & Groves	25000	2.57
Permanent pasture	26000	2.68
Culturable waste	16000	1.65
Land put to Non-agricultural use	29000	2.99
Barren & Unculturable Land	66000	6.80
Current fallow	28000	2.88
Other fallow	0	0
Net area sown	285000	29.35
<b>Geographical area **</b>	<b>971000</b>	

(Source: Directorate of Agriculture & food production, Odisha , Bhubaneswar 20011-2012)


Figure 7 : **Land Utilization Statistics of Sundergarh district**

139. The scheme area of 7,212ha lies wholly within Rajgangpur block area of 37,542ha and block land use data indicates land use in and around the scheme which is depicted in Table 15.

Table 15 : **Block wise Land use pattern (Area in ha)**

Land Use of Rajgangpur Block	Area in ha	Percentage
Forest area	8490	21.7
Misc. tree crops and groves	7	0.02
Permanent pasture and other grazing land	1,789	4.57
Culturable waste	2302	5.88
Land put to non-agricultural use	3095	7.91
Barren and unculturable land	2046	5.23
Current fallows	862	2.20
Old fallows	5774	14.75
Net sown area	14767	37.74
<b>Total Area under Survey</b>	<b>39132</b>	

(Source: Directorate of Economics & Statistics, District Statistical Handbook 2009, Odisha)

## 8. Ambient Air Quality

140. The Central Pollution Control Board and State Pollution Control Board maintain database on the ambient air quality of the state. However, such database is limited to

major cities/ urban centers and some selected industrial areas. No secondary data is available for the project district particularly representing the rural areas.

141. Along the proposed rehabilitation of the canal system, neither there is any industrial activity nor significant vehicular traffic contributing to air pollution. Therefore the ambient air quality is expected to be within the National Ambient Air Quality Standards (NAAQS) for all parameters (oxides of nitrogen, oxides of sulphur, carbon monoxide, hydrocarbon, benzene, carbon monoxide) excepting the dust or particulate matter. The occasional vehicular movement on unpaved roads led to formation of dust clouds over short periods. The airborne dust increases the concentration of both the Suspended Particulate Matter (SPM) and Respirable Particulate Matter (RPM < 10 micron) beyond the limits of the NAAQS.

## 9. Earthquake Zone / Sensitivity

142. The Bureau of Indian Standards has categorized the entire India into 5 seismic zones depending upon the degree of proneness to earthquakes. The Zone I signify lesser degree while Zone V is of highest order. The northern and southern most parts of Odisha are classified as Zone I and remaining parts of the state are classified under Zone II & Zone III. The sub project area falls in low damage risk zone see **Figure 8**.

Figure 8 Earth quake zones of Odisha



## 10. Flood condition of Mahanadi, Brahmani and Baitarani Basin

143. Brahmani basin partly is under flood prone zone. More or less in alternate years flood condition is recorded by concerned department. Table 16 below indicates flood status of the project area of Odisha.

**Table 16 : List of Past flood and area damaged by Flood in Odisha**

Sr. No.	Year and month	Rivers	Affected Dist./ Area under project area	Loss/Damage Reported		
				Average Human	Average Livestock	Public Utility
1	1960 (August)	Mahanadi, Brahmani and Baitarani	Cuttack, Dhenkanal	Not available	Not available	Average 6 lakh acre of cropped area damaged
2	1961 (Sept)	Mahanadi, Brahmani and Baitarani	Cuttack, Dhenkanal	Not available	Not available	Average 0.48 lakh acre of cropped area damaged
3	1964	Mahanadi,	Cuttack, Dhenkanal,	Not	Not	Average

Sr. No.	Year and month	Rivers	Affected Dist./ Area under project area	Loss/Damage Reported		
				Average Human available	Average Livestock available	Public Utility
	(July- Aug)	Brahmani and Baitarani	Sambalpur			1.35 lakh acre of cropped area damaged
4	1971 (July- Oct.)	Mahanadi, Brahmani and Baitarani	Cuttack, Sundergarh	8	75	Average 3.34 lakh acre of cropped area damaged
5	1974 (August)	Mahanadi, Brahmani and Baitarani	Cuttack, Dhenkanal	Not available	Not available	Average 2.16 lakh ha cropped area damaged
6	1980 (Sept.)	Mahanadi, Brahmani and Baitarani	Cuttack, Dhenkanal	16	3300	Average 0.638 lakh ha. cropped area damaged
7	1982 (Aug- Sept.)	Mahanadi	Cuttack, Dhenkanal	32	6500	Average 3.0 lakh ha. cropped area damaged
8	1984 (June – Sept.)	Mahanadi, Brahmani and Baitarani	Cuttack, Dhenkanal	7	0	Average 1 lakh ha. of cropped area damaged
9	1985 (Aug- Sept.)	Mahanadi, Brahmani and Baitarani	Cuttack	3	587	Average 0.33 lakh ha. of cropped area damaged
10	1986	Mahanadi	Cuttack, Dhenkanal	3	74	Average 0.24 lakh ha. of cropped area damaged
11	1991 (July- August)	Mahanadi, Brahmani and Baitarani	Cuttack, Dhenkanal	10	229	Average 1.3 lakh ha. of cropped area damaged
12	1992 (June – August)	Mahanadi	Cuttack, Dhenkanal	8	250	Average 0.8 lakh ha. of cropped area damaged

Sr. No.	Year and month	Rivers	Affected Dist./ Area under project area	Loss/Damage Reported		
				Average Human	Average Livestock	Public Utility
13	1994 (July-September)	Mahanadi, Brahmani	Cuttack, Jajpur, Jagatsinghpur, Kendrapara, Sundergarh	10		Average 2.5 lakh ha. of cropped area damaged
14	1995 (May – November)	Mahanadi	Cuttack, Dhenkanal, Jagatsinghpur, Jajpur, Kendrapara	11		Average 3.5 lakh ha. of cropped area damaged
15	1997 (June & August)	Mahanadi	Cuttack, Dhenkanal, Jagatsinghpur, Jajpur, Kendrapara, Sundergarh	10	17	Average 1.8 lakh ha. of cropped area damaged
16	1999 (July - August)	Mahanadi, Brahmani, Baitarani	Cuttack, Jagatsinghpur, Kendrapara, Jajpur	4		Average 0.8 lakh ha. of cropped area damaged
17	2001 (July-August)	Mahanadi, Brahmani	Cuttack, Dhenkanal, Jajpur, Jagatsinghpur, kendrapara, Sundergarh	25	4537	Average 2 lakh ha. of cropped area damaged
18	2003 (July – October)	Mahanadi, Baitarani	Cuttack, Jajpur, Jagatsinghpur, Kendrapara	14	450	Average 0.8 lakh ha. of cropped area damaged
19	2006 (July – August)	Mahanadi, Brahmani, Baitarani	Cuttack, Dhenkanal, Jajpur, Jagatsinghpur, Kendrapara	15	300	Average 0.6 lakh ha. of cropped area damaged
20	2007 (July-Aug – Sept)		27, 12, 15 districts respectively			
21	2008( Jun & Sept)	Subarnarekha, Burhabalang, Baitarani, Mahanadi, Rushikulya, Vansadhara	Angul, Balasore, Bhadrak, Boudh, Bolangir, Bargarh, Cuttack, Gajapati, Jagatsinghpur, Jajpur, Kendrapara, Khurda, Kalahandi, Keonjhar, Mayurbhanj, Nuapara, Nayagarh, Puri, Rayagada, Sambalpur, Sonapur -	110	50163	258155 houses damaged, 4.45 lakh Ha. cropped area, 0.14 th Ha sandcast, 651 breaches in rivers, 1276

Sr. No.	Year and month	Rivers	Affected Dist./ Area under project area	Loss/Damage Reported		
				Average Human	Average Livestock	Public Utility
						breaches in canals.
22	2009( Aug & Sept.)		Balasore, Bhadrakh, Bolangir, Cuttack, Ganjam, Jajpur, Kalahandi, Kandhamal, Kendrapara, Koenjhar, Koraput, Mayurbhanj, Nayagarh, Puri, Subarnapur, Sundargarh. 16 Districts	59	NA	Rs.483.02 Cr of Public utility damage.
23	2010( Aug.)		Kalahandi, Nabarangpur, Koraput, Boudh, Rayagada, Malkangiri.	14	1454	Crop damage Rs.2921.2 Hectare
24	2011( June, Aug, Sept)	Subarnarekha, Jalaka, Mahanadi, Brahamani, Baitarani, Budhabalanga.	Angul, Balasore, Bargarh, Bhadrakh, Boudh, Cuttack, Deogarh, Dhenkanal, Jagatsinghpur, Jajpur, Jharsuguda, Kendrapara, Koenjhar, Khurda, Mayurbhanj, Nayagarh, Nuapada, Puri, Sambalpur, Subarnapur, Sundargarh. Districts	82	1493	Crop damage 260256.52 Hectare
25	2012( Aug. & Nov.)		Khordha, Khandhamal, Nayagarh, Kalahandi & Ganjam. 5 Districts	3		Crop damage 1061.82 Hectare. Rs.21386.37 lakh Public utility damage
26	2013( June, July, Aug & Oct)	Baitarani, Budhabalanga, Rusikulya, Subarnarekha & Jalaka.	Kalahandi, Nabarangpur, Koraput, Gajapati, Rayagada, Malkangiri, Mayurbhanj, Bhadrakh, Balasore, Koenjhar, Jajpur, Deogarh, Puri, Khordha, Mayurbhanj, Nayagarh, Cuttack, Bolangir & Ganjam. 19 Districts.	70		Crop damage 12.80 Lakh Hectare. Rs.21766.87 Crores Public utility damage

(Source: Official website of State of Odisha & Office of Special Relief Commissioner, Bhubaneswar)

Remark : From the year 1960 to 1992 the districts mentioned in the column No.5 related to undivided 13 districts of the States of Orissa.)

144. Flood – The catchment area of the dam site of Kansbahal subproject is 179 sq.km. The maximum flood peak of 1600 Cumecs has been ascertained on 17th September 1994 against which spillway has been designed for a flood discharge of 1745 Cumecs from safety consideration. (DPR Kansbahal, June 2010)

## 11. Surface Water Resources and Quality

### i. SURFACE WATER RESOURCES

145. The Badjore river catchment upstream of the dam has the following characteristics:

(i)	Catchment area	179km <sup>2</sup>
(ii)	Length of main watercourse	37 km to confluence
(iii)	Length of main watercourse	26 km above dam site
(iv)	Total length of drainage network (tributaries)	163.55 km
(v)	Surface network drainage density	0.91 km/km <sup>2</sup>

(vi)	Altitude at origin	600 m amsl
(vii)	Altitude at dam site	210m amsl
(viii)	Average slope above dam site	8.08 m/km (0.81%)
(ix)	Average annual rainfall (1996-2006)	1,240mm

146. There is a rain gauge at the dam site. Daily readings are taken at 08.30 hours and recorded in a register. Other data recorded at the dam site comprise: (i) depths over spillway and therefore spillway flows; (ii) gate openings and therefore canal flows released to the left and right main canals; and (iii) reservoir water levels. Data are available from 1996 to 2006.
147. Reservoir inflow volumes are estimated from the outflows and change in reservoir storage volume. The reservoir storage volume is determined from the reservoir water levels and the stage-storage characteristic (capacity curve). No allowance is made for seepage or evaporation.
148. Average monthly runoff volumes (as mm over catchment) are shown on the figure below. Rainfall data are also shown giving an upper bound check.

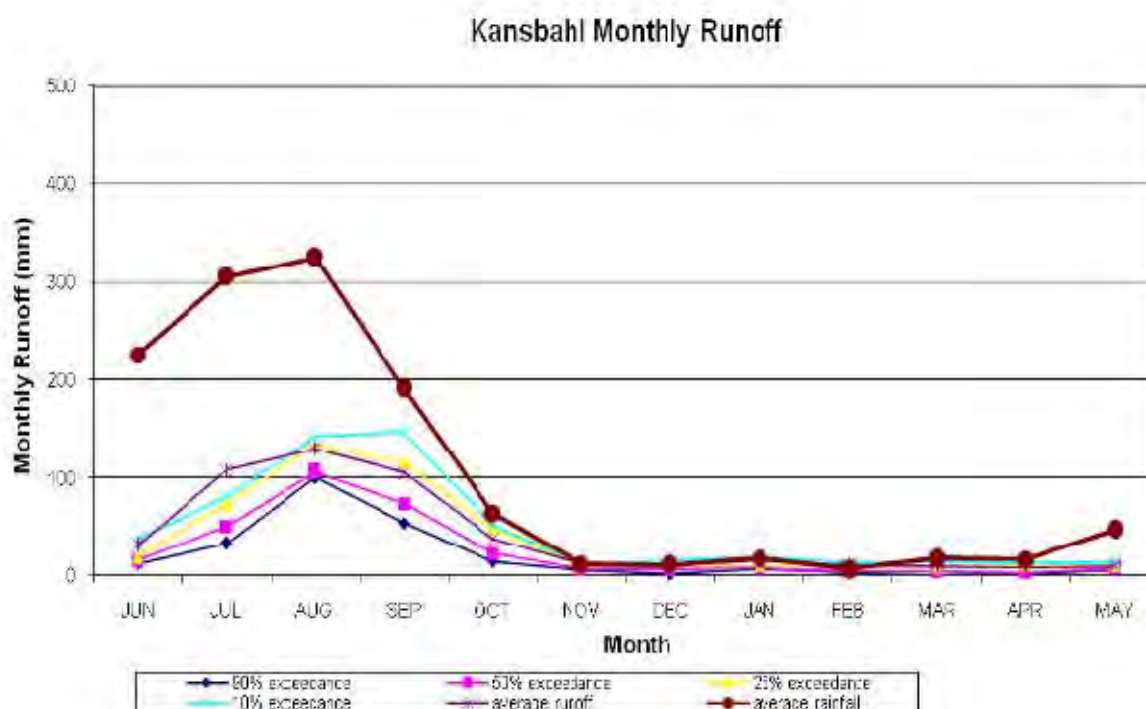


Figure 9: **Monthly Runoff of Kansbahal canal**

149. These “gauged” or direct estimates for reservoir inflow volumes were compared with estimated runoff volumes calculated using (i) the U.S. Soil Conservation Services (SCS) curve number method; and (ii) Strange table numbers. However these methods are likely to be less accurate than the gauged estimates and only served for comparison.
150. Reservoir inflows averaged 9,025ham. This is equivalent to 1,908mm over the CCA of 4,730ha. However the extent reservoir inflows can be productively used for cropping depends primarily on reservoir capacity to store monsoon water for use in Rabi and minimize flow over the spillway.

## II. Reservoir Water Quality

151. Testing of water samples from the reservoir and canals indicated a pH of 7.6 (reservoir) and 8.3 (canal). Salinity as indicated by conductivity was low, 110 and 96 microS/cm for reservoir and canal water respectively<sup>6</sup>.

## 9. Surface Water Quality –Brahmani river basin

152. Under National Water Quality Monitoring Project (NWMP) water quality of the Brahmani river is monitored by State Pollution Control Board, Odisha for the period 2007 to 2012 for 3 locations. The Table 17 and 18 shows the monitoring result and which also indicates river water class. It is noted from the result that river water contains large numbers of coli form bacteria and with slight to moderate pollution.

**Table 17 : Water quality Brahmani River Basin**

Sl. no	Location	year	Annual average values				Designated Class	Existing Class
			pH	DO mg/l	BOD mg/l	TC MPN/100 ml		
1	Boniagarh	2007	7.8	7.75	1.25	12.97	C	C
		2008	7.9	8.27	1.22	22.62	C	C
		2009	7.9	9	6.5	24.5	C	C
		2010	7.7	7.3	6.1	64.75	C	C
		2011	7.9	7.8	1.6	2825(1400-5800)	C	C
		2012	7.8	8.2	1.3	2841(130-9200)	C	C
2	Rengali	2007	7.6	7.9	0.92	16.25	C	C
		2008	7.6	8.2	0.97	16.5	C	C
		2009	7.3	9.3	1.6	15.2	C	C
		2011	7.7	7.9	1.5	1568(630-4900)	C	C
		2010	7	7.2	1.4	52.25	C	C
		2012	7.7	8.1	1.3	2506(780-9200)		
3	Samal	2007	7.2	8.22	2.9	15.25	C	C
		2008	31.7	8.2	1.25	12.75	C	C
		2009	7.6	44.1	1.32	13.1	C	C
		2010	7.7	7.2	1.45	9.65	C	C
		2011	7.8	7.3	1.8	924(330-1500)	C	C
		2012	7.8	7.7	1.5	2784(170-9200)	C	C

(Source: Water Quality of Major Rivers Of Odisha during 2007-2010, State Pollution Control Board Odisha 2013)

<sup>6</sup> Values less than 250microS/cm are considered a low salinity hazard, Soil-water-plant relations, IHE, Delft

**Table 18 : Biomonitoring of River Brahmani**

Station	Year	Annual average values		Designated class	Existing Biological Water Quality Class
		Saprobility Index	Diversity Index		
Panposh U/s	2007	6.15 (5.6-6.7)	0.47 (0.41-0.52)	C	B-C
	2008	6.7	0.57		
	2009	5.9 (5.7-6.0)	0.57 (0.48-0.65)		
	2010	5.7 (5.1-6.7)	0.61 (0.42-0.90)		
Panposh D/s	2007	5.18 (4.75-5.6)	0.33 (0.29-0.52)	C	B-C
	2008	5.2 (5.0-5.5)	0.46 (0.40-0.51)		
	2009	5.1 (4.7-5.5)	0.41 (0.37-0.47)		
	2010	5.3 (5.0-5.8)	0.50 (.40-0.50)		
	2008	—	—		
	2009	—	—		
	2010	—	—		

(Source: Water Quality of Major Rivers Of Odisha during 2007-2010, State Pollution Control Board Odisha 2013)

**Table 19 Indian Standard for the Surface Water (CPCB Standard)**

Sl.No	Parameters	A	B	C	D	E
1	pH	6.5-8.5	6.5-8.5	6.5-8.5	6.0	
2	Colour ,Hazen unit, max	10	300	300	-	-
3	Total Suspended Solid	Not specified in Standard	Not specified in Standard	Not specified in Standard	Not specified In Standard	Not specified in Standard
4	Total Dissolved Solid, mg/l, max	500	-	1500	-	2100
5	Free Ammonia (as N),mg/l, max	-	-	-	1.2	-
6	Sulphate (as SO <sub>4</sub> ), mg/l, max	400	-	400	-	1000
7	Total Hardness as CaCO <sub>3</sub>	Not specified	Not specified	Not specified	Not specified	Not specified
8	Total Alkalinity as CaCO <sub>3</sub>	Not specified	Not specified	Not specified	Not specified	Not specified
9	Lead(as Pb) mg/l, max	0.1	-	0.1	-	-
10	Dissolved Oxygen, mg/l, max	6	5	4	4	-
11	BOD, mg/l, min	2	3	3	-	-
12	COD	Not specified	Not specified	Not specified	Not specified	Not specified

**Note:**

A- Drinking water source without conventional treatment but after disinfection.

B- Outdoors bathing

C- Drinking water source with conventional treatment followed by disinfection.

D- Propagation of wildlife, fisheries.

E- Irrigation, Industrial cooling, controlled, controlling waste disposal

153. It is observed that Brahmani water quality meets Central Pollution Control Boards (CPCB)'s class C water quality criteria. The presence of coli form in water quality shows that there is domestic waste discharge in the river. In India, the Central Pollution Control Board (CPCB) has developed a concept of designated best use and classified water based on the surface water quality (IS: 2296- 1992) into five classes i.e. A – E ( Table 19). The different classes are: A- Drinking Water Source without conventional treatment but after disinfection; B- Outdoor bathing (Organized); C- Drinking water source after conventional treatment and disinfection; D- Propagation of Wild life and Fisheries and E -Irrigation, Industrial Cooling, and Controlled Waste disposal.

**10. Groundwater Resources**

154. Groundwater resources in Rajgangpur Block were assessed in 1999 at 3,752ham, of which 12% is utilised for irrigation, and 9% for domestic and industrial purposes. There is potential for further groundwater development, particularly in the tail reach of the LMC where the water table is quite shallow (0-4m).

**B. ECOLOGICAL RESOURCES**

**i. FISHERIES**

155. There is no fishing activity in Kansbahal canal but presence of fishes has been reported in dam. The yield from the dam as reported block the Rajganpur Block Fishries Extension Officer is aprox 18.60 Mt for the year 2010-2011. The common fishes found in the dam are rohi (Labeo rohita), bakur (Catla catla) mirkali (Cirrhina mirgala) balia (Wallagonia attu) etc., State Fisheries department is testing dam water quality, the parameters that are tested during the month of October are pH – 6.8, Dissolved Oxygen – 4.8 ppm, Dissolved free Carbondioxide – 12 ppm and Total alkalinity – 44 ppm. The fresh water fishes of Brahmani basin are given in Table 20 below.

**Table 20 : Common fresh water fishes of Brahmani basin**

Sr No.	Local Names	Latin Names
1.	Balia	<i>Wallagonia attu</i>
2.	Baligarda	<i>Glossogobius gizziris</i>
3.	Bhakur	<i>Catla catla</i>
4.	Chengu	<i>Ophicaphalus gachus</i>
5.	Dandkhiri	<i>Esomus dandrica</i>
6.	Gadsi	<i>Ophioapunetatus</i>
7.	Jalanga	<i>Panga sisus</i>
8.	Jallah	<i>Chelaargentea</i>
9.	Kantia	<i>Myotous carasistus</i>
10.	Kerandi	<i>Barbus ambasis</i>
11.	Mangura	<i>Clarias batrachus</i>
12.	Mirakali	<i>Amblypharyngodan mola</i>
13.	Neuli	<i>Gobiopterus ohund</i>
14.	Pohale (chuna)	<i>Cirrhina reba</i>
15.	Pohale (dhanga)	<i>Labeo bata</i>
16.	Pabatata	<i>Callichrous bimaculatus</i>
17.	Phali	<i>Notopterus notpterus</i>
18.	Rohi	<i>Labeo rohita</i>
19.	Serana	<i>Barbus serana</i>

20.	Seula	<i>Ophiocephalus striatus</i>
21.	Singi	<i>Heterophnaustec fossilis</i>
22.	Todi	<i>Mastacembelus armatus</i>

Source: Official Website

## 11. Flora and Fauna

156. About 36% of the district is covered with dense forest and a long range of hills. Primarily agricultural district, the principal forest products of the district are timber, bamboo, firewood and kendu leaf, and raw materials used for medicine are obtained from the forests.
157. Important medicinal plants found in the project area are chandan (*Santalum album*), bija (*Pterocarpus marsupium*), rohini (*Ssoyimida fabrifuga*), fanfana, (*Oroxylon indicem*), kamalagudi (*Malotus philipinansis*), patuli (*Pterospermum swave*), chandeigodi (*Vitex peduncularis*), bidanga (*Embelia ribes*), modafal (*Helioteres isora*), bumpipali (*Piper longum*), karpura haldi (*Curcuma aromatica*), iswari (*Aristoloechea indica*), bridha daruka (*Aargeyreia durvula*) etc.
158. Plants/animals and environment are inter related to each other. With the change in environmental conditions, the vegetation cover as well as animals reflects several changes in its structure, density and composition.
159. The prevailing vegetation cover over the area is mainly of tropical dry deciduous forest [5B/C-1/C] as per the Champion and Seth (1968) "Classification of forest type of India". The dominant flora comprised generally the trees planted along canal side and road. Some of these trees may be required to be felled during the canal rehabilitation and construction work. The common trees observed are presented in Table 21. Within the Malidih RF (200 m from Barenuagaon), Ramlata RF (within 1 km of Kadambahal village) the major tree species are Sal (*Sorea robusta*), Mahua (*Madhuca indica*), Ashan (*Terminilia tomentosa*), Kendu (*Diospyros melanexylon*), and Sirish- Chakunda (*Albizia lebbeck*).

Table 21 : List of Common Trees of Project Districts

S. No.	Botanical Name	S. No.	Botanical Name	S. No.	Botanical Name
1	<i>Acacia Catechu</i>	9	<i>Anthocephalus</i>	17	<i>Casuarina equisetifolia</i>
2	<i>Acacia nilotica</i>	10	<i>Azadirachta indica</i>	18	<i>Ceiba pentandra</i>
3	<i>Acacia auriculiformis</i>	11	<i>Artocarpus integrifolia</i>	19	<i>Cordia myxa</i>
4	<i>Adina cardifolia</i>	12	<i>Bauhinia variegata</i>	20	<i>Dalbergia sissoo</i>
5	<i>Aegl mermelos</i>	13	<i>Bombax cieba</i>	21	<i>Delonix regia</i>
6	<i>Alangium Salvifolium</i>	14	<i>Boswellia serratta</i>	22	<i>Dipterocarpus</i>
7	<i>Albizzialebbek</i>	15	<i>Cassia fistula</i>	23	<i>Diospyros malaberica</i>
8	<i>Alstonia sholaris</i>	16	<i>Cassia seamea</i>	24	<i>Ervthrina strieta</i>
25	<i>Eucalyptus globossus</i>	37	<i>Mumusops chemgi</i>	49	<i>Sweitenia macrophylla</i>
26	<i>Ficus benghalensis</i>	38	<i>Mytragyna perviflora</i>	50	<i>Syzygium cumini</i>
27	<i>Ficus glomerata</i>	39	<i>Odina wodier</i>	51	<i>Tectona grandis</i>
28	<i>Ficus infectoria</i>	40	<i>Oroxylum indicum</i>	52	<i>Terminalia arjuna</i>
29	<i>Ficus religiosa</i>	41	<i>Peltophorum pterocarpum</i>	53	<i>Terminalia catappa</i>
30	<i>Gliricidia sepium</i>	42	<i>Pithecolobium dulee</i>	54	<i>Tamarindus indica</i>
31	<i>Gmelina arborea</i>	43	<i>Phoenixsylyestris</i>	55	<i>Thespesia populnea</i>

S. No.	Botanical Name	S. No.	Botanical Name	S. No.	Botanical Name
32	<i>Guazoma tomentosa</i>	44	<i>Pongamia pinnata</i>	56	<i>Toona ciliata</i>
33	<i>Lagerstroemia speciosa</i>	45	<i>Polyalthia longifolia</i>	57	<i>Trema orientalis</i>
34	<i>Leucaena leucocephala</i>	46	<i>Samanea saman</i>	58	<i>Trewia nudiflora</i>
35	<i>Mangifera indica</i>	47	<i>Stereulia foetida</i>		
36	<i>Melia azaderach</i>	48	<i>Sweitenia macrophylla</i>		

108 The general faunal study was carried out for the core zone and buffer zone separately as given below; the species observed in buffer zone are migratory, common ones are given in Table 22.

Table 22 : List of common fauna of Project District

S. No.	Zoological Name	S. No.	Zoological Name	S. No.	Zoological Name
1	<i>Bufo sp</i>	14	<i>Rattus rattus</i>	27	<i>Copsychus sp.</i>
2	<i>Rana tigrina</i>	15	<i>Corves splendens</i>	28	<i>Coracijs bengalensis</i>
3	<i>Calotes versicolor</i>	16	<i>Passer domesticus</i>	29	<i>Ceryle sp.</i>
4	<i>Hemidactylus sp.</i>	17	<i>Ploceus philippinus</i>	30	<i>Vespa orientalis</i>
5	<i>Naja naja</i>	18	<i>Psittacula krameri</i>	31	<i>Agrian sp.</i>
6	<i>Vipera sp</i>	19	<i>Pavo cristatus</i>	32	<i>Apis indica</i>
7	<i>Fumambulus pennanti</i>	20	<i>Columba livia</i>	33	<i>Musca domestica</i>
8	<i>Felis sp.</i>	21	<i>Egretta sp.</i>	34	<i>Periplanata sp.</i>
9	<i>Cuon sp</i>	22	<i>Pycnonotus sp.</i>	35	<i>Lasioderma sp.</i>
10	<i>Bos sp.</i>	23	<i>Acridotheres tristis</i>	36	<i>Pachlomerus sp.</i>
11	<i>Bubalis babalis</i>	24	<i>Eudynamys scolopacea</i>	37	<i>Schistocera sp.</i>
12	<i>Eqqus sp.</i>	25	<i>Apus affinis</i>	38	<i>Camponotus sp.</i>
13	<i>Herpestes sp.</i>	26	<i>Ardeola grayii</i>	39	<i>Gryllus sp.</i>

**Amphibians:** Among amphibians toad (*Bufo sp.*) and frog (*Rana tigrina*) are reported.

**Reptiles:** Among reptiles Indian garden lizards (*Calotes versicolor*), house lizards (*Hemidactylus sp.*) are generally reported while cobra (*Naja naja*) and viper (*Viper sp.*) are rarely reported.

**Wild Animal :** Elephant (*Elephas maximus indicus*), Wild boar (*Sus scrofa cristatus*), Chital Deer (*Axis axis*), Black Bear (*Ursus thibetanus*), Langur / Hanuman (*Semnopithecus entellus*), Jackel are reported at RF area

**Mammals:** Among mammals Indian palm squirrel (*Fumambulus pennanti*), cat, dog (*Cuon sp.*), cow, Buffalo, rat (*Rattus rattus*) etc. are reported.

**Aves:** Among aves common birds like crow (*Corves splendens*), sparrow (*Passer domesticus*), parrot (*Psittacula krameri*), baya (*Ploceus philippinus*), peafowl (*Pavo cristatus*), pigeon (*Columba livia*), *Egretta sp.* etc. are reported.

**Arthropods:** Among arthropods common insects viz Butterflies, Dragonflies, Wasps; Grasshopper, Cockroach, House fly, Beetles, Mosquitoes etc are reported.

As per the Red Data Book Elephant is the endangered species and Black Bear is under Vulnerable category and the rest of the wild animals are of least concern status (Table 23).

Table 23 : Showing List of Fauna showing IUCN Status

Sl.No	Common name	Scientific name	IUCN conservation status
1	Elephant	<i>Elephas maximus</i>	E
2	Chital Deer	<i>Axis axis</i>	LC
3	Black Bear	<i>Ursus thibetanus</i>	V
4	Barking Deer	<i>Muntiacus muntjak</i>	LC
5	Monkeys	<i>Semnopithecus entellus</i>	LC
6	Indian palm squirrel	<i>Fumambulus pennanti</i>	LC
7	Crow	<i>Corves splendens</i>	LC
8	Sparrow	<i>Passer domesticus</i>	LC
9	Parrot	<i>Psittacula krameri</i>	LC
10	Baya	<i>Ploceus philippinus</i>	LC
11	Peafowl	<i>Pavo cristatus</i>	LC
12	Ppigeon	<i>Columba livia</i>	LC
13	cobra	<i>Naja naja</i>	LC
14	viper	<i>Cryptelytrops erythrurus</i>	LC

## 12.Forests

160. The forest map of Odisha indicates that north western district along with central part are having dense to moderately dense forest areas while south and western parts have a mix of dense and open forest areas.

161. The forest in Sundergarh district can be classified under the following four categories and the district has a geographical area of 9712 sq.km out of which 4959.17 is the forest area which is around 51.06%:

1. Reserve Forests	-	2651.88 sq. kms.
2. Demarcated Protected forests	-	838.70 sq. Kms
3. Un-demarcated forest.	-	0.0 sq. Kms
4. Unclassified Forests	-	1.72 sq. Kms.
5. Other Forests	-	1466.87 sq. Kms.
<b>TOTAL:</b>		<b>4959.17 sq. Kms.</b>

(source: Statistical Handbook 2009, Sundergarh district.)

162. The forest of the district is of northern tropical dry deciduous type, mainly containing Sal, Assan and Kurum. The eastern half of Bonai and Rajagangapur contain better quality of vegetation. The forest area is mostly studded with rich mineral deposits, like iron ore, manganese, limestone, lead; also forest products like bamboo, timber and kendu leaf which are export-oriented. The district was a very inaccessible tract having no proper communication. The tribal people living in the area used to subsist for the most part of shifting cultivation which resulted in denudation of forest. The principal forest produce are timber, kendu-leaf and bamboo besides minor product like sabai grass, lac, tassar, myrabolan, mahua, kusuma seed, resin, tamarind, gum and sal seed. The exports of forest produce are mainly done through road and railway.

## C. ECONOMIC DEVELOPMENT

### i. INDUSTRIES

163. Among the big industries at Sundergarh, fully modernized Rourkela Steel Plant has a capacity to produce 1.9 million tonnes of crude steel, is very famous. Rourkela Fertilizer Plant, set up to utilize the residue of the steel plant and to re-utilise the chemicals is also located in Sundergarh district.
164. One cement factory is located at Rajgangpur in Sundergarh district. The factory at Rajgangpur, named as the Odisha Cement Ltd., was established in pursuance of an agreement in December 1948, between the state of Odisha and M/s Dalmia Jain Agencies Ltd.
165. The small scale industries sector has also grown steadily over the past few years in Sundergarh district and has helped in upliftment of economy in the area. The category wise Small Scale Industries (SSI) units set up in the Sundergarh district given below in Table 24.

**Table 24 Small Scale, Cottage and Handloom Industries in Sundergarh District**

Sl No.	Types of Industry	Numbers	Capital Investment (R.s in lakh)
1	Small Scale	407	2564.14
2	Cottage	16	3.75
3	Handloom	128	NA

(Source: District Statistical Handbook 2009)

### ii. TRADE AND COMMERCE

166. The routes passing through the Ib and Brahmani river valleys in the district served ancient trade routes. The people of this area were carrying on trade with Madhya Pradesh, Bihar and other neighboring areas in various forest products like peacock feather, ivory, lac and myrobalan etc. During the Darbar Administration the articles exported were lac, cotton, honey, arrow-rot, sabaigrass, wax whereas the imported articles were salt, sugar, Kerosene oil etc. The railway station at Bisra, Kalunga, Raurkela and panposh were used for export of timber and bamboo etc.
167. In course of time coverage under export has increased considerably which includes minerals like iron ore, dolomite, limestone, manganese and various forest products like timber, bamboo, kendu-leaf, mahua flower etc. The articles imported to the district are ferro-manganese, ferro-silicon, chemical machineries, petrol, kerosene oil, edible oil and stationery goods etc. The goods under import and export of the district are transported by the railway and road transport.

### iii. TRANSPORTATION

168. Communication facilities in the district have improved perceptibly during the second part of the century. The nearest rail head to the district headquarters is at Jharsuguda at a distance of 35 kms. The main line of South Eastern Railway (Calcutta - Mumbai line) runs about 105 kms. in Panposh and Sundargarh sub-divisions of the district. An additional branch line from Rourkela to Biramitrapur (28 kms.), from Bondamunda to Barsuan (68.6 kms.) are available for transportation of minerals. The rail link to Kiriburu passes about 26.2 km. within the district. There is also a rail link between Nuagaon

and Purunapani, a distance of about 10 kms. Rourkela is the busiest railway station in both passenger and good traffic. There is a proposal to link Bimlagarh and Talcher by rail to expedite the transport of minerals. During rainy season small boats carry goods down the IB to Sambalpur whereas the other rivers are not navigable due to rocks and rapids. There is, however, a small airport at Raurkela and maintained by Raurkela owned Steel Plant which is licensed for private use. Coming to road communication, the district headquarters and the Steel city of Rourkela are directly connected by public transport system to the State headquarters and other district headquarters. Nationalised buses ply in most parts of the district. The number, type and length of roads are given in Table 25:

**Table 25: Details of Road in Sundergarh District**

Sl. No.	Types of Roads	Length in K.M
1	National Highways	168
2	State Highways	211
3	Major District Highways	291
4	Other District Highways	274
5	Rural roads	1230
6	Gram Panchayat Roads	7682
7	Forest Roads	685

(Source: District Statistical Handbook Sundergarh- 2009)

#### D. AGRICULTURAL DEVELOPMENT, MINERAL DEVELOPMENT

169. The economy of the district is predominantly agrarian. Over fifty percent of the population is depend on agriculture. Area and production of different crops at Sundergarh district is shown in Table 26 as reported in Odisha Agricultural Statistics 2011 – 2012 by Directorate of Agriculture & Food Production, Odisha..

**Table 26 : Area and production of different crops at Sundergarh district (2004-05)**

Area under different crops		Area in Hact	YPH/Kg/Ha	Production in MT
Rice	Autumn Rice	78.36	11.98	93.89
	Winter Rice	113.21	2203	249.43
	Summer Rice	1.77	1989	1794
Total Rice		111.48	2678	1794
Cereals	Maize	0.11	2241	0.25
	Ragi	2.22	868	1.93
	Wheat	2.05	2102	4.31
Total Cereals		63.68	568	36.19
Pulses	Mung	7.48	473	3.54
	Biri	17.99	457	8.23
	Kulthi	18.81	463	8.71
	Total Pulses	63.68	568	8.71
Total Food Grain		63.68	568	36.19
Oil Seeds	Groundnut	5.97	1631	9.74
	Sesame(Til)	20.02	506	10.13

Area under different crops		Area in Hact	YPH/Kg/Ha	Production in MT
	Mustard	8	426	3.41
Total Oil Seeds		38.42	663	25.46
Vegetables	Khariff	13.09	12775	167.23
	Rabi	19.08	14445	175.62
	Summer			
Total Vegetables		32.17	13766	442.86
Cash Crops	Sugarcane	0.02	76575	1.53
	Cashew			
	Mango	8.83		
	Banana	1.59		
	Citrus	1.68		
Total Cash Crops				
Condiments & Spices	Chillies	3.49	960	3.35
	Ginger	0.6	5100	3.06
	Turmeric	0.42	5667	2.38
Total Spices		5.41	2074	11.22

(Source: Odisha Agriculture Statistics 2011-12)

170. Crop yield rates for the sub project are detailed in Table 27 which also shows the yield rates assumed for the crop production models. Yield rates of Kharif and Rabi rice are more than the district average but below the state average. The yield rates of pulses, oil seed, maize, fibre crops and spice, but not rabi pulse and spices, are more than the district average. Yield rates of vegetables in Kharif and Rabi are much below the district average. The lower yield rates cannot be attributed only to irrigation scarcity, but are due to lack of interest of farmers because of uncertainty of irrigation and better alternate sources of income. There is much scope for improvement.

Table 27 : Crop Yield Rates (kg per hectare)

	Rajgangpur Block	Sundargarh District	Odisha State	Used for Analysis: Current	With Full development
<b>Kharif</b>					
Paddy	2,140	1,837	2,236	2,100	2,400
Vegetables	8,080	10,217	10,774	8,000	10,000
Spices	1,008	1,225	1,625	1,000	1,200
Maize	1,200	1,189	1,575	1,200	1,400
Fibre	820	793	635	820	900
Pulses	480	450	482	480	550
Oilseed	550	417	490	550	630
<b>Rabi</b>					
Hy Paddy	3,180	2,558	3,475	3,100	3,500
Pulses	350	432	422	350	420
Vegetables	8,700	13,089	13,817	8,700	11,000

Spices	750	1,183	1,108	750	820
Wheat	1,420	1,580	1,415	1,400	1,500
Oilseed	430	336	972	430	520

Source: District area, yield & production for 2006-07, Directorate of Agriculture & Food Production, and local staff of DA&FP, Odisha.

171. Fertilizers are applied by most farmers in both Rabi and Kharif seasons. Application rates in the command area are low compared to the recommended rates. Consumption of NPK during Kharif 2005-06 in Rajgangpur block was 20kg/ha with N57%, P31% and K11%. These rates do not compare well with the typical recommendation of 120 kg/ha for Kharif paddy rice, with N50%, P25% K25%. Many farmers are not aware of crop deficiency symptoms. Heavy subsidies on nitrate fertilisers encourage farmers to use this rather than relatively expensive P and K, or compound fertilisers. This imbalanced use of chemical fertilisers affects productivity and soil status in the long run.
172. There are numbers of working mines in Sundergarh. The details of mines and mining ores are given in Table 28.

**Table 28: Working mines, area and production**

Sl No.	Name of the Ore	No. of Working mines	Area covered (in HQ.)	Production-output(in 000 MT)
1	Dolomite	23	3638.25	1531.18
2	Bauxite	5	662.64	0.718
3	Coal	2	140.84	7972
4	Pyroxenite	1	50.64	0.456
5	Iron Ore	35	6905.02	15003.19
6	Manganese Ore	33	5945.29	471.89
7	Lime stone	20	3204.33	1689
8	Quartz	3	89.87	15
9	Silike sand	2	129.42	4.5
10	Soap stone	2	161.12	0
11	Total	126	20927.42	26687.934

(Source: District Statistical Handbook 2009, Sundergarh)

## **E. SOCIAL AND CULTURAL RESOURCES POPULATION AND COMMUNITIES**

### **(i). Demographic Status**

173. Total population of Sundergarh district is 2,080,664 as per provisional census 2011. The decadal growth is 13.66 and the annual growth rate is 1.29% for the district. As per 2002 census the district has 18, 31,000 out of which 12, 02,000 is the rural population and 6, 29,000 is the urban population, which constitutes about 34 % of the total population. The population of schedule cast is 1, 58,000 and schedule tribe is 9, 19,000. A detail of demographic structure of the Sundergarh district is given in Table 29.

**Table 29: Demographic Pattern of Sundergarh District (2011 census)**

Sl. No.	Demographic Details	Numbers
1.	Total Population as per 2011 provisional census	2,080,664

2.	Rural Population as per 2011 census	1342031
3.	Urban Population as per 2011 census	738637
4.	ST Population as per 2011 census	9,19,000
6.	SC Population as per 2011 census	1,58,000
8.	Sex ratio (No. of females per 1000 males) – 2011 census	971
9.	Density of population per Sq. km. as per 2011 census	214
10.	Literacy rate (%) 2011 census	74.13
11.	SC literacy rate (%) as per 2001 census	62
12.	ST literacy rate (%) as per 2001 census	53

Note: (i) The District has a preponderance of rural population (more than 65 % of total population)  
(ii) The percentage of ST and SC population to total population is more than 58 % as per 2001.  
(iii) Figures for 2011 are as per provisional census

**Source: District Statistical Handbook, Sundergarh 2009, Government of Odisha & provisional census 2011)**

174. Demographic pattern for the Rajgangpur block within the sub project as per 2001 census is given below. The project area entirely falls under Rajganpur Block covering 24 numbers of villages covering approximately 6658 number of beneficiaries from the project (Table 30). The percentage of SC population is around 13.70% and ST population is around 73.62%.

**Table 30 : Showing Population Details of the subproject**

No. of Villages	24
No. of Households	10348
SC Population	6639
ST Population	35664
General Caste	6140
Total Population	48443

(Source: Population Census of India, 2001)

## **(ii). Places of Historical, Archeological and Religious Significance**

175. The Sundargarh District was constituted by the merger of two princely states of Bonai and Gangapur. According to historians, the region was once under the rule of South Kosalas. The Maratha Chief Raghuji Bhonsla handed over the area to the British in the beginning of 19th century.
176. Blessed with rich flora and fauna and the presence of modern industrial towns have made the district a lovely tourism center of the state. Every year thousands of tourists visit the Sundargarh district and enjoy sightseeing tours to the below mentioned places of interest:
177. Important fairs and festivals observed in different parts of the district are Shivaratri, Kartikapuja, Dasahara, Bhai Jiuntia, Ganesh Puja, Saraswati Puja, Makar Mela, Basanti puja, Raja , Chandan Jatra, Dola Jatra, Durga puja, Kali puja, Pana Sankranti Jatra, Snana Purnima,Ratha Jatra,Jhulen Purnima, Ramanabami Jatra, Laxmi Puja, Mahavisuba Sankranti, Rahas Purnima, Sitala puja.

**(iii). Important Places in Sundergarh district**

- **Rourkela:** It is the modern industrial city of Odisha. The steel plant, fertilizer plant, Indira Gandhi Park and zoo are the visiting places
- **Vedavyasa :** Vedavyasa is the confluence of the river Sankara and river Koel. It is 8 km from Rourkela. This place is Legenderily associated with Maharshi Vedavyasa , the author of the epic Mahabharat. There is a Shiva temple at Vedavyasa.
- **Manikmoda :** There are beautiful historic rock paintings in the cave .The paintings are of animals ,birds, humans ,hunting scene. This natural cave has water resources in it.
- **Manindra Dam:** It is situated at a distance of 32 km. from Rourkela. Boating on the river Sankha is of another attraction.
- **Ghogar :** It is situated at a distance of 43 km from Sundrargarh on the river IB. It is a picturesque picnic spot
- **Khandadhar :** Khandadhar waterfall is located amidst the forest of Sundergarh. The height of the fall is 800 m. The magnificent sight of the fall makes a great picnic spot. The spot is 114 km from Rourkela.
- **Darjeeng :** A beautiful picnic spot surrounded with blue mountain, spring and dense forest.

## V ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

### A. GENERAL

178. The positive and negative impacts associated with this project are described in this chapter. The negative environmental impacts, both direct and indirect associated with the project location and impacts arising due to the construction phase of the project will be temporary and short term in nature. The direct and short term impacts concern the implementation stage of the ERM works. During the operation phase, indirect impacts expected are long term and are in general positive. For purposes of this IEE report, the environmental impacts in the study area have been discussed during the pre construction, construction and operation phase of the project. Identification of these impacts is followed by recommendations of appropriate cost effective mitigation measures. These impacts along with the mitigation measures are given in the following sections:

### B. SUB PROJECT ACTIVITIES

179. Priority for infrastructure works is as follows:
- (i) Improved hydraulic performance of main system canals, checking for trapezoidal shape and stability, and also provide guard walls to reduce rainfall runoff erosion of sediment into the canals.
  - (ii) Hydraulic control structures for improved flow control and flow measurement along left and right bank main canals and to offtaking minors and sub-minors canals.
  - (iii) Provision of additional cross drainage structures and properly designed drainage inlets to minimize entry of sediment into the canals.
  - (iv) Selective lining of canals to reduce seepage as well as canal breaches caused by shrinkage and cracking of embankments in black-cotton-like soils.
  - (v) Bridges for improved access across canals.
  - (vi) Minor canal systems.
  - (vii) Improved access along inspection / patrol roads.
180. Activities related to Kansbahal sub-project is listed below:
181. The list of structures that are likely to be undertaken repair/ renovation proposed under the sub project in the left, right, distributaries, minors and sub-minors are stated in the Table 31.

Table 31 Showing the list of Structures in the Kansbahal subproject

No.	Structures	Entire Canal System (Left, Right, Minors and sub-minors)		
		As per inventory	To be Repaired	New construction
1	Head Regulator	37	34	0
2	Canal Siphon	13	3	0
3	Aqueducts	8	7	0
4	Drainage Siphons	107	8	1
5	Bridges	104	47	11
6	Escapes	1	1	1
7	Cross Regulators	0	0	1

No.	Structures	Entire Canal System (Left, Right, Minors and sub-minors)		
		As per inventory	To be Repaired	New construction
8	Fall/Drop structures	172	70	0
9	Outlets	341	88	3
10	Total	783	258	16

### C. SUBPROJECT ACTIVITIES DURING CONSTRUCTION PHASE

#### 1. Head and Spillway Work:

182. The head works are in reasonable condition and only minor works are required, for example: (i) to repair the lined channels on the earthen back-slope; (ii) improve access to the walkway over the spillway; (iii) painting of gates; and (iv) to address leakage around the gates.

#### 2. Canal Work:

- ❖ Resection of the main canal, distributaries, minor and sub-minor as per design section
- ❖ Lining of selected sections for canals to address localized soil related problems.
- ❖ Strengthening and protection of embankments.

#### 3. Irrigation system structure work:

All existing cross and head regulators are to rehabilitated and upgraded, gated, with separate gate operating platforms and bridge decks, improved and more gradual transitions, new flow measurement flume

- ❖ Construction of new cross regulator, drainage structures, other hydraulic structures including bridges / culverts as per requirement.
- ❖ Repairing of existing hydraulic structures including bridges
- ❖ Improvement of inspection / patrol road
- ❖ CAD works.

### D. SUB PROJECT ACTIVITIES DURING OPERATION PHASE

- ❖ Maintenance of water availability from Dam reservoir
- ❖ Operation of the regulating gates.
- ❖ Maintenance of canal through desilting operation
- ❖ Maintain drainage system of agricultural field

### E. POSSIBLE ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

183. The proposed project will have impacts on the environmental in distinct phases:

- Impact Due to Project Location
- Impacts During Planning and design phase
- Impact During the construction phase
- Impacts During operation phase

184. The activities which could have negative impacts and the type of impact are summarized for different phases. Mitigation that necessary to be considered to minimize impacts and for protection of environment are also discussed.

## **F. IMPACTS DUE TO PROJECT LOCATION**

185. The environmental issues that may arise due to the present project location are minimal:

- No land acquisition, no resettlement and no change in landuse and landcover will take place, as the proposal envisages the rehabilitation, upgradation of the canal system without increasing the command area or any new canals.
- The dam, catchment area is surrounded by Kumaria reserved forest, Jambua reserved forest and Chudia reserved forests. The canal system The right main canal also originates in the reserved forest RD 0 to 100m falls in the Kumaria RF. Two minors of left main canal Badnuagaon minor -1 RD 360m to 400m and Badnuagaon minor -2 RD 720m to 750 m pass adjacent to the village forest on the right side
- No impact on archaeological, monumental, religious and cultural sites will take place as these are not present within the ROW
- No encroachments (Structures) are present along the canal system as per survey conducted by SIO and confirmed by the R & R specialist.
- Some trees present on the canal embankment may likely get affected or may require cutting or removal.
- Utilities like electric poles/ lines, transformers or any water pipelines present on the canal may get affected due to the proposed work.

186. The mitigation measures proposed are:

- Proper planning and precaution would be taken by the contractor while executing the works in consultation with the local people
- Demarcation of ROW before executing the canal works by the SIO in the presence of PP and addressing any disputes in consultation with PP and in accordance with the R & R policy.
- No additional impact on forest land as it is an existing canal system where some the right main canal originates in the reserved forest RD 0 to 100m falls in the Kumaria RF. Two minors of left main canal Badnuagaon minor -1 RD 360m to 400m and Badnuagaon minor -2 RD 720m to 750 m pass adjacent to the village forest on the right side
- During the survey PMU / SIO along with the survey team and Design engineers shall identify the number of trees to get affected and to the possible extent should avoid tree cutting.
- Utilities like electric poles, line, transformers and water pipelines if any on the canal may not get affected due to the proposed work, if any SIO comes across in any minors or sub-minors shall identify such poles / lines that need to be shifted.

## **G. IMPACT DURING PLANNING & DESIGN PHASE**

187. The planning phase will include further detailed topographic and geotechnical surveys and hydrological assessments which will provide information for the detailed design of the scheme. As such impacts during this planning phase may be limited to erroneous or inadequate field assessments and data interpretation. These impacts could manifest themselves in the following manner:

- Incorrect survey in order to align / resection of canal. This may result in loss of cultivated land or encroachment of community owned land;
- Incorrect hydrological assessment of flood magnitude resulting in under-design of conveyance system, leading to hydraulic/structural failure;
- Incorrect and insufficient geotechnical survey which does not adequately taken into account the geology of the area.

- Improve the efficiency of the canal by reducing the water losses.
- Some large girth trees present on the embankment may get affected or may require tree cutting.
- Utilities like electric poles / electric lines were found within the ROW on the canal embankment.
- No Archaeological sites are within the project area but while excavation work chance find protocol would be used.
- Identification of potential sites or locations for drilling tube wells

188. The mitigation measures proposed would include:

- Thorough hydrological assessment using all available background data and making use of flood simulation software to better estimate optimum design flows. This is to be conducted as the starting point to the design process and will be checked and verified in accordance with project quality assurance procedures;
- A geotechnical survey, topo survey and a soil survey particularly along the axis of the canal side should be conducted at the beginning of the design process to reduce the risk of costly design revisions during construction, or worse the failure of a scheme due to a design based on erroneous parameters;
- The design should be checked in accordance with project quality assurance and quality control procedures.
- Desilting, lining of the canals and minor repairs to existing structures will improve operation of the canals and positively impact on the hydrology of the project.
- Repair of drop structures, and regulators, and construction of permanent outlets with gates will improve the efficiency of canal operation and reduce water losses.
- Repair of Cross drainage structure and construction of new CD would reduce water logging / ponding
- Construction of new bridges and repair of existing bridges will improve the connectivity of the people and in transporting agricultural products.
- Some trees present on the canal embankment may require removal or tree cutting. During survey and design PMU/ SIO staff along with survey team and in consultation with design engineers shall identify the number of trees that may get affected. To the possible extent tree cutting shall be avoided, if any tree shall be removed from the ROW before commencement of actual work it shall be done in consultation and with the permission of State Forest Department. Stacking, transport and storage of wood shall be done as per the relevant norms. All efforts shall be made to preserve the trees to the possible extent.
- Utilities like electric poles / lines /transformers/ water pipelines existing within ROW may not be affected if any identified during survey in the minor and sub-minors which are likely to be damaged during widening or strengthening the canal embankment or may cause hindrance to the movement of construction equipment, the PMU/ SIO in consultation with design team may identify the utilities that may need shifting, if they need to be relocated proper planning and contingency for shifting need to be planned by the SIO in consultation with the PMU.
- Tube wells locations shall be away from dumps, refuse piles, storage facilities, fuel storage areas, seepage pits, pit toilets, septic tanks, surface water bodies, drains, field fertilized with dung.

## H. IMPACTS DURING CONSTRUCTION PHASE

189. Most of the impacts during construction phase are temporary or short term in nature and can be mitigated by using appropriate methods. Impacts during construction phase has been assessed under the following aspects:

- Pre-construction activities like selection of Camps, Borrow areas, Quarry etc
- Construction Method
- Source of materials and process of procurement of material like earth from borrow areas, Quarry areas, mining of sand
- Transportation of construction materials used in the construction
- Storage of materials and
- Work site maintenance and
- Labour related issues like their shelter, facilities etc

190. Most of the impacts during construction phase are temporary or short term in nature and can be mitigated by using appropriate methods.

### a) Construction Method

191. Rehabilitation and resection of the existing canal system will involve earth moving equipment like excavators, rollers, tippers, tractors, concrete mixers, vibrators, dozers, etc and stripping and leveling of borrow areas etc. Materials will be brought through trucks and offloaded and lifted through manually (head load) where the approach roads in the minors and sub minors are narrow. Excavation and manual digging and cutting would be involved. The excess material would be disposed off within the low lying areas of right of way.

### b) Sources of Materials

192. The approximate quantities of different materials as identified by SIO staff as part of preliminary estimate is shown in Table 32.

Table 32 Showing the Approximate quantities of Material required for the sub-project

Sl.No	Materials	Approx. Estimated Quantities in Cum
1	Gravel / Moorum	27763 Cum
2	Sand	23334 Cum
3	Stone Boulders	1710 Cum
4	Steel	612 Qntl
5	Granite Material (IRC G I)	9107 Cum
6	Granite metal chips ( 40, 20 & 12 mm)	23574 Cum
7	Cement	71252 Qntl

### c) Pre construction activities by the contractor

193. After finalizing the contractor before the contractor commence his work the Contractor along with the SIO staff shall identify

- Contractor shall identify potential sites for work camps, stockpiles, storage areas and disposal sites with the help of SIO staff and takes the approval of the SIO manager.

- Contractor shall identify the potential locations for sources of borrow areas, quarry and other materials if any required and take the prior approval of the SIO Manager
194. The mitigation measures proposed are:

- The responsibility of establishing camps, stock piles, storage areas and disposal sites mainly lies with the Contractor, however before commencement of work; with help of SIO staff shall identify the potential sites within the sub-project. He shall avoid locations within the reserved, protected, village forest and elephant transit paths. However, if it is deemed necessary to locate elsewhere, sites to be considered will not damage any property, vegetation, irrigation, drainage and drinking water supply. Residential areas will not be considered and sensitive locations need to be avoided like schools if any. All locations identified for disposal need to be included in the design specifications and on plan drawings.

**(i) Camp**

- Contractor shall avoid establishment of camp / plant in forest areas.
- Contractor shall prioritize areas within or nearest possible vacant space within the subproject without affecting property, forest, vegetation, drinking water sources and away from the water bodies and the canal system.
- All construction plants shall be sited sufficiently away from the settlements and agricultural operations or any commercial establishments. Such plants shall be located at least 100m away from the nearest dwelling preferably in the downwind direction.
- The Contractor shall submit a detailed layout plan for all such plant sites established and approved by the SIO manager.
- If any contractor has to establish crushers, hot mix plants and batching plants shall comply with the requirements of the relevant emission control legislations. Consent for Establishment and Operation from state pollution control board Odisha shall be obtained before establishment and operation and a copy to be submitted to the SIO Manager.
- Arrangements to control dust pollution through provision of wind screen, water sprinklers and dust extraction systems shall have to be provided at all such sites (plants).

**(ii) Borrow areas**

- If earth material is required or need to be procured from borrow pits.
- Finalisation of borrow areas for earth and all logistic arrangements as well as compliance to environmental requirements, as applicable shall be the sole responsibility of the Contractor.
- Contractor shall identify the potential borrow areas and take permission from SIO manager before operating any borrow areas.
- Contractor shall identify the potential borrow areas and take permission from SIO manager before operating any borrow areas. Earth material should be taken from barren land or selected borrow area during lean period as per IS Code 1498 after taking approval from SIO Manager. The criteria of selection is as follows:

**Selection Criteria of Borrow areas is as follows: IS 4701: 1982**

- No borrow pits shall be dug within 5m of the toe of the embankment, if the depth of the borrow pit is less than 0.5m it shall be after 5m of the toe of the embankment and if the pit depth shall be more than 0.5m it shall be 10m of the toe of the embankment or within such a distance from the toe of the bank where a 4:1 hydraulic gradient line cuts the ground surface, whichever is more.
- Borrow pits shall not be more than 1m in depth and 25 m in length.
- A clear distance of 1m shall be left between the pits
- The bed of borrow pits shall be left reasonably smooth and even.
- Contractor shall not be permitted to lift any material from the forest areas.
- The Contractor shall not start borrowing earth from selected borrow area until the mutual agreement is signed between landowner and Contractor. Copy of the document shall be submitted to SIO manager.

- The Contractor in addition to the established practices, rules and regulation will also consider following criteria before finalizing the locations.
    - 1) The borrow area should not be located in agriculture field unless unavoidable i.e. barren land is not available.
    - 2) The borrow pits should not be located along the roads.
    - 3) The loss of productive and agricultural land should be minimum.
    - 4) The loss of vegetation is almost nil or minimum.
    - 5) Sufficient quality of soil is available.
    - 6) The Contractor will ensure the availability of suitable earth. The Contractor shall obtain representative samples from each of the identified borrow areas and have these tested at the site laboratory following a testing programme as approved by the concerned Engineer. It shall be ensured that the fill material compacted to the required density.
  - The different options of procuring earth suggested by SIO are as: Option 1. Kansbhal subproject has 22.18 acres in Kadambahal village, Rajghanpur Village( Plot no.39, 43, 45, 46, 47,51, 52,53, 54,55, 56, 57, 58, 60, 61, 125, 126, 127, 134, 135, 136, 536 and 537 of acquired private land for borrow areas in the year 1986 which may be utilized for some quantity after taking permission from SIO manager. Option 2. Some potential farmers who are willing to give earth from their own lands are being identified by WUAS which can be utilized by the contractor for borrow areas, the potential list of farmers / PPs are enclosed as Annexure 4, the potential farmers list may be handed over to the contractor after the agreement. Option 3. Enquiry with the local revenue department by the SIO manager has revealed there are some government revenue lands in the Rajghanpur block which the Contractor can take temporary lease after award of Contract and can be utilized for borrowing earth. These potential locations shall be verified for the suitability of the material by the SIO staff and the list of potential sites will be provided to the Contractor. As per the contractual conditions an agreement with the land owner will be reached by the contractor and he will also ensure to take the necessary permission for operating these borrow areas from the revenue authority like temporary lease etc. The necessary royalty would be deducted by the SIO staff from the Contractor. Contractor would try to procure earth within a lead of 5 Km of the canal system in small quantities.
  - Planning of haul roads for accessing borrow areas shall be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas as well as forest areas as far as possible and shall use the existing village roads wherever possible.
  - The rehabilitation of the borrow areas shall be done by the contractor as per the land owners requirements.
- (iii) **Quarry areas**
- The Contractor shall finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials, quality and other logistic arrangements.
  - A preliminary survey has been carried out by the SIO and identified the quarry as shown in Annexure 3.
  - If extraction shall be done, prioritize sites already permitted by the Mining or concerned department,
  - Contractor shall purchase materials and finalize vendors who have valid permissions. The list of potential crusher who has valid license from State Pollution Control board, Odisha is enclosed for reference as Annexure 2.
  - If other sites are necessary and the contractor want to use, let the contractor obtain necessary permission from the concerned regulatory authority and inform SIO Manager.
  - The contractor shall avoid all forest areas for quarrying

**(iv) Sand**

- The sand shall be procured from identified (by SIO) sand mines as far as possible. If Contractor wishes to procure from other sources he shall obtain the lease agreement of the supplier
- Most of the impacts during construction phase are temporary or short term in nature and can be mitigated by using appropriate methods.

**d. IMPACT ON LAND USE**

195. Land acquisition will be not required for this subproject. No major adverse impact is expected on the living conditions of the inhabitants. Storage of construction materials and silt at construction sites may temporarily change local land use status. The disposal of debris and silt shall be done properly. The Table 5 & 6 shows the details of reserved and village forest areas; these shall be prohibited by the Contractor / WUAs for using as Camps / Storage places or dumping sites.
196. Felling of trees of canal embankment will also change local (minor) land use pattern.

**Mitigation Measures:**

197. The Contractor while working in main canal, distributaries and minors and WUAs while working in sub-minors shall follow the below:
- Construction materials / silt should be stored properly and proper appropriate measures shall be taken while disposing the debris and silt.
  - To the possible extent the materials like stone and other reusable materials shall be utilized in the construction.
  - The iron and wood if any generated shall be taken into the surplus stock and the scrap shall be auctioned as per the procedures of Odisha Water Resources Department.
  - The generated cutting material is very small quantity found to silty and sandy, not suitable for filling the embankments, hence unsuitable material shall be utilized in the spoil banks of the existing canals and in the low lying sections of the canal bank within the available ROW after toe line, a provision for turfing the spoil banks to avoid erosion is recommended. However, if any additional material is generated it would be disposed by identifying suitable places like old borrow areas, quarry sites and low lying government land by taking appropriate permission from the SIO manager and competent authority. The silt shall be tested for heavy metals and pesticide residues also before disposal and some quantities if suitable for agriculture can be distributed to adjacent farmers through PP.

**e. IMPACT OF SOIL - SOIL EROSION AND SILTATION**

198. Soil erosion will take place during earthworks, such as filling and cutting for resectioning of the canals and disposal of cutting earth in the spoil bank. The impact will be localized, short-term and minor. These activities will be conducted in the dry season. Mitigating and safeguarding measures to prevent excessive dust will be taken up by the contractor. Further safeguards associated with on-site activity and clean-up will be incorporated into the procurement documents.

**Mitigation Measures:**

199. The Contractor while working in main canal, distributaries and minors and WUAs while working in sub-minors shall follow the below:

- Confirming excavations operations and slope stabilization work during the dry season only and compaction in main canal by powered road roller and vibratory roller and in the distributaries, minors and sub-minors by ordinary compaction
- Careful construction planning for surface protection particularly before monsoon season and planning of turfing activities in the inner slope of the canal and a provision for turfing the spoil bank is also suggested.
- Earth material and selection of Borrow area as per IS code 1498 1970 reaffirmed 1970.
- Earthworks operations shall be strictly limited to the areas to be occupied by the permanent Works and approved borrow areas and quarries, unless otherwise permitted by the Project Manager. Due provision shall be made for temporary drainage. Erosion and/or instability and/or sediment deposition arising from earthwork operations not in accordance with the Specifications shall be made good immediately.
- The Contractor shall obtain the permission of the Project Manager before opening up any borrows or quarries. Such borrow pits and quarries may be prohibited or restricted in dimensions and depth by the Project Manager where:
  - they might affect the stability or safety of the Works or adjacent property;
  - they might interfere with natural or artificial drainage or irrigation;
  - they may be environmentally unsuitable.
  - the contractor should enter into an equitable agreement with landowner for borrow area redevelopment if any landowner requires and after completion of the borrow area the contractor obtains a "Satisfaction Letter " or "No – objection Letter" from the land owner on a stamp paper
- At least 14 days before he intends to commence opening up any approved borrow pit or quarry, the Contractor shall submit to the Project Manager his intended method of working and restoration. These shall include but not be limited to:
- the location, design and method of construction of any access track;
  - (ii) the volume and nature of materials to be removed;
  - (iii) the sequence and method of excavation of materials;
  - measures for controlling runoff and sediment from the site during operations; and
- Proposals for site restoration including approximate finished levels, drainage, erosion and sediment control, slope stabilization and re-vegetation, including reinstatement of any access track.
- The operation of borrow pits or borrow areas shall not be permitted until the method of working for that particular pit or area has been approved by the Project Manager in writing. Restoration shall be to the satisfaction of the Project Manager
- Soil erosion will take place during earthworks, such as filling and cutting for re-sectioning of the canals. The impact will be localized, short-term and minor. These activities will be conducted in the dry season. Mitigating and safeguarding measures to prevent excessive dust will be taken up by the contractor like sprinkling of water. Further safeguards associated with on-site activity and clean-up will be incorporated into the procurement documents.
- Borrow pits shall not be permitted within the forest areas.
- The rehabilitation of the borrow areas shall be done by the contractor as per the land owners requirements.

**f. IMPACT ON ACCESS ROADS AND HAULAGE ROADS**

200. Deterioration in quality of roads and damage to some of the existing bridges on the canal anticipated while transporting the materials. There is a need for using existing cart roads within the forest areas and canal embankment service road within the forest areas so there is a scope for some damage or deterioration.
201. The mitigation measures proposed are:

202. The Contractor while working in main canal, distributaries and minors and WUAs while working in sub-minors shall follow the below:

- Limited construction period, careful planning on the movement of vehicles and restrictions on construction workers movement and adequate monitoring shall be carried out by the contractor
- All existing roads used by vehicles of the contractor or any of his suppliers of material shall maintain during construction period. Clear any materials dropped by the vehicles on the access roads.
- There is no need for construction new haulage roads within the forest areas where the canal passes, as the canal embankment itself serves as service road which can be utilized for transporting material and even the forest areas have exiting forest cart roads which can be utilized with the permission of local forest department and they need to be maintained.

#### **G. IMPACT ON WATER QUALITY**

203. Water used in construction process is not in the large quantities. Thus impact on water quantity is negligible. However there would be other minor impacts that may arise are:

- Inadequate drainage in the temporary camp site resulting poor sanitation condition and surface and ground water pollution and promote breeding of mosquitoes.
- Contamination of ground and surface water due to inappropriate disposal of spoil materials, debris and waste, due to fuels and lubricants and construction waste waters
- Erosion of canal embankments due to improper compaction.

204. The mitigation measures proposed are:

205. The Contractor while working in main canal, distributaries and minors and WUAs while working in sub-minors shall follow the below:

- Proper disposal/reuse of construction spoils and silt generated from desilting operation considering environmental safeguard
- Arrangement to drain out wastewater from construction site should be planned as per the site conditions i.e. along the natural gradients. The Contractors are hiring buildings for Camp as these are scattered works. If Contractor establishes any Camp he shall ensure adequate drainage and sanitation at the site.
- The contractor shall procure the fuel from the nearest authorized outlets, if any minor storage if he has to make he shall ensure he doesn't contaminate the area.
- Contractor shall avoid oil spillages etc.,
- Contractor shall not wash his vehicles in the canals
- Contractor shall ensure or install equipments in such a way that the waste water doesn't enter the canal during monsoon season.
- Contractor shall ensure proper compaction after completion of the earthwork, for the main canal compaction has to be done by Powered Road Roller or Vibratory Roller and in the distributaries, minors and sub-minors by hand roller.
- To protect the canal from erosion in the completed earth work of the sections of the canals a provision for turfing has been made

#### **H. IMPACT ON AIR QUALITY**

206. Deterioration of air quality would be mainly due to fugitive dust emission from construction activities, and gaseous emissions from construction equipments and

vehicular movements (equipment like concrete mixers, hot mix and vibrators and vehicles like lorry, tractors, roller, dozers, excavators, etc). These impacts would be short term in nature and limited to the project site and construction phase only.

207. The mitigation measures proposed are:

208. The Contractor while working in main canal, distributaries and minors and WUAs while working in sub-minors shall follow the below:

- Contractor shall ensure trucks carrying soil, sand and stone will be duly covered to avoid spilling.
- Contractor shall ensure adequate dust suppression measures such as regular sprinkling of water especially at the time of construction along the village corridor will be undertaken. Contractor shall ensure that all construction equipments and vehicles are in good working condition, properly tuned and maintained to keep emissions within permissible limits.

**i. IMPACT ON NOISE LEVEL**

209. The construction phase will see the operation of only light construction machinery, which is known to emit sounds with moderate decibel (dB). Temporary impacts in the immediate vicinity of project site may occur due to noise generated from construction activities superimposed with existing vehicular noise. The magnitude of impact will depend upon specific types of equipment to be used, the construction methods employed and scheduling of the work. The construction noise will be intermittent and of short duration and mostly during day time.

210. The mitigation measures proposed are:

211. The Contractor while working in main canal, distributaries and minors and WUAs while working in sub-minors shall follow the below:

- In order to reduce these impacts it will be ensured that all construction equipment and vehicles used in construction shall strictly conform to the MoEF / CPCB standards.
- All vehicles exceeding the limits shall be fitted with exhaust silencers.
- Regular servicing of all construction vehicles and machinery shall be done regularly and during servicing the effectiveness of exhaust silencers shall be checked.
- All the construction sites within in 150m of the nearest habitation, noisy construction work such as crushing, operation of DG sets and any high noise construction equipments shall be stopped during night time between 10.00pm and 6.00 am.
- Working hours of the construction activities around sensitive areas like schools / hospitals up to a distance of 100m shall be restricted.

**j. IMPACT ON BIOLOGICAL ENVIRONMENT**

212. In the subproject site, though elephants are present their movement mostly confined to the reserved forest in the catchment area. The subproject activities are mostly confined to the command areas which are devoid of any forest and wild life. In the command does not include any rare or endangered species of plant and animals. Thus, no impacts on rare / endangered species are envisaged due to site operations. The canal system passes through reserved forest and village forest only 170 m length, the details are provided in the Table 5 & 6. While working in the forest areas there might be negligible disturbance to the wild life and trees. The increased irrigation facilities in the area will actually enhance the environmental conditions resulting in more greenery.

There is also a possibility of planting more trees by farmers due to the easy availability of water. Only few canal side trees will be felled during construction phase.

213. The mitigation measures proposed are:

The Contractor while working in main canal, distributaries and minors and WUAs while working in sub-minors shall follow the below:

- The Contractor and WUAs will obtain the permission from state forest department while working in the reserved forests.
- Contractor shall ensure that no trees shall be cut by the workers while working in the forest areas
- Contractor shall ensure the workers are not involved in any hunting or poaching areas
- Contractor shall not create paths existing cart tracks shall be used or canal service road shall be utilized.
- The Contractor shall ensure while working in forest areas, all works shall be carried out during day time only.
- The Contractor shall not dump material in the forest areas only existing ROW available within the canal shall be used for dumping / storing materials.
- The Contractor shall not be permitted to establish Camps / labour camps within forest areas.
- The sub-project has provision for planting around 400 trees along the canal banks against the tree loss if any
- Plantation of indigenous tree species along the irrigation canal compensates loss of flora.
- The survival of trees needs to be monitored by the WUAs and SIO staff.

#### **k. IMPACT ON SOCIAL ENVIRONMENT**

214. Most of the social impacts related to development of irrigation project are positive. Some of the impacts and mitigation measures are,

- The sub project is to be implemented on a community participative basis, with full consultation during the planning and design process.
- Most impacts pertaining to the establishment of the proposed scheme are positive in nature, the soils in the area will become more stable and the area will have a source of irrigation and farm use water, which has a positive impact on the agriculture of the area, thereby enhancing farm incomes.
- During the construction phase, there may be an influx of migrant skilled and unskilled workers in the project area. This will be restricted to the construction phase of the project. Efforts will be made to recruit local workers from the area as a priority to create employment opportunities and provide a sense of well being among local people as well as social compatibility among the people.
- Labour/construction camps will be sited based on consultation with local communities with the priority of causing the least disruption to the residents and the surrounding environment. Transport routes for materials to the site, given the proximity of the residents houses etc will also be selected with community consultation such that minimal disturbance will be made to residents. Given the proximity of the houses to the

entry road to the site, the final selection of the entry route to the site for construction purposes will need to be carefully monitored for impacts during the construction period.

- The location of key infrastructure under the Main Contract is located at a distance from the communities, therefore the camp sites are unlikely to cause disturbance to the communities.
- For construction activities undertaken close to communities, movement of construction equipment, vehicles and personnel will be restricted to within work areas, to avoid noise disturbance.
- For construction activities undertaken close to communities, movement of construction equipment, vehicles and personnel will be regulated to avoid traffic jams and noise.
- After completion of all construction activities, excess construction material and debris, is should be removed from the site and disposed of in the low lying areas within ROW.

#### **I. OCCUPATIONAL HEALTH AND SAFETY**

215. The potential impacts of occupational hazards are minor due to handling of cement and working in excavations. Few sections of the canals (The left main canal 5 numbers of new bridges are proposed at RD 750m, 6000m, 11500m, 19030m and 22900m and in the right main canal one new bridge at RD 3800m has been proposed. ) people are crossing the canals to reach the either side of the roads, so construction of new bridges are proposed at these locations. In addition left main canal at RD 5690 crosses railway track and State Highway at RD 8823m and 10302m. So Contractor while working at these places he ensures proper safety requirements. These impacts can be mitigated through proper safety measures. The Construction contractor will be required to:
216. Develop and implement site specific safety and health plan which include measures like: (a) proper safety measures while working at VRB's (b) ensuring all workers are provided with and use of Personal Protective Equipments (PPE); (c) Contractor ensuring all workers follow the documented procedures and providing health and safety training to the workers
- Providing first aid kits at the work sites at all times
  - Providing insurance including medical coverage for workers
  - Providing basic amenities like drinking water, clean eating areas, sanitation etc
  - Safety and security of the work sites etc
  - Providing proper lighting arrangement while working in the nights
  - Moving equipment and vehicles equipped with back alarms or flag men
  - Maintaining equipment properly and ensuring the workers are not exposed to noise high noise level and use of hearing protection etc if required should be enforced
  - Providing appropriate sign boards while excavation / construction work and providing proper barricades for preventing people and animals.

#### **m. COMMUNITY HEALTH AND SAFETY**

217. Most sections of the canals are passing through reserved forest, village forest, elephant paths, crop lands except few locations canal passes through nalas and roads. The canal bank serves as an access road in the command areas. So construction Contractor shall avoid all forest areas and elephant transit paths and should ensure the materials he dumps or equipment he installs will not obstruct the movement of local people or wildlife in the area also. If necessary he will ensure proper safety measures

in the areas and take dust suppression measures adequately to prevent dust pollution etc. The Contractor or WUAs while working in the sections of the forest areas shall ensure they will not light Halogen lamps, shall not establish any crusher, digging of trenches above 10'; shall not use any explosive devices without appropriate permission and avoid liquor etc

- In the section of the canal mostly electrical poles / line are away and may not hinder the proposed work however if any found in the minor or sub-minors the Contractors and WUAs while working shall ensure all precautions and prevent any danger from electrical line or equipments and ensures that they doesn't cause any inconvenience to the people. If any found in the minor or sub-minors, the SIO shall identify the electric poles / lines that may hinder the movement people and machines during construction and SIO shall request the local electricity department for shifting such poles/ lines by depositing the required shifting charges from the department contingency funds
- The Contractor Camp is not permitted in the forest areas. The contractor Camp can cause some temporary disturbance, if established near the residential areas care should be taken while identifying the areas and ensure the place is not polluted due to the storage of oils/ fuels used for construction. While storing fuel he ensures he practices approved practices of storing fuels and train the staff in handling and recovering the materials. Provide proper lighting, sanitation and drinking water facilities for the workers and staff. If the contractor constructs any temporary structures he will follow the approved practices and clear the site and handover to the concerned and take a no – objection or satisfaction letter from the land owner.

#### **n. IMPACT ON ARCHAEOLOGICAL SITES DURING EXCAVATION**

- No Archaeological sites are within the project area but while excavation work chance find protocol would be used.
- While excavating or dismantling any structure if any fossils, coins, articles of value / antiquity and remains of archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per the provisions of the relevant legislation
- The Contractor shall take reasonable precautions to prevent his workmen or any other persons from damaging or removing any such articles, if any articles found shall be brought to the notice of SIO and Environment Specialist and shall seek the direction of Archaeological Survey of India (ASI) before contractor recommencing the work

### **I. IMPACTS DURING OPERATION & MAINTENANCE PHASE**

#### **(i) IMPACT ON IRRIGATION WATER QUALITY AND QUANTITY**

218. Periodic testing of water for chemical and biological properties will help in establishing a database on water quality. This will help in taking planning decision and remedial measures for any adverse impacts on the water quality. The result of the testing if disseminated to the pani panchayats would help in bringing awareness to the local people. Weed removal should be done regularly and community should be made aware of the causes of weed growth and washing of domestic animals and letting domestic sewage into the canal should be checked with help of pani panchayats. If proper water planning not done with PP there could lead to conflicts within the WUAs. Hence WUA, Apex committee and Distibutary committees shall be involved in the water planning and distribution.

**(ii) IMPACT ON CANAL SYSTEM DUE TO WEEDS**

219. Fast multiplying weeds impairs flow of water and reduces water availability and damages structures and increases mosquitoes if unchecked. So regular dweeding and checking of weeds by mechanical means or by usage of herbicides if necessary. Pani Panchayat members including community members shall be made aware and encouraged to prepare compost / vermi compost etc. The State Agriculture Policy 2013 emphasizes on the provision of assistance for organic farming i.e. provision of subsidy for establishing vermi compost units, so linkages shall be established with the local agriculture department.

**(iii) IMPACT ON THE AESTHETICS**

220. After completion of works, replanting of economically and aesthetically important plants can be ensured along the canal. Greening of the area may offset the ecological effects of the clearing and felling of any trees during construction phase. So monitoring of trees and their survival planted along the canal shall be ensured.

**(iv) IMPACT DUE TO NON -MAINTENANCE**

221. The responsibility of maintaining main canal, distributaries likes with the SIO staff and minor and sub-minors with WUAs. The responsibilities of PP are as:
- Removal of silt and proper up keeping off minor/ sub-minor/ water courses / field channels and field drains
  - Repair and maintenance of inspection path and service roads
  - Removal of grass, shrubs and bushes from the canal embankment and canal beds
  - Repair and maintenance of all structures in the distribution system handed over for operation and maintenance.
  - Restoration of banks – earthwork
  - Repairs to lining, painting, plastering and replacing damage portions to structures etc.

**(V) SOIL MODIFICATION**

222. Agriculture practiced by beneficiary farmers will intensify as a result of infrastructure improvements. The nature and extent of improvements will be influenced by agriculture extension. The changes in agriculture practices may result in soil modifications, including increased susceptibility to slumping, reduced nutrient status and impaired structure if the organic matter content is not maintained. These can be mitigated by including sustainable land use practices in the agriculture extension component. These include (i) continued use of traditional terrace construction and management of water flows, (ii) the use of deep rooting grasses and shrubs to further strengthen bunds and terrace walls, and (iii) promotion of continued use of organic based practices like use of bio-fertilizers.

**(vi) SOIL AND WATER CONTAMINATION DUE TO AGROCHEMICALS**

223. The intensification of agriculture may also result in increased use of agrochemicals including mineral fertilizers and pesticides, which may result in soil and water contamination. Although the use of agrochemical is currently far less than the level applied in productive agriculture systems, these need to be carefully monitored, and mitigated through agriculture extension that promotes (i) optimum, informed use of mineral fertilizers in combination with organic manure and bio fertilizer, (ii) promotion of the concept of integrated pest management, focusing on cost effective and environmentally friendly or benign pest management techniques; and (iii) emphatic discouragement of the use of persistent and banned pesticides.

**(vii) BIODIVERSITY**

224. Introduction of high yielding varieties (HYV) if any in the sub project area at the expense of traditional low yielding varieties might affect the agricultural biodiversity of the area. These can be mitigated by establishing linkages with local agriculture department on (i) awareness raising through the agriculture extension component and through training and support to WUAs of the importance of maintaining diversity of farming practices and local landscape, (ii) promoting under the agriculture extension component the maintenance of variety of production of both cash and subsistence crops and (iii) promoting under the agriculture extension component the use of indigenous multi-purpose trees for soil protection, watershed management and cash crop production.
225. The renovation and modernization of this project will have beneficial impacts in terms of improved irrigation and road facilities in the area that increase overall agriculture production and improved economic conditions of the area.

## **VI INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION**

### **A General**

226. The Consultation, participation and disclosure has been taken up as an integral part of environmental assessment process for this project and was used as a tool to inform and educate stakeholders about the proposed project. It helped in identification of needs of the local population that is likely to be benefited. Aiming at promotion of public understanding and fruitful solutions of developmental problems such as local needs of farmers and problem and prospect associated with irrigation facilities, various sections of community people and other stakeholders were consulted through individual consultations. It was attended by pani panchayat officials, pani panchayat members, local farmers, gram panchayat members and engineers from DOWR. The findings and consultation will be carried out at consultation stage of the project.
227. Discussions were held with groups of beneficiaries during initial field visits and the preparation of feasibility studies for the core sub-projects. During these discussions, the scheme was discussed with groups of beneficiaries, typically 10 to 20 persons in size, and their views sought on key issues including (i) anticipated effects of the proposed scheme improvement, (ii) the extent and nature of changes in land use that may occur with improved supplies of irrigation water (iii) presence of any sites of archaeological or cultural importance (iv) land stability in the around the existing scheme and (v) potential land use conflicts. No serious concerns were raised by villagers during these discussions. Villagers anticipated higher yields of existing crops as well as the ability to produce a greater range of crops, including cash crops, as well marketable surpluses that would increase cash incomes.
228. The list of villagers met during focus group discussion is given in Annexure 5 & 8A and sources of data are given in bibliography that is given in Annexure 6 The findings of focus group discussion for individual village are given in Annexure 7 & 8. Household surveys are also conducted in selected villages to understand the present problem of irrigation system.

### **B Survey**

#### **(i) HOUSEHOLD SURVEYS**

229. In order to access the existing environment and likely impacts on irrigation, a house hold survey for 120 households in Badanuagaon, Ghogar, Tiliamal, Kilinga, Kadambahal and Garvana covering head, middle and tail part of village was carried out with the help of local NGO. A common approach is to interview a representative sample of affected people and ask a predefined set of questions, with a response recoded in a standard form. Survey was conducted for sample population that consisted equal representation of gender, age and economic status. Survey also ensured equal distribution of higher and backward cast groups.
230. The views of people on the existing environmental scenario reveals from household survey is given below,
1. Households at all the 6 locations indicate that they have no idea on the proposed project
  2. Majority of the house holds when discussed about proposed project activities felt it will be helpful and beneficial for their economic upliftment

3. Main sources of the drinking water are well and tube well. In 90% cases as per villager perception quality of drinking water is good for consumption
4. In 85% cases villagers pointed out that there is significant dust and gaseous emission problem in villages as there are few sponge iron industries located nearby.
5. Local people very much interested to involve in the project as labour. They express that if outside labours are engaged they may loose their job.
6. Most of the villagers feel that during construction time generated dust and noise may not be a problem
7. About 26% of the respondents mention that they may get fish from the canal / nearer reservoir/ dam for own consumption
8. Most of the surveyed households (about 50%) point out that forest and wildlife (mainly elephant) exist nearby to their villages (within 0.5 to 2 km). Villagers utilised forest product as fuel and wood
9. Farmers (about 75% of the households) generally used DAP, urea, potash as fertilizer without testing the soil
10. 65% of the farmers disclose that they utilise pesticide for control of pest
11. Households reported that they have not facing any flooding problem. But drainage problem exist in 17% cases.
12. Always (70% cases) conflict arise on water right, since most of cases irrigation water not available

### **C Focus Group Discussions**

231. Focus group discussions (FGDs) were used as an effective tool in the public participation process. The FGDs were held at Badanuagaon, Ghogar, Tiliamal, Kilinga, Kadambahal and Garvana covering head, middle and tail part of village with the help of local NGO active in environmental field to understand the implication of the project impacts on various groups, especially those with a distinct degree of vulnerability.
232. Issues discussed with the village community are regarding environmental aspects are given below.
- Awareness and extent of the project and development components
  - Benefits of Project for the economic and social Upliftment of Community
  - Labour availability in the Project area or requirement of outside labour involvement
  - Sources of water for the villager and quality of available water
  - Overall dependency on canal system
  - Local disturbances due to Project Construction Work
  - Necessity of tree felling, requirement and responsibility for the maintenance of canal bund plantation
  - Views on disposal of debris and desilted soil from canal
  - Water logging and drainage problem if any
  - Forest and sensitive area nearby the project site
  - Movement of wild animal within the village

- Use of fertilizer, manure, pesticide and bio-fertilizer
- Precaution during application of pesticide
- Soil salinity problem
- Necessity of testing of water and soil.

#### D Issues and Action Plan

233. On the basis of FGD some action plan is being recommended Table 33 for fulfillment of villager demands and issues and mitigation of short term impacts.

**Table 33 Issues of the Public Consultation**

Sr. No.	Key Issues/Demands	Perception of village community	Action to be Taken
1	Awareness of the project – including coverage area	People were not much aware of the project but felt that Kansbahal medium irrigation project will bring prosperity to the village.	Project should be consider for detail design program and to be finalize for funding
2	Presence of any forest, wild life or any sensitive / unique environmental components nearby the project area	As per the villagers there are no special environmental components nearby. Reserve Forest area is located near the head part village. Wild life like elephant, bear, jackel, monkey pass through the villages located near forest	Points are noted and construction scheduling is necessary Necessary permission will be required for felling of forest trees if necessary
3	Presence of historical/ cultural sites	As per the villagers there are no special historical / cultural sites. Only few old temples located within the village	Points are noted
4	Occurrence of flood	Occurrence of flood is not common. But when dam water level increase chances of flooding of land near head part is maximum	Proper designing of drainage outlet will be absolutely required during detail designing
5	Drainage problem – canal water seepage	Particularly at head area (like village Kadambahal) water logging and drainage problem exist	Canal lining will be required to check loss of water In addition drainage will be required
6	Salinity problem	As per villagers there is no salinity problem of the area.	Points are noted
7	Testing of soil and water	Generally soil and water not tested	Routine testing of agricultural soil and irrigation water will be essential as per EMP. Provision of soil testing at block level is absolutely necessary. Responsibly can be given to pani panchyat
8	Cultivation practices during Kharif and Rabi seasons	At present people are cultivating paddy as Kharif crop People like to cultivate economically rewarding crops like ground nut, spices,	Ensure sufficient available water in entire command area during Rabi season by said

Sr. No.	Key Issues/Demands	Perception of village community	Action to be Taken
		potato and vegetables in the farms after implementation of project.	irrigation scheme Application of organic manure will improve water holding capacity and soil health
9	Use of fertilizer and pesticides for cultivation of crops	Cultivators used chemical fertilizer like DAP, urea, super phosphate and potassic fertilizer without testing of soil Use of organic manure, bio-fertilizer are not common Farmers used pesticides (except few villages) like Phorate, Dimecrone, Themate etc. some of them are banned due to long persistence in soil	Pesticides those have long residual persistence in soil should be banned and close monitoring from agricultural extension side will be required. Before application of chemical fertilizers soil testing will be required to maintain good productive soil health
10	Safety aspects during spraying/ application of pesticide	No safety precaution taken up during application of pesticide	Safety precaution like use of noise mask/ cloth and hand gloves will be suggested through awareness program
11	Occurrence of pesticide contamination of surface water and contamination of fish	No as such contaminated observed	Application of organic fertilizer (that have binding characteristics) and non use of banned pesticide are necessary
12	Availability of labour during construction time	The farmers agreed to involve in project implementation by providing labour for excavation and earth work. Availability of labour may be a problem during intense cropping season and where industrial area exist nearby	If labour available from beneficiary village no need to bring construction worker from outside. Further community consultation will be required before starting of work
13	Access road to project site	Access road to project site is either old or non existence Villagers said if required they will help for construction of temporary road	Engineering design will be required for transportation of construction material
14	Setting up worker camp site within the village	Places available within the village.	Point is noted for further consultation just before setting up workers camp In most of the areas setting up of labour camp is not necessary as labour will be available locally
15	Dust and noise pollution and disturbances during construction work	May not be a problem for short duration transport of materials and they will accommodate the impact within their community	Stringent control measures will be adopted as per EMP Carefully controlled and continuously implementing soil wetting will be done
16	Safety of residents	As per the opinion of villagers, since	Application of safety

Sr. No.	Key Issues/Demands	Perception of village community	Action to be Taken
	during construction phase and plying of vehicle for construction activities	transportation of construction material is minimum it may not be a problem in lieu of implementation of said beneficial and highly needed project	measures as per EMP
17	Conflict among beneficiaries downstream users	Sometimes conflict may result among the user but that get solved through Pani Panchayat meeting	Point noted
18	Enhancement of other facilities	Requirement of sufficient and quality drinking water since water quality in most of areas are not as per drinking water standard.	Points are noted and to be addressed in feasibility report
19	Non availability of canal water during construction	Farmers (particularly head area where irrigation water available) agreed to sacrifice one productive season due to closure of canal during construction Farmers requested consider lien period for construction work	In implementation schedule EMP should be consulted

234. The main points that emerge from public consultation are:
- Villagers will cooperate in all aspects for implementation of the prestigious project
  - They will accommodate the short term impacts during construction phase
  - They need real help from government side for regular testing of agricultural soil and irrigation water
  - Environmental awareness program will be required for non use of banned pesticide as well as personal safety during application of pesticide
  - Non availability of the canal water during construction work- villagers requested planning of construction work during period when irrigation water not much required
  - Introduction of organic manure, bio-fertilizer and vermicompost will be required. Farmers have no knowledge on beneficial effect of utilization of bio-fertilizer
  - Minimization of conflict among water users through PP intervention
  - Necessity of permission from forest for felling of plantation trees
  - Solving of drainage problem particularly at head part
235. The approach adopted for the Project ensures that all sub-projects are community driven. Design and implementation involves the groups potentially influenced by the schemes, ensuring a very high level of public awareness and involvement at each stage. The IEEs will be made available at the SIO office and consultation with the stake holders will be carried out during construction phase also. The PP will be informed about the project achievement and will made aware of the environmental issues during consultation. In accordance with the main issues identified in the project implementation in the Project Completion Report (PCR), essential elements incorporated into procedures for the Project include (i) understanding the project during the planning phase, (ii) physical and financial contributions during the construction phase, and (iii) taking ownership for operation, maintenance and management of the irrigation systems after construction.

## E Future Consultation and Disclosure

236. During construction period also consultations will be carried out with affected persons, stakeholders. Small meetings with the Pani Panchayat members and farmers and other vulnerable communities including women will consulted to address any issues

related to the proposed construction. The findings would be presented in the monitoring reports that would be submitted to ADB. findings would be presented in the monitoring reports that would be submitted to ADB. The brief executive summary of the IEE would be translated into local language and it would be made available to local people at SIO office.

237. As per the ADB SPS 2009, for Environment Category “B” subprojects, the following documents will be submitted to ADB for disclosure on ADB's website.

- Draft IEE
- Final IEE
- A new or updated IEE and corrective action plan prepared during project implementation, if any, and
- Environmental Monitoring reports

## **VII GRIEVANCE REDRESS MECHANISM**

238. A joint social and environmental redress mechanism will be implemented under the Project. The Grievance Redress Committee will be constituted at PMU level comprising of the Project Director, Resettlement Officer, Environmental Officer, representatives from local Non – Governmental Organization (NGOs), elected representatives from Municipality / Panchayat, representatives of affected persons including vulnerable groups and women in the committee. It is proposed GRC will meet regularly (at least once a month) on a prefixed date. All the grievances of the people will be reviewed and resolved within 6 weeks of the date of submission. Through public consultations and disclosure, the APs will be informed that they have a right to grievance redressed. The APs can call upon the support of the NGO to assist them in presenting their grievances or queries to GRC.
239. Grievances and suggestions from local and affected people may come-up related to inappropriate implementation of the project and components of EMP. Grievance redress mechanism shall be translated in Odia language and posted to the respective village/Panchayat office by Contractor on behalf of the OIIAWMIP at least 6 weeks prior to commencement of construction works.
240. The expected range of grievances to be handled through this mechanism will encompass but not limited to the following: i) nuisance from noise, dust, borrow earth, disposal of spoil and temporary blocking of access; ii) contamination of receiving water from runoff iii) emissions from increase vehicular traffic and stationary sources like hot mix plant, WMM etc., ;iv) conflict between local residents and migrant workers; v) ownership of vegetation for clearing; and vi) damage compensation. These issues will be addressed through acknowledgement, evaluation and corrective action and response approach. Grievances from public or stakeholders concerning the project and EMP implementation will be received by the concerned Executive Engineer (SIO Manager) of the sub-project. The Executive Engineer shall refer the application to PD, PMU who with the help of Construction Management Specialist, Quality Control and Assurance Specialist and Environment specialist of ISPMC then assess the grievances/suggestions and if they are found to be genuine and acceptable, shall be moved to GRC and they will be resolved within 6 weeks from the date of receipt. In site the Contractor shall provide a sign board notifying the contact details of the GRC.
241. This mechanism is non-judicial in nature and does not preclude the affected people coursing their grievances to the courts. The corrective action will be started as per the action plan indicated to the stakeholder. The action taken and the outcome shall form a part of half yearly report to ADB.

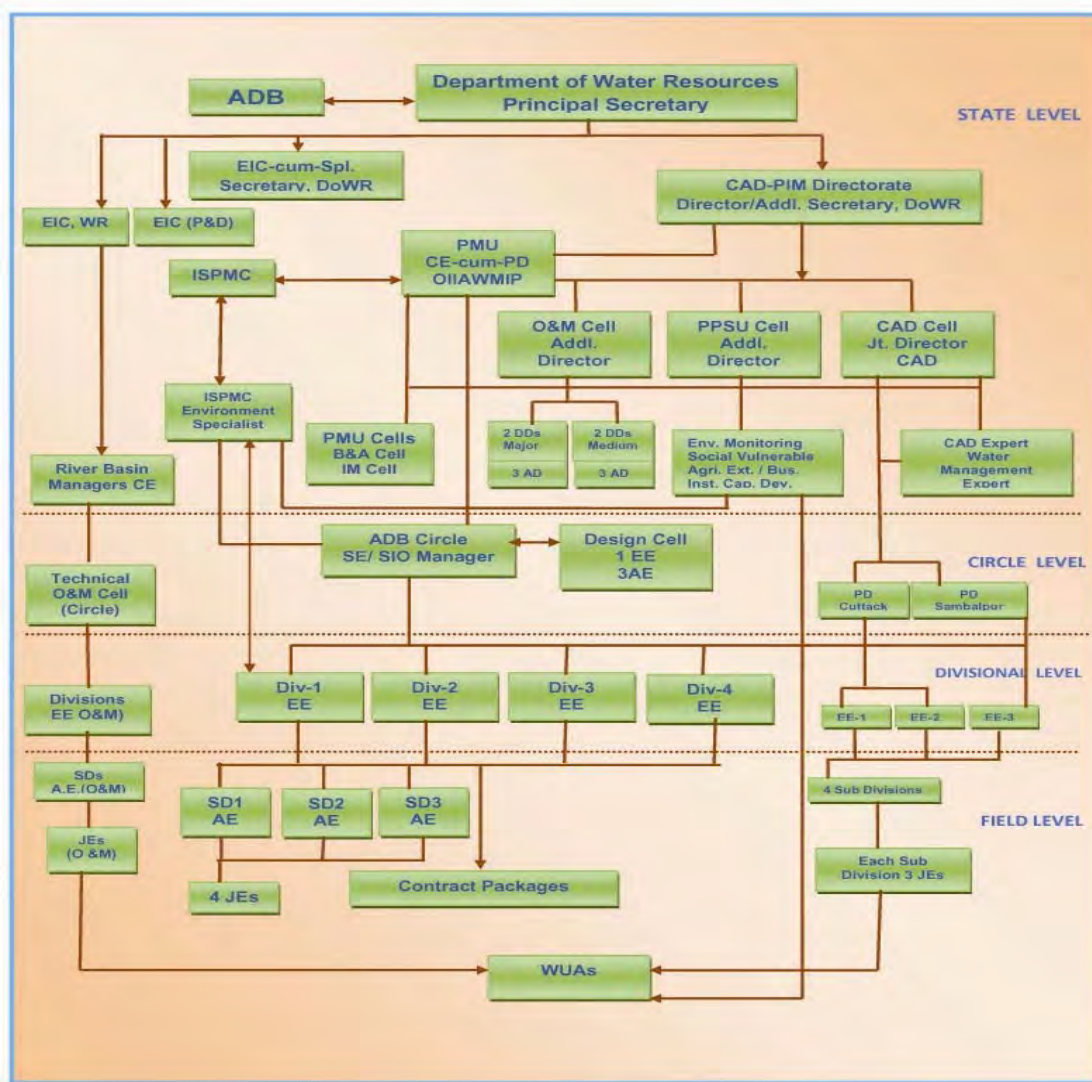
## VIII ENVIRONMENTAL MANAGEMENT PLAN

### A General

159 This chapter describes the Environmental Management and Monitoring Plan (EMP) to mitigate the likely adverse impacts arising from this project. This chapter also provides institutional requirements and environmental monitoring plans required to effectively implement the environmental mitigation measures into the project.

### B Institutional Arrangement

The Figure 11 shows the organization structure of the DoWR for the OIIAWMIP project.



(Note: EIC – Engineer in Chief; C.E –Chief Engineer; S.E- Superintendent Engineer; E.E – Executive Engineer, A.E – Assistant Engineer, J.E – Junior Engineer; CAD – Command Area Development, O &M – Operation& Maintenance; D.D – Deputy Director; PPSU – Pani Panchayat Support unit; ISPMC- Institutional Strengthening and Project Management Consultants)

Figure 10 Organization structure of the DoWR for the OIIAWMIP project

**C. The key agencies involved in implementation of EMP are:**

242. DoWR is the Executing Agency for OIIAWMIP. The DoWR has been reorganized to constitute a Command Area Development and Participatory Irrigation Management Directorate (CAD&PIM Directorate) for more effectively integrating irrigation system management and on-farm development through participation of the Pani Panchayats. The Project is being implemented through the existing setup technically headed by EIC. Special Secretary, DoWR has been designated as the Engineer-in-Chief for OIIAWMIP. Special Secretary, DoWR will advise and guide on overall implementation matters including PIM-CAD.
243. A Project Management Unit (PMU) has been established within the CAD&PIM Directorate with a Project Director of the rank of Chief Engineer operating under the overall guidance of Additional Secretary cum Director CAD - PIM with the overall responsibility of program implementation. Chief Engineer cum Project Director, PMU will exercise the powers vested by the OPWD code for execution of all civil works. At the field level Sub-project Implementation Offices (SIO) have been formed to implement the program. For Major irrigation sub-projects the concerned Superintending Engineer is the Sub-project manager and the concerned Executive Engineer is the Sub-project manager for Medium irrigation Sub-projects. The Sub-Project Manager, who is a Superintending Engineer (SE) for major irrigation systems and an EE for medium schemes, will manage the Technical Cell as well as monitor and guide the CAD and PP Support Cells for effective integration and coordination of the sub-project activities, under the support and guidance of PMU, EIC (P&D), and ISPM Consultants provided through regular PMU-SIO meetings.
244. DoWR for effective implementation of Tranche-2 sub-projects under OIIAWMIP proposes to create one Circle, four Divisions, 12 Sub-Divisions under the Chief Engineer – cum – Project Director, PMU.

**Circle:** One Superintending Engineer S.E will be in charge of circle office. He will be responsible for the managing the Technical Cell as well as monitor and guide the CAD and PP Support Cells for effective integration and coordination of the sub-project activities.

**Division:** Under each division one Executive Engineer (E.E) will be in charge of the division for, processing tender and bid documents executing the works, check measurement etc. He will ensure the quality of the ongoing works etc.

**Sub-Division:** Under each sub-division Assistant Engineer / Asst. Executive Engineer shall be in charge of the sub-division office. He will be supported by field functionaries like Junior Engineer and other field for execution, check measurement, monitoring the works and ensuring the quality of the work.

245. The Junior Engineer at the field level will be responsible for day to day environmental monitoring and the overall supervision and responsibility of EMP implementation will be with the concerned SIO ( S.E for Major sub project and E.E for medium sub project).

**D. Institutional Strengthening and Project Management Consultants (ISPMC)**

246. The ISPMC will have an Environment Specialist, Resettlement Specialist and Indigenous group Specialist who will support the PMU in advising and monitoring the EMP measures with help of SIO Staff and WUAs. The ISPMC will assist in reviewing all the contractors monthly environmental reports submitted by Contractors through SIO in consultation with PMU. They will assist the PMU in preparing environmental monitoring reports and other reports like preparation of IEEs, RP and social assessment reports.

## **E. Responsible for carrying out monitoring measures - Staffing Requirements**

247. As per the “ Environmental Assessment and Review Frame work (EARF) prepared for the project it states that “PMU will be responsible to undertake (i) environmental screening at subproject identification stage; (ii) preparation of IEEs/EIAs at subproject appraisal stage; and (iii) environmental management and mitigation during subproject implementation and operational stage. At appraisal, IEEs /EIAs will be done with the engagement of consulting firms who would be guided by the project environmental specialist. Environmental management and mitigation will be undertaken by the construction contractors during construction phase under the supervision of the designated staff in the subproject management offices (SIOs) and monitored by PMU environmental cell. The consultants mobilized for institutional strengthening and project management will also be entrusted to provide necessary capacity development of the DOWR engineers and SIO staff in terms of environmental planning and management”.
248. The PMU / SIO of DoWR assisted by the WUAs, and the Institutional Strengthening and Project Management Consultants (ISPMC) will be guiding the implementation of the EMP. During project works the responsibility to implement environmental mitigation and safeguards shall be primarily on the Contractor for main canal, distributaries and minors and monitored by the SIO (S.E for major sub project and E.E for medium subproject). The field level Junior Engineer shall be made responsible for monitoring the EMP activities of the Contractors on a day to day basis. The field level Junior Engineer shall be made responsible for the monitoring the EMP activities of the Contractors. The SIO staff and WUAs with the help of ISPMC, Environment Specialist will monitor the EMP implementation of the Contractor.
249. While the implementation of sub-minors shall be on WUAs and monitored by SIO. Pani Panchayat Support Unit (PPSU) is the state level apex agency who is responsible for strengthening the PP activities. Under PPSU one Environmental Monitoring Specialist was recruited to provide capacity building of the PPs. He may be made responsible for the monitoring of WUAs along with SIO staff and these will work under the overall guidance of ISPMC. The WUAs will end up leading O&M responsibilities with the help of Environmental Monitoring Specialist of PPSU, CAD unit.
250. The current structure of DoWR indicates that they have no environmental management system. The WUAs will end up leading O&M responsibilities. Neither DOWR nor the WUAs are currently in a position to assume EMP responsibility. Their institutional capabilities and capacities will have to be developed and strengthened under the Project.
251. So for effective monitoring there is a need to designate or made in charge one Junior Engineer (Technical / Works) from each sub-project to look into the environmental aspects, he may be named as “ Environmental Co-ordinator” who would be working under the guidance of National Environment Specialist- ISPMC in addition to his regular duties. The Environmental Co-coordinators would be trained time to time; this will ensure proper and systematic environmental monitoring and ensuring timely compliances from the contractors. In addition Junior Engineer (O&M) would also be trained along with the Junior Engineer (Technical / Works) who will monitor after the completion of works i.e. during “Operation and Maintenance Period”.
252. To make environmental monitoring integral in to the system and since the projects are of larger scale there is a need for systematic and continuous monitoring. To ensure systematic monitoring the ISPMC had developed formats presented in Annexure-9 & 9a. The format has to be filled up and submitted by the Contractor / WUAs to SIO staff on a monthly basis. The Contractors / WUAs and SIO shall be trained for filling up the format during the project period.

253. As per the Technical Specification for construction of civil works of ADB assisted schemes, DoWR, Odisha Section – 6 Clause – 1.23 – Sub – Clause 1.23.1& 1.23.3 Contractors shall be designate as “Safety Officers” and he shall also be made responsible for environmental issues and he shall be named as an “Environmental Co-coordinator” from the Contractors side and he shall also be trained on the environmental issues.

## **F. REPORTING SYSTEM OR RESPONSIBLE FOR REPORTING**

254. Reporting system suggested under this project is three tier systems:

- Reporting of the Contractor and WUAs to the SIO staff.(For the civil works implemented by Contractors monitoring shall be done SIO with the help of ISPMC and for the civil works carried out by WUAs monitoring shall be done by SIO with the help of PPSU Environmental Monitoring Specialist).
- Reporting of ISPMC, Environment Specialist after evaluating the contractor reports and evaluating the indicators at PMU level (The reports submitted by Contractors shall be evaluated by ISPMC Environment Specialist and feedback provided to SIO and PMU); In addition, ISPMC, Resettlement Specialist for resettlement issues and Vulnerable Group Specialist responsible for preparing Indigenous People Development Plan (IPDP) and for any social related issues.
- PMU reporting to ADB. Annual environmental monitoring reports need to be submitted to ADB.

255. Environmental monitoring suggested involves regular checking of the parameters suggested in the environmental management plan to ascertain the mitigation measures are achieved as the work progress. It provides the necessary feedback and midcourse corrections for project management to keep the program to achieve the expected outputs.

256. The reporting system starts with the construction Contractor who is the main executor of the implementation activities. The Contractor will report on a monthly basis to SIO staff as per the check list provided in the Annexure16 to the Junior Engineer. Junior Engineer will be responsible for EMP implementation under the guidance of SIO, he on the basis of daily visits to the site and observations evaluates and submit to the SIO manager. This will form the basis for evaluating the Contractor on the implementation process.

257. For the works executed by Pani Panchayat or WUAs similar simplified reporting system is proposed, the PPs have to complete a check list Annexure 16a and submit to the SIO staff, the Environment Monitoring Specialist recruited under PPSU, CAD unit will evaluate on a monthly basis and submit to the PMU and ISPMC.

258. The Environment Specialist, ISPMC during period visits spot checks the sites and evaluates the monthly reports submitted by the Junior Engineer and PPSU Environmental Monitoring Specialist and on this basis brief quarterly reports would be prepared and submitted to the PMU and on a yearly basis a detailed report with corrective action plans would be prepared.

259. The PMU will submit the annual reports for Category B sub projects prepared during the construction phase to the ADB. The PMU in the monthly meetings should discuss

the implementation of EMP with the SIO staff and ISPMC and suggest remedial measures to the contractor.

**G. Environmental Mitigation Plan**

260. An Environmental Management and Monitoring Plan (EMP) is key to ensure a safe and clean environment. The desired results from the environmental mitigation measures proposed in the project can only be obtained with a management plan to assure its proper implementation & function. The EMP outlines the plans for the proper implementation of mitigation measures to reduce the adverse impacts arising out of the project activities. The EMP has been prepared addressing issues such as:

- Mitigation measures for abatement of adverse impacts caused during the construction and operation stage;
- Details of management plans;
- Institutional set up identified/recommended for implementation of the EMP;
- Post project environmental monitoring programme to be undertaken;

**H. Expenditures for environmental protection measures and budget for EMP.**

261. The major impacts due to different project activities and their mitigation measures have been identified in Chapter 5. The environmental parameters checklist for the anticipated impacts and suggested mitigation measures with implementation and supervision responsibility during Pre construction Table 34 and 35; Pre construction activity for the works executed by contractor Table 36, Construction phase for the works executed by contractor Table 37; Preconstruction activities for the works executed by WUAs Table 38 and Construction phase for the works executed by WUAs Table 39 and Operation & maintenance phases Table 40 for the Kansbahal subproject is shown below:

Table 34 **Environmental Parameters Checklist for Anticipated Impacts and Mitigation Measures for Kansbahal Sub-project - Pre Construction Activity (Impacts due to Location)-Environmental Mitigation Plan**

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
Minor	Moderate	Major								
1	Land Acquisition	Not likely to cause specific environmental problems as long as steps are made to select sites which are not located in protected/inhabited areas etc.	No land acquisition is involved only existing ROW is being used	√				SIO	PMU	
2	Encroachments	No encroachments along the ROW of the canal system except some illegal cultivation after the toe line with in ROW	Demarcation of ROW need to be done before commencement of the work by the SIO in the presence of PP members. while preparing micro plans SIO with the help of WUAs the assessment of areas for identifying the legal and illegal outlets and increase the scope for improved water planning and distribution to the tail end users		√			SIO	PMU & ISPMC R & R Specialist will assess and prepare a separate report.	ISPMC R&R specialist will assess and prepare a separate report.
3	Tree cutting	Removal of trees planted on the embankment with in the ROW	To the possible extent the desig should reduce or avoid tree cutting. If any trees need to be removed from the ROW before actual commencement of work, it shall be done in permission with the State Forest Department. Stacking, transport and storage of wood shall be done as per the relevant norm. All efforts shall be made to preserve trees including evaluation of miinor deisgns , adjustment / alternatives to save trees to the possible extent.		√			SIO	PMU & ISPMC	

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate			Major	
4	Forest Areas	In the canal system, the right main canal also originates in the reserved forest RD 0 to 100m falls in the Kumaria RF. Two minors of left main canal Badnuagaon minor -1 RD 360m to 400m and Badnuagaon minor -2 RD 720m to 750 m pass adjacent to the village forest on the right side	No additional impact on forest land as it is an existing canal system. Where the right main canal also originates in the reserved forest RD 0 to 100m falls in the Kumaria RF. Two minors of left main canal Badnuagaon minor -1 RD 360m to 400m and Badnuagaon minor -2 RD 720m to 750 m pass adjacent to the village forest on the right side. For the sections of the canal passing through R.F SIO has to obtain permission from State Forest Department before initiating the civil works.		√			SIO	PMU& ISPMC	
5	Utilities	Electric poles/ electric lines within the ROW may get damaged or some need to be shifted mainly in the minors and sub-minors	Mostly these may not get affected in the main canal if any likely to be affected in the minor or sub-minors PMU/ SIO should Identify the electric poles which may be a hinderance as per the designs. During survey and detailed estimate a contingency plan for shifting if necessary should be done and the utilities need to be shifted if necessary with the appropriate permission from the electicity department as per the provisions		√			SIO	PMU& ISPMC	

**Table 35 Environmental Parameters Checklist for anticipated impacts and Mitigation Measures for Kansbahal Sub-project - Pre Construction Activity (Impacts During Design and Survey) - Environmental Mitigation Plan**

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate				Major
1	Trees cutting	Change in Aesthetic value	During detailed, the PMU/ SIO with the help of survey team and in consultation with Deisgn Engineers shall assess the number of trees that may likely tobe affected due to the designs. If some trees may be required to be cut to the possible extent trees cut would be minimized Some part of the Project budget shall be consider for tree-planting activities wherever places available along the canal / distributaries. <b>The proposed tentative budget is presented in the Table-----</b> Suitable species suitable to the area need to be selected in consultation with horticultural department. This would also have the added value of employing water conservation methodologies and thus increased sustainability of the system and stability of canal slope.		√			SIO staff with the help of survey team	PMU, Design engineer, ISPMC	Some trees are noted on the canal embankment
2	Impact on productivity due to water lossess	Water losses leading to reduced efficiency of the canal.	During project planning, desilting, lining of the canals and minor repairs to existing structures will improve operation of the canals and positively impact on the hydrology of the project. Repair of drop structures and regulators, and construction of permanent outlets with gates will improve the efficiency of canal operation and reduce water losses proposed for reappear and treatment . Repair of existing CD structureas and construction of new CD structures would reduce water logging / ponding.		√			SIO Staff	PMU and Design Engineer, ISPMC	
3	Utilities	Electric poles/ electric lines with in the ROW may be damaged or some need to be shifted in minors and sub-minors	The number of electric poles that need to be shifted shallll be identified, if necessary to be shifted SIO shall include some contingency plan for shifting in consultation with the electricity department..		√			SIO staff with the help of survey team	PMU, Design engineer, ISPMC	

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate				Major
4	Proposed Tube well Drilling	Scope for changes in ground water	<p>A preliminary need assessment and identification of potential sites for the proposed drilling based on the peoples need to be carried out.</p> <p>The sites or locations identified shall be away from dumps, refuse piles, storage facilities, pit toilets, fields fertilized with dung, septic tanks, drains , away from flooding areas.</p> <p>Identify the locations which are socially acceptable</p> <p>Care shall be taken not to locate the tube wells adjacent to the existing tube wells , the distance between two tube wells proposed shall be as per the Odisha State Ground water department rules.</p> <p>Odisha state ground water department should be consulted for the proposed depth and precautions while drilling and suitability of the proposed site for quantity and quality before finalisation of the drilling site by the SIO..</p>		√			SIO Staff	PMU	

**Table 36 Environmental Parameters Checklist for anticipated impacts and Mitigation Measures for Kansbahal Sub-project (Main canal, Distributaries and Minors executed by Contractors) - Pre Construction Activity (Construction Contractor) - Environmental Mitigation Plan**

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate			Major	
1	Establishment of Camp / Plants	Disruption to traffic flow and sensitive receptors and change land use as well as aesthetic value of area	<p>Contractor shall avoid establishment of camp / plant in forest areas.</p> <p>Contractor shall prioritize areas with in or nearest possible vacant space within the subproject without affecting property, forest, vegetation, drinking water sources and away from the water bodies and the canal system.</p> <p>All construction plants shall be sited sufficiently away from the settlements and agricultural operations or any commercial establishments. Such plants shall be located at least 100m away from the nearest dwelling preferably in the downwind direction.</p> <p>The Contractor shall submit a detailed layout plan for all such plant sites established and approved by the SIO manager.</p> <p>Arrangements to control dust pollution through provision of wind screen, water sprinklers and dust extraction systems shall have to be provided at all such sites.</p> <p>If any contractor has to establish crushers, hot mix plants and batching plants shall comply with the requirements of the relevant emission control legislations. Consent for Establishment and Operation from state pollution control board Odisha shall be obtained before establishment and operation and a copy to be submitted to the SIO Manager.</p>		√			Contractor	SIO Staff, PMU and ISPMC	

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate				Major
2	Sources of Materials	Borrow areas- extraction of materials like earth etc., can disrupt natural drainage, vegetation and resulting in accelerated erosion and leading to water stagnation, ponding and pollution	<p>If additional material is required or procured from borrow pits. Finalization of borrow areas for earth and all logistic arrangements as well as compliance to environmental requirements, as applicable shall be the sole responsibility of the Contractor.</p> <p>Contractor shall identify the potential borrow areas and take permission from SIO manager before operating any borrow areas. Earth material should be taken from barren land or selected borrow area during lean period as per IS Code 1498 after taking approval from SIO Manager. The criteria of selection is as follows:</p> <p>Selection Criteria of Borrow areas is as follows: IS 4701: 1982</p> <p>No borrow pits shall be dug within 5m of the toe of the embankment, if the depth of the borrow pit is less than 0.5m it shall be after 5m of the toe of the embankment and if the pit depth shall be more than 0.5m it shall be 10m of the toe of the embankment or within such a distance from the toe of the bank where a 4:1 hydraulic gradient line cuts the ground surface, whichever ever more.</p> <p>Borrow pits shall not be more than 1m in depth and 25 m in length.</p> <p>A clear distance of 1m shall be left between the pits</p> <p>The bed of borrow pits shall be left reasonably smooth and even.</p> <p>Contractor shall not be permitted to lift any material from the forest areas.</p> <p>The Contractor shall not start borrowing earth from selected borrow area until the mutual agreement is signed between landowner and Contractor. Copy of the document shall be submitted to SIO manager.</p> <p>The Contractor in addition to the established practices, rules and regulation will also consider following criteria before finalizing the locations. 1) The borrow area should not be located in agriculture field unless unavoidable i.e. barren land is not available.</p>		√			Contractor	SIO Staff and PMU ISPMC	
IEE & PC Kansbahal										
84										

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks
				No Significant Impact	Significant Impact		Implementation	Supervision	
					Minor	Moderate			
			<p>The different option of procuring earth suggested by SIO are as:</p> <p>Option 1. Kansbhal subproject has 22.18 acres in Kadambahal village, Rajghanpur Village( Plot no.39, 43, 45, 46, 47,51, 52,53, 54,55, 56, 57, 58, 60, 61, 125, 126, 127, 134, 135, 136, 536 and 537 of acquired private land for borrow areas in the year 1986 which may be utilized for some qunatity after taking permission from SIO manager. Option 2. Some potential farmers who are willing to give earth from their own lands are being identified by WUAS which can be utilized by the contractor for borrow areas, the potential list of farmers / PPs are enclosed as Annexure 4. the potential farmers list may be handed over to the contractor after the agreement. Option 3. Enquiry with the local revenue department by the SIO manager has revealed there are some government revenue lands in the Rajghanpur block which the Contractor can take temporary lease after award of Contract and can be utilized for borrowing earth.</p> <p>These potential locations shall be verified for the suitability of the material by the SIO staff and the list of potential sites will be provided to the Contractor. As per the contractual conditions an agreement with the land owner will be reached by the contractor and he will also ensure to take the necessary permission for operating these borrow areas from the revenue authority like temporary lease etc. The necessary royalty would be deducted by the SIO staff from the Contractor. Contractor would try to procure earth within a lead of 5 Km of the canal system in small quantities.</p> <p>Planning of haul roads for accessing borrow areas shall be undertaken during this stage. The haul roads shall be routed to avoid a gricultural areas as well as forest areas as far as possible and shall use the existing village roads wherever possible.</p>						

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate				Major
		Quarry areas-Extraction of materials like earth etc., can disrupt natural drainage, vegetation and resulting in accelerated erosion and leading to water stagnation, ponding and pollution	The Contractor shall finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials, quality and other logistic arrangements. A preliminary survey has been carried out by the SIO and identified the quarry as shown in Annexure 3. If extraction shall be done, prioritize sites already permitted by the Mining or concerned department, Contractor shall purchase materials and finalize vendors who have valid permissions. The list of potential crusher who has valid license from State Pollution Control board, Odisha is enclosed for reference as Annexure 2. If other sites are necessary and the contractor want to use, let the contractor obtain necessary permission from the concerned regulatory authority and inform SIO Manager.		√			Contractor	SIO Staff and PMU ISPMC	
		Sand	The sand shall be procured from identified (by SIO)sand mines as far as possible. If Contractor wishes to procure from other sources he shall obtain the lease agreement of the supplier		√			Contractor	SIO Staff and PMU ISPMC	
3	Drilling of tube wells	Possibility of drilling tube wells in a near distance and change in water quality	The contractor along with SIO staff should locate all the potential sites proposed for drilling and initiate drilling as per the provisions of the contract.		√			Contractor	SIO Staff and PMU ISPMC	

**Table 37 Environmental Parameters Checklist for anticipated impacts and Mitigation Measures for Kansbahal Sub-project (Main canal, Distributaries and Minors executed by Contractors) - Construction Phase - Environmental Mitigation Plan**

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate				Major
1	Inadequate monitoring during construction stages	Potential damages to system likely to be maximised as a result of neglect on part of contractor.	Contractor to execute works in accordance with standard Contract Specification. Provision of site supervisory staff to ensure quality control and adherence to contract requirements. Monthly progress reporting and recording of community complaints/ objections. Issues to be resolved jointly with Project (SIO), PMU and ISPMC.		√			Contractor	SIO Staff, PMU and ISPMC	
2	Tube well drilling	Scope for contamination of water	The Contractor after tube well drilling shall purge and decontaminate before it is put to use  Tube well shall be sealed and its pedal shall be sealed properly to avoid mixing of impurities mixing with ground water  A concrete pad around the tube well may be constructed		√			Contractor	SIO Staff, PMU and ISPMC	
3	Site clearance – Clearing and grubbing	Damage to existing vegetation	If any vegetation shall be removed from construction site / zone before commencement of construction shall be carried out such that damage to the surrounding vegetation other than identified vegetation proposed for clearing is minimal.  Only ground cover/ shrubs that impinge directly at the work site shall be removed prior approval from SIO staff and in consultation with Environment Specialist		√			Contractor	SIO Staff, PMU and ISPMC	
4	Disposal of debris from dismantling structures and spoil	Scope for contamination of soil and blockage of natural drains and pollution of ground water by dumping of construction spoils	To the possible extent the materials like stone and other reusable materials shall be utilized in the construction.  The iron and wood generated if any would be disposed off as a surplus stock and scrap shall be auctioned as per the procedures of Odisha Water Resources Department.		√			Contractor	SIO Staff, PMU and ISPMC	

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE				Responsibility		Remarks
				No Significant Impact	Significant Impact			Implementation	Supervision	
					Minor	Moderate	Major			
5	Disposal of canal silt	Affect agricultural land / forest land and change in land use for stacking of silt	<p>The generated cutting material is very small quantity found to silty and sandy, not suitable for filling the embankments, hence unsuitable material shall be utilized in the spoil banks of the existing canals and in the low lying sections of the canal bank with in the available ROW after toe line..</p> <p>However, if any additional material is generated it would be disposed by identifying suitable places like old borrow areas, quarry sites and low lying government land by taking appropriate permission from the SIO manager and competent authority. The silt shall be tested for heavy metals and pesticide residues also before disposal and some quantities if suitable for agriculture can be distributed to adjacent farmers through PP.</p> <p>If the silt is found to be contaminated then it should not be distributed to farmers however the contractor with the help of SIO shall identify low lying waste lands or play grounds and disposed off in that area and some plantation can be made on this area.</p> <p>A provision for turfing the spoil banks to avoid erosion is recommended.</p> <p>Disposal of silt in the forest areas is prohibited.</p>		√			Contractor	SIO Staff, PMU ISPMC	Before disposal of silt chemical testing shall be carried out.
6	Stripping , Stocking and Damage to top agricultural soil due to earth work	Loss of productive soil and plant nutrients – impact on production	<p>Before beginning the construction of embankments the surface area of ground to be occupied shall be cleared of all roots and vegetable matter and stripped to a suitable depth as per IS: 4701 - 1982</p> <p>(i)Depth of stripping 5.0 to 7.5 cm for soil containaing light grasscover</p> <p>(ii) Depth upto to bottom of ploughed zone usally 15.0 to 22.5 cm in agricultural land.</p> <p>Top soil may be preserved and resued in turfing activities if possible in borrow areas bunds or if excess shall be distributed to farmers for using in the agricultural lands</p> <p>Project activities shall be carried out during lean period and non-monsoon period for minimizing loss.</p>		√			Contractor	SIO Staff, PMU ISPMC	

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE				Responsibility		Remarks
				No Significant Impact	Significant Impact			Implementation	Supervision	
					Minor	Moderate	Major			
7	Earth from Borrow areas for construction	Loss of productive soil and plant nutrients – impact on production	Contractor shall not be permitted to borrow areas in forest areas. Contractor shall identify location of borrow areas and get approval from SIO staff and in consultation ISPMC. Earth material should be taken from barren land or selected borrow area during lean period as per IS Code 1498 after taking approval from SIO Manager. Borrow areas should be dug as per IS code :4701 and prior approval from the competent authorities must be taken before execution and mutual agreement with the land owners should be taken by the contractor and ensure the borrow areas should not have any environmental issues like water logging etc. Borrow areas should be avoided in agricultural areas as well as forest areas. Required permission should be obtained from the authorized person as stipulated in the Orissa state minor minerals act and if operating in private lands mutual agreement and no objection certificate need to be produced to SIO by the contractor.			√		Contractor	SIO staff, PMU and ISPMC	
8	Quarry operation	Can disrupt natural drainage, vegetation and results in accelerated erosion	The contractor shall obtain materials from approved quarries only after the consent of Department of mines and Geology and District Administration. If any crusher need to be established it shall be done after obtaining proper consents for establishment and operation from the statutory agencies. All the materials purchased shall be from the approved vendors		√			Contractor	SIO staff, PMU and ISPMC	
9	Storage of Construction materials like sand, stone etc	Storage of construction materials may temporary change local land use	Temporary impact – materials should be stored properly avoiding agricultural lands and forest lands while working in the sections of the canal passing through forest areas.		√			Contractor	SIO staff, PMU and ISPMC	Only rehabilitation work no change in land use

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate			Major	
10	Use of access roads and Transporting of Construction materials and Haul Road Management	Deterioration in quality of road condition and damage of forest cart roads within the forest areas	Limited construction period, careful planning, restrictions on construction workers movements, adequate monitoring. All existing roads used by vehicles of the contractor or any of his suppliers of material shall maintain properly during construction period and clear any materials dropped by the vehicles. There is no need for construction new haulage roads within the forest areas where the canal passes, as the canal embankment itself serves as service road which can be utilised for transporting material and even the forest areas have existing forest cart roads which can be utilised with the permission of local forest department and they need to be maintained.		√			Contractor	SIO staff, PMU and ISPMC	
11	Transporting of materials and operation of equipment	Dust pollution – nuisances and health hazards to travelers / neighbors / workers  The areas adjoining to construction sites would be subjected to the air pollution from both due to construction work (including operation of equipments) and vehicle movement with construction materials	Contractor and his material shall cover vehicles while transporting materials. Careful planning to minimize and offset losses Construction practices in accordance with Specification, community consultation prior to detailed design and adequate monitoring shall be carried out Temporary impact on air quality shall be mitigated by using water sprinklers. Trucks carrying dirt, earth material, sand and metal to and from construction site, should be limited and wetted to prevent material being spilled on public roads. Necessary protection has to be taken to meet relevant emission standards for all construction machinery and vehicle, maintaining construction equipment in good condition and servicing diesel engines for reduction of emissions. The contractor shall ensure all the vehicles, equipments and machinery used for construction are well maintained and confirm that emissions levels comply with the relevant statutory requirements of CPCB and Motor Vehicle Rules		√			Contractor	SIO staff, PMU and ISPMC	

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate				Major
12	Noise from vehicles, plants and equipments and Vibration hazards	Nuisances to travelers/ workers and neighbors if increase in sound levels – health hazard	All construction plants and equipment used in construction shall strictly conform to the MoEF / CPCB noise standards All vehicles and equipment used in construction shall be fitted with exhaust silencers Regular servicing of all construction vehicles and machinery shall be done regularly and during servicing the effectiveness of exhaust silencers shall be checked All the construction sites within 150m of the nearest habitation, noisy construction work such as crushing, operation of DG sets and any high noise construction equipment shall be stopped during night time between 10.00 pm and 6.00 am. Working hours of the construction activities around sensitive areas like schools / hospitals upto a distance of 100m shall be restricted.		√			Contractor	SIO staff, PMU and ISPMC	
13	Contamination of water due to fuel and lubricants and construction waters	Water pollution from fuel and lubricants	The contractor shall procure fuel from the nearest outlet if any minor storage if he does he shall ensure the land is not contaminated. Contractor shall avoid oil spillage etc. Contractor shall not wash his vehicle in the canals Contractor shall ensure or install equipment in such a way that the waste water doesn't enter the canal during monsoon period.		√			Contractor	SIO staff, PMU and ISPMC	

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate				Major
14	Interference with existing road network and traffic, blockage of access ways. Restriction on movements of communities	Disruption of services and land uses and canal passes in certain sections parallel to state highway, and road in some sections of the canal crosses railway line and state highways.	Close consultation with community during planning and design stages necessary. Few sections of the canals ( The left main canal 5 numbers of new bridges are proposed at RD 750m, 6000m, 11500m, 19030m and 22900m and in the right main canal one new bridge at RD 3800m has been proposed. ) people are crossing the canals to reach the either side of the roads, so construction of new bridges are proposed at these locations. In addition left main canal at RD 5690 crosses railway track and State Highway at RD 8823m and 10302m. So Contractor while working at these places he ensures proper safety requirements. Construction implementation in accordance with specification, prior agreement with community on alignment of access roads and irrigation infrastructure, and monitoring is required Contractor shall if necessary prepare a traffic management plan in consultation with the local police and ensure adequate safety measure.			√		Contractor	SIO staff, PMU and ISPMC	
15	Soil Erosion and Siltation	Degraded embankments, damage to soil and general land value. Increased sedimentation build-up and clogging of surrounding waterways.	Employment of stringent construction practices and monitoring Confirming excavations operations and slope stabilisation work during the dry season only and compaction in main canal by powered road roller and vibratory roller and in the distributaries, minors and sub-minors by ordinary compaction Careful construction planning for surface protection particularly before monsoon season and provision of turfing and plantation. Plantation can be taken up on the canal embankments with the available funds under plantation and also with the other ongoing schemes of Govt. Odisha like social forestry programmes etc		√			Contractor	SIO staff, PMU and ISPMC	
16	Stocking materials or Blockage of natural drainage with materials	Damage to natural drainage patterns Presently natural Drains are dominated with weeds	Assessment of existing drainage channels during construction stages. Contractor to maintain natural drainage, stipulate in Contract Specification. Provision of site supervision during construction implementation.		√			Contractor	SIO Staff, PMU and ISPMC	

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate				Major
17	Personnel Safety Measures for Labour	Workers health would get affected	Contractor shall provide the necessary personnel Protective Equipment (PPE) like foot wear, gloves, protective goggles and eye –shields etc for workers employed in concrete, crusehrs, welders and bitumen work Ear plugs to workers exposed to loud noise and workers working in crushers etc if the contractor establishes. The contractor shall comply with all the regulations regarding safe scaffolding, ladders, working platforms, excavations and safe emans of entry and engress The contractor shall not employ any person below age of 14 years for any work and no pregnant women. The contractor shall comply with all the relevant provisions of the Orissa Buidlings and other Construction Workers ( Regulations of Employment and conditions of service) Rules 2002 and shall also comply with the precautions as required for ensurig the safety of thw workMen as per International Labour Organisation (ILO) Convention No 62 as far as thise are applicable to this contract.		√			Contractor	SIO Staff, PMU and ISPMC	
18	Traffic and Safety	Disruption of services and may lead to accidents	The contractor shall take all necessary measures for maintaining the traffic during construction and errect safety barricades, safety ribbons and safety boards including sign boards, flags and other measures as per the requirement		√			Contractor	SIO Staff, PMU and ISPMC	
19	Protection of public and workers health and safety	Loss of public / workers health status	Project staff to provide basic health and safety trainings to all construction workers and providing periodic health check ups and AIDS awareness camps		√			Contractor	SIO Staff, PMU and ISPMC	
20	Risk from Electric Poles / lines and electrical equipments	Scope for electric socks and electrocution hazard	While giving level or marking workers should ensure they take preventive measures while working with electric lines. The contractor shall take all required precautions to prevent danger from electrical equipmetns and esnures that he doesn't place or stack any material that may cause danger or inconvenience to any person or public All machines and equipments and lighting used will be as per the IS standards and shall mainatian properly withoout any defects.		√			Contractor	SIO Staff, PMU and ISPMC	

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE				Responsibility		Remarks
				No Significant Impact	Significant Impact			Implementation	Supervision	
					Minor	Moderate	Major			
21	Damage to different flora / fauna habitats	Along the canal side few trees are present- during renovation work those trees might be felled	<p>Close consultation with community prior to detailed design to identify important flora/fauna habitats. Careful planning of infrastructure alignment prior to construction/ implementation. Stipulate in Conditions of Contract and provision of site supervision.</p> <p>The Contractor and WUAs will obtain the permission from state forest department while working in the reserved forests.</p> <p>Contractor shall ensure that no trees shall be cut by the workers while working in the forest areas</p> <p>Contractor shall ensure the workers are not involved in any hunting or poaching areas</p> <p>Contractor shall not create paths existing cart tracks shall be used or canal service road shall be utilized.</p> <p>The Contractor shall ensure while working in forest areas, all works shall be carried out during day time only.</p> <p>The Contractor shall not dump material in the forest areas only existing ROW available within the canal shall be used for dumping / storing materials.</p> <p>The Contractor shall not be permitted to establish Camps / labour camps within forest areas.</p> <p>Plantation of trees along the irrigation canal compensate loss of flora</p> <p>Contractor shall take reasonable precaution to prevent his workers from damaging any flora or fauna of the area including fishing or hunting of any animals in the area.</p> <p>If by chance if the contractor sights any animal (wild) the contractor shall inform the SIO staff and Environment Specialist and need to be reported to the State Forest Department immediately and shall take appropriate steps / measures in consultation with Forest Department Officials.</p>		√			Contractor	SIO Staff, PMU and ISPMC	No forest land exist along the canal
22	Temporary closure of irrigation system	Non availability of irrigation water and impact on production and livelihood of farmers	<p>Consultation with local Water Users Associations members or Panu Panchayat members before closing the canal</p> <p>The construction activities will be scheduled after Kharif crop period only</p> <p>Proper information shall be given to the farmers</p>			√		Contractor	SIO Staff, PMU and ISPMC	

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate				Major
23	Digging activity – Chance found Archaeological property	By Chance if any Archaeological property is found while digging	While excavating or dismantling any structure if any fossils, coins, articles of value / antiquity and remians of archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as oer the provisions of the relevant legislation  The Contractor shall take reasonable precautions to prevent his workMen or any other persons from damaging or removing any such articles, if any articles found shall be brought to the notice of SIO and Environment Specialist and shall seek the direction of Archaeological Survey of India (ASI) before contractor recommencing the work		√			Contractor	SIO Staff, PMU and ISPMC	
24	Provision of Basic Ameneties and proper accomodation	Scope for providing improper accomodation and basic amenities to workers	The Contractor shall provide the basic accomodations as per the provisions of the Orissa Building and Construction Workers Rules The location and layout of the labour camps shall be provided to the SIO staff and take his approval The Contracator will ensure all the basic amenities like provision of drinking water at work site and camps and proper sanitation facilities and arrangement for eating the food. The drinking water he provides shall be as per the IS 10,500.		√			Contractor	SIO Staff, PMU and ISPMC	
25	Clearing of site before monsoon and Demobilization of contractor	Scope for not clearing materials from the site especially cutting materils from the canal bed and materials used for construction	The Contractor shall ensure that he clears all the unwmanted materials from the canal bed which may effect or obstruct after releasing the water into canal In the tube wells drilled areas pits if any removed shall be refilled All excess materials and debris shall be cleared		√			Contractor	SIO Staff, PMU and ISPMC	
26	Tree plantation	Scope for wrong species selection and not able to survive	SIO shall consult horticultural department before selecting the tree species that would be planted along the canal Appropriate distance shall be maintained and Regular maintenance shall be carried out.		√			SIO staff	PMU and ISPMC	

**Table 38 Environmental Parameters Checklist for anticipated impacts and Mitigation Measures for Kansbahal Sub-project (Sub Minors executed by WUAS) – Pre construction Activity - Environmental Mitigation Plan**

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate				Major
1	Sources of Materials	Extraction of materials like earth etc., can disrupt natural drainage, vegetation and resulting in accelerated erosion and leading to water stagnation, ponding and pollution	WUAs shall identify the potential borrow areas and take appropriate permission from the regulating agencies and shall enter into mutual agreements with the land owners. WUAs shall obtain SIO manager permission before operating any borrow areas. <b>Selection Criteria of Borrow areas is as follows:</b> IS 4701: 1982 No borrow pits shall be dug with in 5m of the toe of the embankment, if the depth of the borrow pit is less than 0.5m it shall be after 5m of the toe of the embankment and if the pit depth shall be more than 0.5m it shall be 10m of the toe of the embankment or within such a distance from the toe of the bank where a 4:1 hydraulic gradient line cuts the ground surface, which ever more. Borrow pits shall not be more than 1m in depth and 25 m in length. A clear distance of 1m shall be left between the pits The bed of borrow pits shall be left reasonably smooth and even. WUAs shall not be permitted to lift any materials from the forest areas. WUAs shall purchase materials and finalize vendors who have valid permissions in consultation with SIO staff.		√			PP/ WUAs	SIO Staff and PMU ISPMC	

**Table 39 Environmental Parameters Checklist for anticipated impacts and Mitigation Measures for Kansbahal Sub-project (Sub Minors executed by WUAs) –Construction Phase - Environmental Mitigation Plan**

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE				Responsibility		Remarks
				No Significant Impact	Significant Impact			Implementation	Supervision	
					Minor	Moderate	Major			
1	Inadequate monitoring during construction stages	Potential damages to system likely to be maximised as a result of neglect on part of contractor.	WUAs to execute works in accordance with standard Contract Specification.		√			PP/ WUAs	SIO Staff, PMU and ISPMC	
2	Site clearance – Clearing and grubbing	Damage to existing vegetation	If any vegetation shall be removed from construction site / zone before commencement of construction shall be carried out such that damage to the surrounding vegetation other than identified vegetation proposed for clearing is minimal. Only ground cover/ shrubs that impinge directly at the work site shall be removed prior approval from SIO staff and in consultation with Environment Specialist		√			PP/ WUAs	SIO Staff, PMU and ISPMC	
3	Disposal of debris from dismantling structures and spoil	Scope for contamination of soil and blockage of natural drains and pollution of ground water by dumping of construction spoils	To the possible extent the materials like stone and other reusable materials shall be utilized in the construction.  The iron and wood generated if any would be disposed off as a dead stock and scrap shall be auctioned as per the procedures of Odisha Water Resources Department.		√			PP/ WUAs	SIO Staff, PMU, PPSU and ISPMC	
4	Disposal of canal silt	Affect agricultural land and change in land use for stacking of silt	The sub-minors shall generate very low quantities of cutting material if any generated shall be utilized in filling spoil banks and filling the low lying section the canal bank within the available ROW.  If available in excess after testing for pesticide and heavy metals it can be distributed to farmers for using in agricultural fields		√			PP/ WUAs	SIO Staff, PMU, PPSU and ISPMC	Before disposal of silt, chemical testing will be required

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate				Major
5	Stripping , Stocking and Damage to top agricultural soil due to earth work	Loss of productive soil and plant nutrients – impact on production	Before beginning the construction of embankments the surface area of ground to be occupied shall be cleared of all roots and vegetable matter and stripped to a suitable depth as per IS: 4701 - 1982 (i)Depth of stripping 5.0 to 7.5 cm for soil containaing light grasscover (ii) Depth upto to bottom of ploughed zone usally 15.0 to 22.5 cm in agricultural land. Top soil may be preserved and resued in turfing activities if possible in borrow areas bunds or if excess shall be distributed to farmers for using in the agricultural lands Project activities shall be carried out during lean period and non-monsoon period for minimizing loss.		√			PP/ WUAs		
6	Earth from Borrow areas for construction	Loss of productive soil and plant nutrients – impact on production	WUAs shall identify location of borrow areas and get approval from SIO staff and in consultation ISPMC. Earth material should be taken from barren land or selected borrow area during lean period as per IS Code 1498 after taking approval from SIO Manager. Borrow areas should be dug as per IS code :4701 and prior approval from the competent authorities must be taken before execution and mutual agreement with the land owners should be taken by the contractor and ensure the borrow areas should not have any environmental issues like water logging etc. Borrow areas should be avoided in agricultural areas as well as forest areas. Required permission should be obtained from the authorized person as stipulated in the Orissa state minor minerals act and if operating in private lands mutual agreement and no objection certificate need to be produced to SIO by the contractor.			√		PP/ WUAs		
7	Quarry operation	Can disrupt natural drainage, vegetation and results in accelerated erosion	The WUAS shall obtain materials from approved quarries only. All the materials pruchased shall be from the approved vendors.		√			PP/ WUAs		

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	No Significant Impact	IEE			Responsibility		Remarks
					Minor	Moderate	Major	Implementation	Supervision	
8	Storage of Construction materials like sand, stone etc	Storage of construction materials may temporary change local land use	Temporary impact – materials should be stored properly avoiding agricultural lands in consultation with local people		√			PP/ WUAs	SIO Staff, PMU PPSU and ISPMC	Only rehabilitation work, no change in land use
9	Use of access roads and Transporting of Construction materials and Haul Road Management	Deterioration in quality of road condition	Limited construction period and small quantities of materials involved, so care need to be taken and if any damages the WUAs shall maintain		√			PP/ WUAs	SIO Staff, PMU PPSU and ISPMC C	
10	Interference with existing road network and traffic, blockage of access ways. Restriction on movements of communities	Disruption of services and land uses	Close consultation with community during planning and design stages necessary. since local communities are involved they will take precautions in protecting the interest and safety of the people living around.  Construction implementation in accordance with specification, prior agreement with community on alignment of access roads and irrigation infrastructure, and monitoring			√		PP/ WUAs	SIO Staff, PMU PPSU and ISPMC	
11	Soil Erosion and Siltation	Degraded embankments, damage to soil and general land value. Increased sedimentation build-up and clogging of surrounding waterways.	Employment of stringent construction practices and monitoring Confirming excavations opearions and slope stabilisation work during the dry season Careful construction planning for surface protection particularly before monsoon season and provision of turfing and plantation		√			PP/ WUAs	SIO Staff, PMU PPSU and ISPMC	
12	Stocking materials or Blockage of natural drainage with materials	Damage to natural drainage patterns Presently natural Drains are with weeds	Assessment of existing drainage channels during construction stages. WUAs to maintain natural drainage, stipulate in Contract Specification. Provision of site supervision during construction implementation.		√			PP/ WUAs	SIO Staff, PMU PPSU and ISPMC	Co-odrination with CADA division recommended

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE				Responsibility		Remarks
				No Significant Impact	Significant Impact			Implementation	Supervision	
					Minor	Moderate	Major			
13	Protection of public and workers health and safety	Loss of public / workers health status	Awareness to workers / staff to provide basic health and safety trainings to all construction workers		√			PPSU	SIO Staff, PMU PPSU and ISPMC	
14	Risk from Electric Poles / lines and electrical equipments	Scope for electric socks and electrocution hazard	While giving level or marking workers should ensure they take preventive measures while working with electric lines.  The WUAs shall take all required precautions to prevent danger from electrical equipmetns and esnures that he doesn't place or stack any material that may cause danger or inconvenience to any person or public		√			PP/ WUAs	SIO Staff, PMU PPSU and ISPMC	
15	Damage to different flora/fauna habitats	Along the canal side few trees are presnt- during renovation work those trees will be felled	WUAS shall take reasonable precaution to prevent his workers from damaging any flora or fauna of the area including fishig or hunting of any animals in the area.  If by chance if the WUAS sights any animal (wild) the WUAs shall inform the SIO staff and Environment Specialist and need to be reported to the State Forest Department immeidately and shall take appropriate steps / measures in consultation with Forest Department Officials		√			PP/ WUAs	SIO Staff, PMU PPSU and ISPMC	Canal RD - ----through RF and .....through village forest
16	Digging activity – Chance found Archaeological property	By Chance if any Archaeological property is found while digging	While excavating or dismantling any structure if any fossils, coins, articles of value / antiquity and remians of archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as oer the provisions of the relevant legislation  The WUAs shall take reasonable precautions to prevent his workMen or any other persons from damaging or removing any such articles, if any articles found shall be brought to the notice of SIO and Environment Specialist and shall seek the direction of Archaeological Survey of India (ASI) before WUAs recommencing the work		√			PP/ WUAs	SIO Staff, PMU PPSU and ISPMC	

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE			Responsibility		Remarks	
				No Significant Impact	Significant Impact		Implementation	Supervision		
					Minor	Moderate			Major	
17	Clearing of site before monsoon and Demobilization of contractor	Scope for not clearing materials from the site especially cutting materials from the canal bed and materials used for construction	The WUAs shall ensure that he clears all the unwmanted materials from the canal bed which may effect or obstruct after releasing the water into canal		√			WUAs	SIO Staff	

**Table 40 Environmental Parameters Checklist for anticipated impacts and Mitigation Measures for Kansbahal Sub-project – Operation and Maintenance Phase - Environmental Mitigation Plan**

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE				Responsibility		Remarks
				No Significant Impact	Significant Impact			Implementation	Supervision	
					Minor	Moderate	Major			
1	Overall Environmental problem	Competent O&M plus monitoring necessary.	Monitoring of irrigation water quality and soil quality will be required during operation phase for maintaining best productive environment. The proposed sampling locations, parameters to be monitored and frequency are provided in Table 41 and proposed buget and stage of testing is provided in Table 43 of this chapter.		√			WUAs & SIO staff	PMU and PPSU Env. Monitoring Specialist	Presently soil and irrigation water not tested
2	Impact on canal system due weeds growth	Growth of weeds impairs flow of water and reduces water availability, damages structures and becomes habitat of mosquitoes	Regular deweeding and checking of weeds by mechanical means or by usage of herbicides if necessary. Involving community and PP members in undertaking regular cleaning and encouraging the PP to prepare compost with the help of agriculture department.		√			WUAs & SIO staff	PMU and PPSU Env. Monitoring Specialist	

Sl. No	Field / Activity	Anticipated Impact	Recommended Mitigation Measure	IEE				Responsibility		Remarks
				No Significant Impact	Significant Impact			Implementation	Supervision	
					Minor	Moderate	Major			
3	Non Restoration of aesthetics after construction activity overall ecological impact.	Ecological unbalancing	Monitoring of survival of tree planted along the canal. The SIO with the help of contracot / local Forest Department / Horticulture Department shall monitor the survival. After completion of works, replanting of economically and aesthetically important plants can be ensured along the canal area. Greening of this area may offset the ecological effects of the clearing and felling of trees during the construction phase. Further in course of time the population of avian fauna may go up and enhance the biological diversity.		√			Contractor/WUAs & SIO staff/ Local Forest Department / Horticulture Department	PMU and PPSU Env. Monitoring Specialist	
4	Modification of soil	The changes in agriculture practices may result in soil modifications, including increased susceptibility to slumping, reduced nutrient status and impaired structure if the organic matter content is not maintained.	Continued use of deep rooting grasses and shrubs to further strengthen bunds and terrace walls, and promotion of continued use of organic based practices – use of bio fertilizer and vermi-compost.		√			WUAs & SIO staff and agriculture dept	PMU and PPSU Env. Monitoring Specialist	
5	Soil and water contamination due to agrochemicals	Increased use of agrochemicals including mineral fertilizers and pesticides, which may result in soil and water contamination.	Optimum utilization of chemical fertilizer and discourage utilization of long persistence and banned pesticide Use of bio fertilizer and vermi-compost to minimize contamination Post project water quality both surface and ground water, silt and soil shall be monitored for the pollutants			√		WUAs & SIO staff and agriculture dept	PMU and PPSU Env. Monitoring Specialist	Presently use of bio-fertilizer and organic manure is limited
6	Impact on biodiversity	•Biodiversity may be affected by increased specialized mono-cropping, use of agrochemicals, introduction of alien (invasive) species, introduction of high yielding varieties (HYV).	Awareness raising through the agriculture extension component and promoting under the agriculture extension component the use of indigenous multi-purpose trees for soil protection, watershed management and cash crop production, optimum use of agrochemical			√		WUAs & SIO staff and agriculture dept	WUAs & PPSU and agriculture dept	PMU and PPSU

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## **J. Environmental Monitoring Plan**

262. Environmental Monitoring is an essential component of any developmental project, it is an integral; part of any environmental assessment process. Any intervention in the form of development shall have complex-inter relationships between people, natural resources, biotic and other forces resulting in a new environment. So it is essential to monitor critical environmental parameters in the pre- project scenario, during and post project scenario. The monitoring program suggested mainly meeting the data base requirements of water resources department on water quality, soil quality and silt etc. The impacts arising through construction are minimal like change in turbidity etc. The parameters suggested for 0monitoring ground water, surface water, silt and soil is presented in Annexure 10, 10a &b.

263. The monitoring can be carried out by (i) PMU outsourcing to a Laboratory for all the subprojects , or (ii) SIO outsourcing to a laboratory directly. The suggested parameters, description of sampling locations and different stages of monitoring required along with suggested frequency is shown in Table 41.

2.70 The environmental monitoring during the different phases of the subproject implementation can be carried out by a recognized laboratory (i.e approved by State Pollution Control Board, Odisha or National Accreditation Board for Testing and Calibration Laboratory (NABL) or National Accreditation Board for Education and Training (NABET) or any Ministry of Environment and Forests (MoEF) recognized laboratory.

Table 41: Showing the Suggested Environmental Monitoring

Sl.No	Parameter to be monitored	Parameter / Indicators	Location	Responsibility	Frequency
<b>Pre- Construction Stage ( Baseline data)</b>					
1	Ground water (IS: 10,600)	Physico, chemical, bacteriological parameters. Total of 34 parameters as per IS: 10,600:1991 details in Annexure 10	preferably from the newly drilled tube wells under the project ( 4 locations)	SIO /Laboratory	Once before start of the project for baseline data
2	Surface water (IS: 2296: 1992)	Physico, chemical, bacteriological parameters. Total 39 parameter including pesticide residues as per IS: 2296: 1992,details in Annexure 10a	Barrage and canal water (4 locations)	SIO /Laboratory	Once before start of the project for baseline data
3	Silt	Physio- chemical, micro and macro nutrients and pesticide residue. Total 27 parameters including 4 pesticide residue details in Annexure 10b	Silt from Canal (4 locations)	SIO /Laboratory	Once before start of the project for baseline data
4	Soil	Physio- chemical, micro and macro nutrients and pesticide residue. Total 27 parameters including 4 pesticide residue details in Annexure 10b	(Soils from canal Adjacent - agricultural fields and preferably water logged areas) (4 locations)	SIO /Laboratory	Once before start of the project for baseline data
<b>Construction Stage</b>					
1	Ground water (IS: 10,600)	Physico, chemical, bacteriological parameters. Total of 34 parameters as per IS: 10,600:1991 details in Annexure 10	preferably from the newly drilled tube wells under the project (4 locations)	SIO /Laboratory	Twice a year for the construction of 3 years
2	Surface water (IS: 2296: 1992)	Physico, chemical, bacteriological parameters. Total 39 parameter including pesticide residues as per IS: 2296: 1992,details in Annexure 10a	Barrage and canal water (4 locations)	SIO /Laboratory	Twice a year for the construction of 3 years
3	Silt	Physio- chemical, micro and macro nutrients and pesticide residue. Total 27 parameters including 4 pesticide residue details in Annexure 10b	Silt from Canal (4 locations)	SIO /Laboratory	Twice a year for the construction of 3 years

4	Soil	Physico- chemical, micro and macro nutrients and pesticide residue. Total 27 parameters including 4 pesticide residue details in Annexure 10c	(Soils from canal Adjacent - agricultural fields and preferably water logged areas) (4 locations)	SIO /Laboratory	Once in a year times during construction period of 3 yrs ( i.e. Between April to May
6	Dust Monitoring	Visual Observation	Entire Project Corridor	SIO	Daily
6	Noise	Observation	Entire Project Corridor	SIO	Daily
<b>Operation &amp; Maintenance Phase ( Post Project)</b>					
1	Ground water (IS: 10,600)	Physico, chemical, bacteriological parameters. Total of 34 parameters as per IS: 10,600:1991 details in Annexure 10	preferably from the newly drilled tube wells under the project (4 locations)	SIO /Laboratory	Once after after completion of works
2	Surface water (IS: 2296: 1992)	Physico, chemical, bacteriological parameters. Total 39 parameter including pesticide residues as per IS: 2296: 1992, details in Annexure 10a	Barrage and canal water (4 locations)	SIO /Laboratory	Once after after completion of works
3	Silt	Physico- chemical, micro and macro nutrients and pesticide residue. Total 27 parameters including 4 pesticide residue details in Annexure 10b	Silt from Canal (4 locations)	SIO /Laboratory	Once after completion of works
4	Soil	Physico- chemical, micro and macro nutrients and pesticide residue. Total 27 parameters including 4 pesticide residue details in Annexure 10c	(Soils from canal Adjacent - agricultural fields and preferably water logged areas) (4 locations)	SIO /Laboratory	Once after completion of
Kansbahal sub project tentative Locations for monitoring: (1.) Dam (2.) Left Main canal RD 13.5 km, (3) Right Min Canal RD 2.5 kmkm (4) Ranibandha sub minor 17.00km					

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**J. Performance Indicators:**

271. The monitoring programme constitutes performance indicators (Table 42) and necessary budgetary provisions.

Table 42 Showing the Performance Indicators

	Indicator	Description of the item	Stage	Responsibility
	Statutory Clearance	Obtaining CFE & CFO -Statutory requirement from regulatory bodies	Pre construction and construction	Contractor
	Borrow area	No. of Borrow areas identified and verified No. of sites redevelopment and no-objection certificate produced after handing over site	Pre and Post Construction	Contractor
	Quarry	No. of Quarry sites identified and verified No. of sites redevelopment and no-objection certificate produced after handing over site	Pre and Post Construction	Contractor
	Disposal sites	Quantity of Debris and Spoil disposed off	Construction and Post Construction	Contractor
	Dust Control	No. of times watering carried out	Construction period	Contractor
	Encroachments	No. of Encroachments identified No. of encroachers and squatters rehabilitated as per RAP provisions	Pre and Post Construction	SIO
	Environmental monitoring Silt, Ground water, Surface water and Soil	No. of times testing( Ground water, Surface water, Silt and Soil) carried out during construction and operation	Pre, Construction and Post Construction	Contractor /SIO
	Use of PPE	No. of work sites provided with PPE	Construction	Contractor
	Usage of safety measures and sign boards	No. of sites safety arrangements made and sign boards installed	Construction	Contractor
	Turfing	Length of turfing carried out	Construction and post construction	Contractor
	Plantation	No. of trees cut and no.of trees planted	Construction and Post Construction	Contractor and SIO
	Health camps	No. of medical and health camps including AIDS awareness camps conducted	Construction	Contractor

## K. Environmental Management and Monitoring Plan (EMMP) Costs

272. Most of the mitigation measures require the Construction Contractors to adopt good site practice, which should be part of their normal regular procedures, so there are unlikely to be major costs associated with compliance. In addition to this, any costs of mitigation by the construction contractors or SIO are included in the budgets for the civil works. All the environmental costs like dust suppression (sprinkling of water), borrow area rehabilitation, haulage road maintenance, safety etc are all inclusive under overheads of item rates as per revised schedule of rates, Govt. of Odisha.
273. Environmental monitoring will be integrated into the Project performance monitoring and evaluation (PPME) system. The majority of activities involved are translating actions suggested in the EMP to be implemented by the Construction Contractor and WUAs. The implementation period stipulated for the sub-projects are three years of construction phase and three years of post construction phase is suggested for environmental monitoring. The environmental monitoring suggested here is developed keeping in view of the needs of the Department of Water Resources as suggested in the EARF. The DoWR want to monitor surface water and ground water to assess the impacts of upstream urbanization and industrialization and it also want to monitor level of deterioration of water quality due to increased use of fertilizers and pesticides within and outside the command area. In addition the department wants to assess contaminants in the silt and soil in the command area. So the SIO, DoWR will be responsible for the implementation of environmental monitoring (Surface water, Ground water, Soil and Silt testing).
274. The monitoring shall be carried out by recognized laboratories { i.e., laboratories approved by State Pollution Control Board, Odisha, or National Accreditation Board for Testing and Calibration Laboratory (NABL) or (National Accreditation Board for Education and Training (NABET) or any Ministry of Environment and Forests (MoEF) recognized laboratory}.
275. The impacts arising out of the construction are minimal and the responsibility of implementation of the EMP mainly lies with the Contractor monitored by SIO staff. In addition to environmental safeguards taken up the contractor and sub project level environmental monitoring shall be carried out by the SIO/ PMU. The total environmental monitoring and management cost for the sub-project covering three years of construction phase and three years of post construction stage are shown in Table 43.

Table 43: Showing Environmental Monitoring Cost

Environmental Parameter	Suggested No. of locations	Frequency and period of monitoring	Unit rate in Rs	Total cost in Rs
<b>Pre - construction period monitoring( baseline data) before commencement of civil works</b>				
Surface water	4	4x1 (4)	10,000	40,000
Ground water	4	4x1(4)	10,000	40,000
Silt	4	4x1(4)	12,500	50,000
Soil	4	4x1(4)	12,500	50,000
Sub-total				<b>1,90,000</b>
<b>Construction Phase</b>				

Environmental Parameter	Suggested No. of locations	Frequency and period of monitoring	Unit rate in Rs	Total cost in Rs
Surface water	4	4x2x3(24)	10,000	2,40,000
Ground water	4	4x2x3(24)	10,000	2,40,000
Silt	4	4x2x3(24)	12,500	3,00,000
Soil	4	4x1x3(12)	12,500	1,50,000
Sub-total				9,30,000
<b>Operation and Maintenance phase – Post construction</b>				
Surface water	4	4X1(4)	10,000	40,000
Ground water	4	4X1(4)	10,000	40,000
Silt	4	4X1(4)	12,500	50,000
Soil	4	4X1(4)	12,500	50,000
Sub-total				1,90,000
<b>Grand Total</b>				<b>13,10,000</b>
Cost of Plantation	400		1200 / plant with 3 yrs maintenance cost	4,80,000

#### L. Environmental Training

276. The basic requirement of the environmental training is to strengthen the knowledge of PMU/ SIO, DoWR and WUAs on environmental aspects.

#### M. Strengthening Environmental Knowledge & Management Capability

277. The capacity and skills of the DoWR to carry out environmental management of irrigated agriculture schemes will need to be developed to be responsive and proactive to the needs and perceptions of environmental management in their jurisdictions during and following Project completion. The institutional strengthening of environmental management will be blended within the activities. The focus will be on building the capacity and capability of the SIO, DoWR to assume their responsibilities in carrying out REAs, IEEs and implementing EMPs. The organizational framework in the DoWR for this to occur will be establishment of new environmental division as per EARF.
278. Awareness raising will initially sensitize the environmental assessment and EMP procedures among the project stakeholders. In addition meetings, seminars and some short courses will be organized to raise awareness within the DoWR. ISPM Environmental consultant during the field visits will also give on-field training on the implementation of EMP to the Contractor staff and SIO staff by the ISPMC and WUAs with the help of PPSU – Environmental Monitoring Specialist. In addition training programs would be conducted to the Contractor staff and SIO staff, DoWR by the ISPMC and for WUAs by the PPSU – Environmental Monitoring Specialist with the available funds of the PMU under training. The list of appropriate training module

and tentative time frame is given in Table 44 and the required budget is suggested in Table 45.

279. Participatory Mechanisms are the building blocks for the success of the Project. Besides the DoWR and WUAs, the community needs to get involved in developing the foundation of future environmental management of irrigated agriculture in the State. Results of Environmental monitoring carried out during construction would be disseminated to WUA / PP members for raising awareness through PPSU Environmental Monitoring specialist and these would be built into the PPME System Participatory Environmental Monitoring guidelines shall be developed with the assistance of the environmental monitoring specialists of PPSU through the PIM Component for use by DoWR and WUA staff during construction and O&M. Lessons learned from past environmental management initiatives will be used to reinforce public participation as an essential aspect to instill a sense of ownership and stewardship among all stakeholders that will be involved in environmental management and the use of resources. Measures to involve active participation of the community will be included to help ensure more effective and appropriate management, since the stakeholders (those using the resources) can become involved in a voluntary way in some of the basic monitoring (e.g., soil erosion point sources) and regulating various activities under the EMP.
280. An environmental monitoring programme is important as it provides useful information and helps to i) assist in detecting the development of any unwanted environmental situation, and thus, provides opportunities for adopting appropriate control measures, and ii) evaluate the performance and effectiveness of mitigation measures proposed in the EMP and suggest improvements in management plan, if required.

Table 44 Proposed Training Module for Capacity building of SIO and WUAs

Item No	Training Type	Item/ subject of Training	Target Group	Time
1	Orientation Training	Need for Initial Environmental Examination Report and Overview of important Environmental Regulation and frame work to the project Applicable statutory Environmental Clearances – by the SIO staff and Contractor	PMU, SIO staff , PPSU staff, Contractors and WUAs while executing construction of minors	Pre-Construction
2	Training on Environmental & Safety Aspects Relevant to Construction	1. Environmental & Safety Aspects Relevant to Construction Environmental obligations as per Contract Clauses and technical specification ( covering issues and impacts related to Borrow areas, Quarries, Aggregates, Top soil usage, Disposal of construction debris, handling of hazardous materials and dust suppression measures) Safety measures and usage of PPE's during construction	PMU, SIO staff , PPSU staff, Contractors and WUAs while executing construction of minors	Twice during Construction period

Item No	Training Type	Item/ subject of Training	Target Group	Time
		2.Implementation of Environmental Monitoring Plans Importance of EMP and parameters to be monitored Parameters for Environmental Monitoring ( Surface water, Ground Water, Silt and Soil) Precautions to be taken while sampling Monitoring frequency		
3	Environmental Issues during maintenance and Operation	Environmental issues during operation and post project Parameters for Environmental Monitoring ( Surface water, Ground Water, Silt and Soil) Precautions to be taken while sampling Monitoring frequency	PMU, SIO staff PPSU staff and WUAs	After Construction

#### N. Training Budget

281. The approximate cost involved under training is shown in Table 45.

Table 45 showing the training budget

Sl.No	Training Details	Unit rate	Frequency	Total cost
1	Orientation training on the EMP implementation to SIO Staff and Contractors for a group 40 to 50 people	Rs. 25,000	4 times during project period	Rs.1,00,000
2	Orientation training on the EMP implementation to SIO Staff and WUAS for a group 40 to 50 people	Rs. 25,000	4 times during project period	Rs.1,00,000
	Total			2,00,000

#### O. Environmental monitoring reporting

The environmental reporting system has been discussed in detail under section E of this Chapter the contractors and WUAs shall submit monthly report to the SIO as provided in Annexure 9 and 9a of this report. The summary of status of EMP implementation shall be provided by PMU to ADB periodically through Quarterly Progress Report (QPR). PMU shall also submit Environmental Monitoring Report describing the status of EMP implementation in detail to ADB on a annual basis for Category "B" projects.

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## IX FINDINGS AND RECOMMENDATIONS

282. There are no significant adverse impacts associated with this project. Instead the project is expected to improve irrigation facilities and enhance economic growth of the area. Increased irrigation will also help in planting of more trees thereby increasing the environmental conditions of the area adding to the greenery and general aesthetics of the area. The indirect benefits of the project will be lowered levels of out migration as the communities will have more opportunity of securing income from within the village. There will be growth in living standard of people, which will encourage proper education, social awareness, health facility and prosperity amongst the people.
283. The IEE clearly states in its findings that there will be no significant impact in the local environmental condition due to construction and operation of the project. Any impact associated with the project activities will be minor in nature and will be restricted only during the construction phase of the project. Increased levels in ground water increase in soil salinity, increased levels of insecticides and pesticides are some of the major impacts during project operation. Increased ground water level is a beneficial impact and hence no mitigation measures are recommended. It is suggested that local villagers should be educated through pani panchayat about rational use of water, chemical fertilizers and pesticides to reduce soil salinity and protect surface and ground water quality. There are forest areas near the project location (head area) and there is movement of wild animals in the project area.

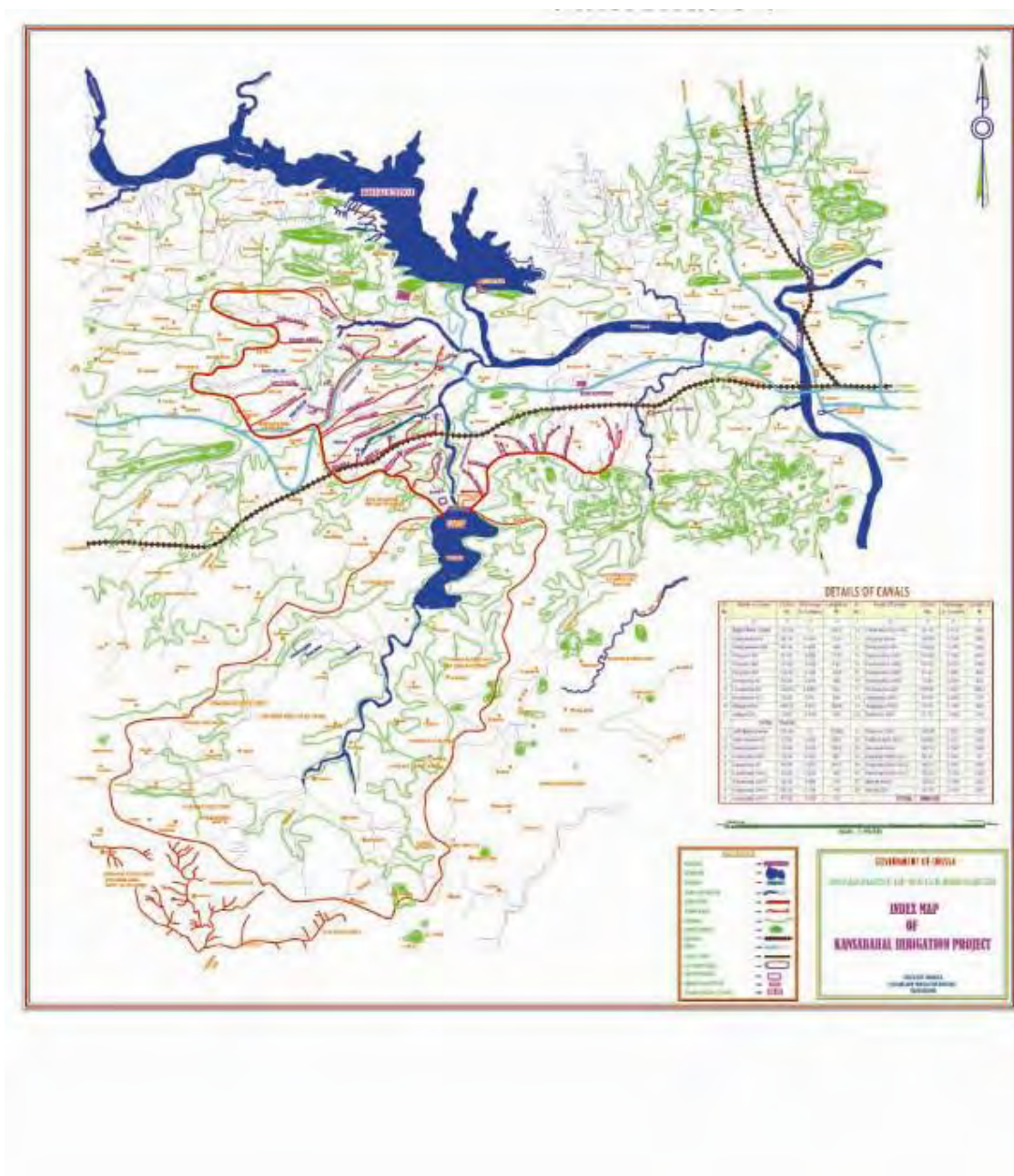
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## **X. CONCLUSION**

284. There are no adverse impacts expected from this project. The project is expected to improve the existing derelict irrigation infrastructure and will be put to beneficial use to the society. This will boost agriculture growth in the area and will bring prosperity to the region. By improving the irrigation infrastructure issues like water seepage, water logging, economic disparity between head end and tail end users will be reduced. The project has already been assessed as category "B" project and will not require environmental clearance from state government as no additional land is covered for irrigation under this project.

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## **ANNEXURE**

**INDEX MAP OF KANSBAHAL SUB PROJECT**

**LIST OF ODISHA STATE POLLUTION CONTROL BOARD APPROVED CRUSHERS****ANNEXURE-1 TO FORM-A**

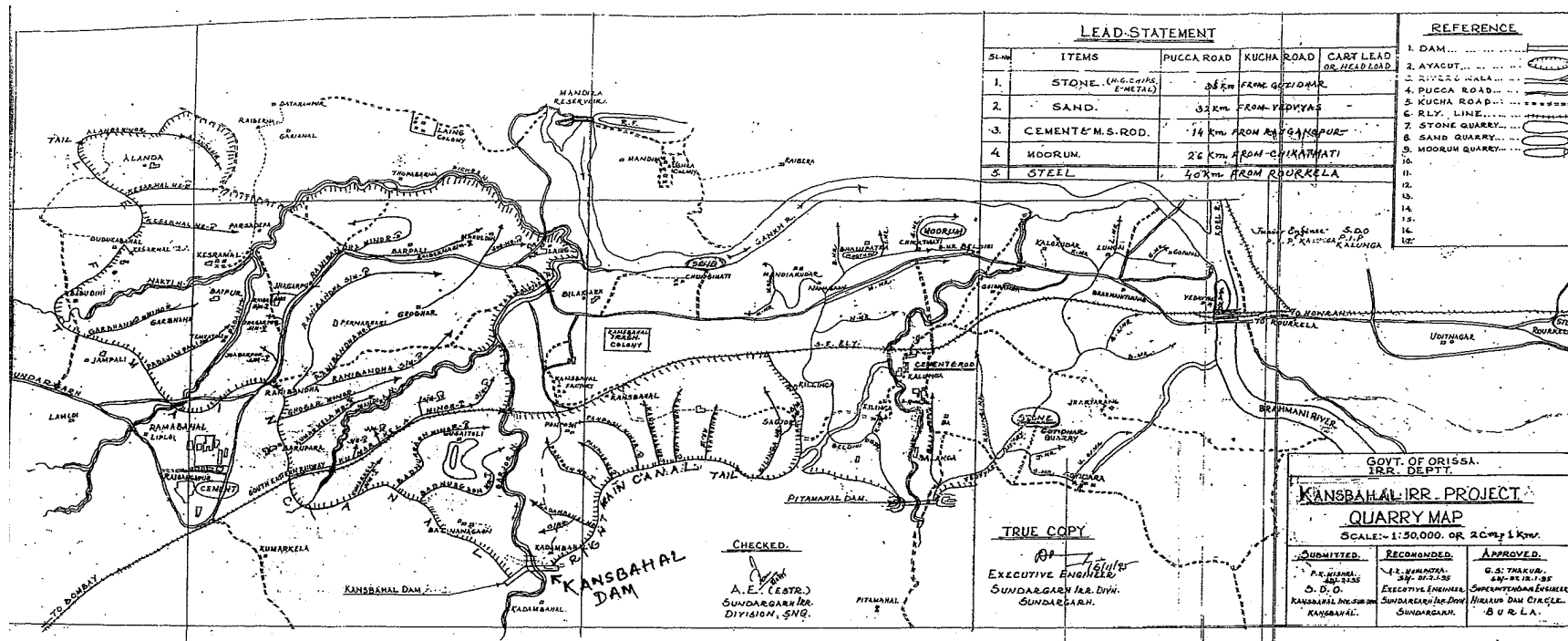
1	2	3	4	5	6	8
Sl. No.	Name of the crusher if any	Location village & post Office, Block	Name and address of the occupier	No & date of the N.O.C issued	No. & date of the "consent to operate" issued	Date & commencement of operation
	<b>Balanda/Gutidhara area</b>					
1.	M/S Konark Aggregate	At/Po- Balanda, Via- Kolunga, Sundargarh	Sri N. N. Pathak At- Uditnagar, Rourkela-12	Not obtained NOC	Consent to operate not obtained from the Board.	As per report it has established 1980
2.	M/S Khusraj Enterprises	At- Gutidhara, Po- Balanda, Via- Kolunga, Sundargarh	Sri P. K. Bedi Bedi Building, Sector-5, Rourkela	Not obtained NOC	Consent to operate not obtained as the case is pending in the Court.	As per report it has established 1988
3.	M/S Sambhu Prasad & Sons (Formerly Dharmendra Prasad)	At/Po- Balanda, Via- Kolunga, Sundargarh	Sri Dharmendra Kumar Prasad At- Power House Road, Rourkela	Not obtained NOC	Consent to operate not obtained	As per report it has established 2003
4.	Sri Ganesh Minerals	At- Gutidhara, Po- Balanda, Via- Kolunga, Sundargarh	Sri Ananda Kumar Agarwal At- Gutidhara, Po- Balanda, Via- Kolunga, Sundargarh	Not obtained NOC	Consent to operate not obtained.	As per report it has established 1985
5.	Sri Ram Stone Crusher	At- Gutidhara, Po- Balanda,	Sri Ramdhani Prasad Gupta	NOC obtained no.	Consent to operate not	As per report it has established

		Via- Kolunga, Sundargarh	At- Gutidhara, Po- Balanda. Via- Kolunga, Sundargarh	957 dtd. 26- 03-2007	obtained.	2007
6.	M/S Goel Stone Works	At- Gutidhara, Po- Balanda, Via- Kolunga, Sundargarh	Sri Suresh Goel At- Chend Basti, Panposh, Rourkela, Sundargarh	NOC notobtained	Consent to operate not obtained.	As per report it has established 1993
7.	M/S Maa Ranisati aggregates Pvt. Ltd	At- Gutidhara, Po- Balanda, Via- Kolunga, Sundargarh	Sri Chandresh Gupta At- Plant Site Road, Rourkela-1, Sundargarh	NOC obtained no. 1577 dtd. 22- 05-2008	--	Not commissioned
8.	M/S Ganapati Stone Crushing Unit	At- Gutidhara, Po- Balanda, Via- Kolunga, Sundargarh	Sri Ganesh Ram agarwal At- P/23, Civil Township, Rourkela	NOC not obtained	Consent to operate not obtained.	As per report it has established 1990
9.	M/S Sai Nath Minerals	At- Gutidhara, Po- Balanda, Via- Kolunga, Sundargarh	Sri Dharmendra Kumar Prasad At- Plot no- 2, Civil Township, Rourkela	NOC obtained no. 1890 dtd. 01- 07-2008	Under commissioning	
10.	M/S Shivam Enterprises	At- Gutidhara, Po- Balanda, Via- Kolunga, Sundargarh	Sri Kameswar Tiwari At- Plot no. NN3/3, Civil Township, Rourkela	NOC obtained no.	Consent to operate obtained no 16241 dtd. 11- 07-07 from Head Office.	As per report it has established 1997
11.	M/S Jai Maa Sharada Minerals	At- Gutidhara, Po- Balanda, Via- Kolunga, Sundargarh	Sri Prem Kumar Sahoo At- TCI Chowk, Brahmanitarang, Rourkela	NOC obtained no. 2159 dtd. 04- 08-2007	Consent to operate not obtained from the Board.	As per report it has established 2008

12.	M/S Kaushalya Industries	At- Gutidhara, Po- Balanda, Via- Kolunga, Sundargarh	Sri Chandra Sekhar Patra At- EM-53, Basanti Nagar, Rourkela	Data not available	Consent to operate obtained from the Board no. 17093 dtd. 19- 07-2007 from HO.	As per report it has established 2002
13.	M/S B. D. Mallik & Sons	At/Po- Balanda, Via- Kolunga, Sundargarh	Sri Suresh Mallik At- 66, Jagda, Rourkela- 42	Not obtained NOC	Consent to operate not obtained from the Board.	As per report it has established 1988
•	<b>Rajganjpur Area</b>					
14.	Orissa Minerals	At/Po- Rajgangpur Dist- Sundargarh	Sri N. K. Sharma At- Rathore Colony, Sundargarh	Not obtained NOC	Consent to operate not obtained from the Board.	As per report it has established 1991
•	<b>Garjan Area</b>					
15.	Babulal Agarwal	At/Po- Garjan, Dist- Sundargarh	Sri Babulal Agarwal, Chend Basti, Panposh Rourkela	Not obtained NOC	Consent to operate not obtained from the Board.	As per report it has established 1993
16.	Balaji stone	At/Po- Garjan, Dist- Sundargarh	Sri K. Magu, Civil Township Rourkela	Not obtained NOC	Not obtained CTO	As per report it has established 1990
17.	M/S K. C. Singh	At/Po- Garjan, Dist- Sundargarh	Sri K. C. Singh, BM-25, Basanti Colony, Rourkela	Not obtained NOC	Not obtained CTO	As per report it has established 1993
18.	M/S Chotelal Kumbhar	At- Jalda A Block	Sri Chotelal Kumbhar At- Jalda C Block	Not obtained NOC	Consent to operate not	As per report it has established

		Po- Jalda, Rourkela	Po- Jalda, Rourkela		obtained from the Board.	1981
19.	M/S Jharabahal Stone Quarry	At- Jalda-A Block, Po- Jalda, Sundargarh	Sri Bharmarbar Das At- Deogaon, Po- Dhabaleswar Market, Rourkela	Not obtained NOC	Consent to operate not obtained from the Board.	As per report it has established 1985
20.	M/S Shiva Stone Quarry	At- Jalda-A Block, Po- Jalda, Sundargarh	Sri Ranjit Kumar Patra At- BB/9, Civil Township, Rourkela	Not obtained NOC	Consent to operate not obtained from the Board.	As per report it has established 1980
•	<b>Chikatmati Area</b>					
21.	Sri Sai Ram Products	At- Chikatmati, Po- San Nuagaon	Sri Jugal Kishore Sultania At- Anadi Niwas, Main Road, Rourkela	Noc obtained no. 82 dtd. 09-01-2008	Consent to operate obtained from the Board.	As per report it has established 2008
•	<b>Bimlagarh Area</b>					
22.	M/S Samaleswari Stone Crusher	At- Badgaon, Po-Kebalang Dist- Sundargarh	Sri Rajesh Kumar Sahu At- Badgaon, Po- Kebalang Dist- Sundargarh	Not obtained NOC	Consent to operate not obtained from the Board.	As per report it has established 2004
23.	M/S Maa Tarini Stone Crusher	At- Badgaon, Po-Kebalang Dist- Sundargarh	Sri Pradeep Kumar Jaisal At/Po- Lahunipara Dist- Sundargarh	NOC obtained no. 28080 dtd. 06-09-2005	Consent to operate not obtained from the Board.	As per report it has established 2004
24.	M/S Baneswar Crusher	At- Sanasivanathpur, Po- Bonai Sundargarh	Sri Deepak Chowhan At- EM-53, Basanti Nagar, Rourkela	Data not available	Consent to operate obtained from the Board no. 16902 dtd. 17-	As per report it has established 1998

					07-2006 from HO.	
25.	M/S Shiva Shakti Crusher Udyog	At- Raidihi, Po- Lephripara, Via- Zinc Nagar, Sundargarh	Smt. Anupama Naik At- Nuadihi, Po- Raidihi, Via- Zinc Nagar, Sundargarh	NOC obtained no. 2695 dtd. 15-10-2007	Commission not completed.	
26.	M/S Kalinga Crusher Udyog	At/Po- Badbonga, Via- Zinc Nagar	Sri Ashok Kumar Patel At/Po- Badbonga, Via- Zinc Nagar	Not obtained NOC	Consent to operate not obtained from the Board.	As per report it has established 2003
•	<b>Bandhamunda area</b>					
27.	M/S Tarini Metals & Minerals	At/Po- Subdega, Sundargarh	Sri Dhananjay Patel, At- At/Po- Sai Vihar, Sundargarh-770 001	NOC refused	--	--
28.	M/S P. K. Stone Works	At- Barkani Po- Bandhamunda Dist- Sundargarh	Sri P. K. Pandey At-, Birsadahor Road, Rourkela	Not obtained NOC	Consent to operate not obtained from the Board.	Data not available
29.	M/S Mangatram & Sons	At- Kudarbahal Po- Bandhamunda Dist- Sundargarh	Sri Ram Chandra Agarwal At- G. T. Lane, Bisra Road, Rourkela	Not obtained NOC	Consent to operate not obtained from the Board.	Data not available
30.	M/S Gajanan Enterprises	At- Bhultabahal, Po- Jaraikela, Dist- Sundargarh	Sri Subhash Chandra Mahanta At/Po- Tulsikani, Via- Bisra, Dist- Sundargarh	NOC obtained no. 15655 dtd. 21-07-2003	Consent to operate not obtained from the Board.	As per report it has established 2003

**QUARRY MAP FOR KANSABAHAL SUB-PROJECT**

**Kansbahal, Sundargarh**

Date: 29.02.2019

ପ୍ରାନ୍ତନୀତି,

ଶ୍ରୀ ଯୁକ୍ତ ନିର୍ମାଣୀ ଶକ୍ତି ସ୍ୱରୂପ ଏହି ଭବନରେ ପ୍ରାରମ୍ଭ ହେଉ

അതിന്റെ - ക്ഷാമപ്രദമായ സാമ്പത്തിക നില വാസ്തവം  
 മുന്നോട്ടെ നോക്കുക. പക്ഷെ ഇപ്പോൾ

पञ्चाननसुः

[illegible]

ସ୍ତ୍ରୀଙ୍କ ନାମ:-

ପୂର୍ବେ / ମାତା :- ପତ୍ନୀମାତା

1 - Roger Menz

$$\max_{g_1, g_2} \frac{g_1}{g_2} = 8.15$$

2. Stephan King.

$$12m / 90 = 9. m \Gamma$$

2. Santosh Kinde

$$ex3e, ex2g / \Gamma 8 = x. \Gamma 5$$

4. Gurbil Wando

78

5. Jama Kinds

ଗୋଟି.ଏମ.ଓଫ

6. Dubray Kinko

7. Temba Kindo

8. Suchu beindo

9 - Tage' lenda

10 - Perno Drake

11 - Sanjay Kumbho

12. ~~Scarf and Lachner~~

13. ~~13~~  
14. Theophrastus

Ram Lalxo

Hansa Lalxo

Baba Baka

ଅମଳା ମାମା

ହେମାମା

Hemlita Laksa

କାମା ମାମା

କୋରା ଲାଲ୍‌କୋ

Ram Lakira

ପୁରୁଷ / ମାତା ହେ ପ୍ରାୟାଗ

, ୧୮୮, ୧୯୮, ୧୯୯ / ୨୩ = ୩.୪୭

, ୩୫୮ / ୨୪ = ୪.୩୦

୧୮୫, ୧୯୦, ୧୯୨, ୧୮୪ / ୩୧ = ୫.୪୪

୧୯୮,

ମାତା. ୧୪.୨୫

୧୩.୦୪

୨୮.୩୧

Nistae Kinto

Secretary

Sarna Pani Panchayat

Unit - 2, HQ Panposh

Kansbahal M. I. P

## ANNEXURE 5

### VILLAGERS PRESENT DURING PUBLIC CONSULTATION- KANSBAHAL

Date	Location	Name	Status
28.01.08	<b>Garvana village (Middle part)</b>	Mr. P. K. Singh	SDO, Water Resource dept.
		Mr. Chandramani Babu	JE, Water Resource dept.
		Mr. K. Kishnan	JE, Water Resource dept.
		Mr. Pankaj Minz	Trainee JE, Water Resource dept.
		Mr. Ramnath Kispetta	PP-7 President
		Mr. Sidha Xalxo	Farmer
		Mr. Sulsen Bodra	Farmer
		Mr. Ramesh Badi	Farmer
		Mr. Karlush Xaxa	PP-9 President, Farmer
		Mr. Sukru Lakra	Farmer
		Mr. Chendu Karketta	Farmer
		Mr. :Pyara Karketta	Farmer
		Mr. Etwa Ekka	Farmer
		Mr. Sukta Minz	Farmer
		Mrs. Gulabi Minz	Farmer
		Mrs. Sukanti Lakhra	President Self Help Group, Farmer
		Mrs. Sakri Lakhra	Farmer
28.01.08	<b>Tilaimal (Tail part)</b>	Mr. P. K. Singh	SDO, Water Resource dept.
		Mr. Chandramani Babu	JE, Water Resource dept.
		Mr. David Barla	Secretary PP 8
		Mr. Antharesh Barla	Farmer
		Tarsiosh Minz	Farmer
		Mr. Paul Barla	Farmer
		Mr. Jagannath Tanti	Farmer
		Mr. Bernet Lakra	Farmer
		Mr. Mishra Barla	Farmer
		Mr. Damnik Lakra	Farmer
		Mr. Amrit Lakra	Farmer
		Mr. Polikar Lakra	Farmer
		Mrs. Sumani Barla	Farmer
		Mrs. Pushpa Lakra	Farmer
		Mrs. Manju Barla	Farmer
		Mr. Rajat Barla	Farmer
		Mr. Tikun Lakra	Farmer
29.01.08	<b>Kadambahal (Head part)</b>	Mr. P. K. Singh	SDO, Water Resource dept.
		Mr. Chandramani Babu	JE, Water Resource dept.
		Mr. Radhyasham Topo	Agricultural overseer, Govt of Odisha
		Mr. Mangu Minz	Farmer
		Mr. Sukru Tanti	Farmer

Date	Location	Name	Status
		Mr. Sudhir Ekka	Farmer
		Mr. Kale Minz	Farmer
		Mr. Sudhu Nag	Ward Member, Farmer
		Mr. Gandhar Tirke	Farmer
		Mr. Chaito Khujur	Farmer
		Mr. Samhya Ekka	Farmer
		Mr. Lohora Oram	Farmer
		Mrs. Dandu Minz	Farmer
		Mr. Manta Minz	Farmer
		Mr. Kali Topo	Farmer
		Mrs. Sabitri Tanti	Farmer
29.01.08	<b>Kilinga (Tail part)</b>	Mr. P. K. Singh	SDO, Water Resource dept.
		Mr. Chandramani Babu	JE, Water Resource dept.
		Mr. Biswanath Kujur	PP 1 President
		Mr. Pantosh Barla	Farmer
		Mr. Prafulla Barla	Farmer
		Mr. Sunny Tigha	Farmer
		Mr. Etwa Barla	Farmer
		Mr. Kalo Kishan	Treasurer, PP 1
		Mr. Tarsush Xalxo	Farmer
		Mrs. Lavencea Barla	Farmer
		Mrs. Chari Barla	Farmer
		Mr. Mangal Kindo	Secretary PP 1, Apex President, Farmer
		Mr. Somnath Barla	Farmer
		Mrs. Remi Barla	Farmer
		Mr. Gobardhan Barla	Farmer
29.01.08	<b>Badanuagaon (Head part)</b>	Mr. P. K. Singh	SDO, Water Resource dept.
		Mr. Chandramani Babu	JE, Water Resource dept.
		Mr. Albert Herenz	PP 3 President
		Mr. Santiprakash Minz	PP Secretary
		Mr. Sahadeb Charmanko	PP Treasurer
		Mr. Ramo Minz	Farmer
		Mr. Lakho Karketta	Farmer
		Mr. Lundru Minz	Farmer
		Mr. Chuas Minz	Farmer
		Mr. Senca Karketta	Farmer
		Mr. Danda Karketta	Farmer
		Mr. Ramesh Chermanko	Farmer
		Mr. Sukhu Tirki	Farmer
		Mrs. Jagabin Khaka	Farmer
		Mrs. Sukanti Khaka	Farmer
		Mrs. Jema Karketta	Farmer
		Mrs. Nauri Karketta	Farmer
		Mrs. Pano Minz	Farmer
		Mrs. Bindo Minz	Farmer
29.01.08	<b>Ghogar (Middle part)</b>	Mr. P. K. Singh	SDO, Water Resource dept.

Date	Location	Name	Status
		Mr. Chandramani Babu	JE, Water Resource dept.
		Mr. Purshatam Gartia	PP -5 President
		Mr. Renta Ekka	Secretary Pp 5, Apex Committee Secretary
		Mr. Aita Topo	Farmer
		Mrs. Rajani Topo	Farmer
		Mrs. Bijay Lakshmi Kindo	Farmer
		Mrs. Suniti Topo	Farmer
		Mrs. Rashni Kindo	Farmer
		Mrs. Sani Kindo	Farmer
		Mrs. Puti Kindo	Farmer
		Mrs. Jyanti Kindo	Farmer
		Mrs. Champabati Ekka	Farmer
		Mrs. Minoto Minz	Farmer
		Mrs. Purnima Lakhra	Farmer
		Mrs. Damayanti Minz	Farmer
		Mrs. Pano Minz	Farmer
		Mrs. Sukho Barla	Farmer
		Mr. Prafulla Kindo	Farmer
		Mr. Shyamsundar Barla	Worker, Sponge Iron Factory
		Mr. Nagmoni Topo	Farmer
		Mr. Naro Barla	Farmer
		Mr. Lachu Barla	Farmer
		Mr. Chanko Kindo	Farmer
		Mr. J. K. Kindo	Farmer
		Mr. Ramchandra Kindo	Farmer
		Mr. Ajay Kindo	Farmer
		Mrs. Amrita Kindo	Farmer
		Mr. Charko Kindo	Farmer
		Mr. Budhani Kindo	Farmer

**KEY PERSONS VISITED AND DATA SOURCES****A. List of persons consulted**

1. Mr. N. Mahapatra, Director, Water Resources Dept., Govt. of Odisha
2. Mr. P.K. Singh, SDO, Water Resources Dept., Govt. of Odisha
3. Mr. Chandramani Babu, Junior Engineer, Water Resource Dept.
4. Mr. K. Kishnan, Junior Engineer, Water Resource Dept.
5. Mr. B. K. Misra , Member Secretary, Odisha State Pollution Control Board
6. Mr. B. N. Bhol, Environmental Engineer, Odisha State Pollution Control Board

**B. List of data sources**

1. District Statistical Hand Book of Sundergarh (2005) Directorate of Economics and Statistics, Govt. of Odisha
2. Economic Survey 2005-06 (2006), Directorate of Economics and Statistics, Planning and Co-ordination Department, Govt. of Odisha
3. District Census data book of Odisha
4. Brief Notes on Kansbahal Irrigation Project for the visit of Asian Development Bank Mission (2007), Department of Water Resources, Govt of Odisha
5. Statistical Abstract of Odisha (2005) Directorate of Economics and Statistics, Govt. of Odisha
6. Statistical Outline of Odisha (2007), Directorate of Economics and Statistics, Govt. of Odisha
7. Official website of State of Odisha ([www.Odisha.gov.in](http://www.Odisha.gov.in))
8. Official website for Sundergarh District ([www.sundergarh.nic.in](http://www.sundergarh.nic.in))
9. Official Website of Ministry of Environment and Forest ([www.envfor.nic.in](http://www.envfor.nic.in))
10. National Engineering Handbook, Hydrology (1972) Section 4 U.S.SCS
11. Annual Report 2005-06 State Pollution Control Board, Odisha
12. Champion and Seth (1968) Classification of forest type of India
13. Mitra, G.N., Misra, U.K. and Sahu, S. K (2002) Macro and Micro Nutrient Status of the soils of Odisha, Dept. of Agriculture Govt. of Odisha
14. State of the Environment Report Odisha (2006) State Pollution Control Board, Odisha
15. Goel, R. S. (2000) Environmental Impacts Assessment of water Resources Projects- concerns, policy issues, perception and scientific analysis, Oxford & IBH Publishing Co. Pvt. Ltd
16. Preliminary Project Report on Odisha Integrated Irrigated Agriculture and Water Management, Department of Water Resources, Government of Odisha, December, 2005.

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17. Wild Odisha, Department of Forest, Government of Odisha, October, 2004
  18. Odisha WRCP Environmental Assessment, Department of Water Resources, Government of Odisha, March, 1995.
  19. Ground Water Resources of Odisha, Director of Ground Water Survey & Investigation, Odisha, 2001
  20. Provisional census 2001, Census of India
  21. DPR report 2011 Kansbahal, Prepared by DoWR

**FINDINGS OF FOCUS GROUP DISCUSSION**

TABLE – A (7) 1: FINDINGS OF FOCUS GROUP DISCUSSION- GARVANA

Name of the Scheme: <b>Kansbahal</b> Distribution – Ramial Left Main canal – Kansbahal – Main canal- Garvana Minor Village Name: Garvana Location in the Scheme: <b>Middle part</b> District: Sundergarh Block: Rajganpur Date of Meeting: 28.01.08		
<b>General Information about the Village</b> Total Population of the Village: 1146 No of Households: 226 General Caste/ OBC:9 SC%:1 % ST%: 90 % Dominant Caste/Group: Minz, Karkatta		
<b>S.No.</b>	<b>Issues Raised</b>	<b>Discussions</b>
1.	Community Awareness About the Project	Most of the villagers have no idea on proposed canal improvement project, some of them are aware of the project through the socio-economic team of ADB TA consultant. No Pani Panchyat member informed them about the project.
2.	Benefits of Project for the Upliftment of Community	Villagers told that the rehabilitation project would benefit them by getting enough water for irrigation and uplift their socio economic condition Only kharif paddy due to unavailability of irrigation water
3.	Labour Participation in the Project	Most of the farmers show their interest to participate in the project as labour
4.	Source of Water for the Village	People have their own tube well , dug well for drinking purpose
5.	Quality of Water for basic need	At present quality of water good, in some cases presence of iron reported. People around the project area felt that there would be no change in the water quality, quantity of water may rise but some even felt that quality of water may deteriorate.
6.	In what way villagers depend on canal water	Other than irrigation villagers use canal water for bathing, cloth and utensils washing and cattle washing – if available
7.	Disturbances due to Project Construction Work	People have no objection on disturbances created due to construction work and they will bear the disturbance on the cost of development work carrying out in their area.
8.	Presence of trees – tree felling requirement	No big trees along minor canal. Only few Babul trees exist
9.	Responsibility for the Maintenance of Canal Bund Plantation	As per villagers Pani Panchyat, gram panchayat committee should take the responsibility for maintaining the canal bund plantation and many of the people felt that barbed wire fencing would be necessary in bund plantation.
10.	Sustainable Disposal of Debris in Lowland	Villagers felt that the debris should be disposed off on low land and would also help in strengthening of canal bund.

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11.	Water Logging in the Village Area- drainage and flooding problem if any	No as such water logging and seepage noted in the village
12.	Forest in Nearby Village	No as such
13.	Sensitive Archeological / historical site	No as such
14.	Movement of Wild Animals Through Village	No forest area nearby, only movement of domestic animal noted
15.	Disposal of canal silt	As per the villager canal silt can be used in canal bund. Villager of the project area told that desilted soil can also be disposed in a low land.
16.	Use of fertilizer, pesticide and biofertilizer	Use of fertilizer like Urea, DAP, Gromour and potash is common. Application of bio –fertilizer is absent. Very few farmers use pesticide like Demecron, Phorate
17.	Precaution taken during application of pesticide	No precaution taken during application of liquid and solid pesticide
18.	Incidence of fertilizer and pesticide toxicity	No as such incidence
19.	Salinity problem of land	No salinity problem in the project area
20.	Testing of water and soil	Local Block – gram sabha taken soil samples for testing but testing result not received

(Special observation - In many agricultural field soils is being contaminated due to disposal of sponge iron factory waste)

**LATEST PUBLIC CONSULTATIONS – OCTOBER 2011**

As part of the updation of IEE a second phase consultation was carried out inviting all the Pani Panchayat Office bearers and farmers at Rajghandpur village of Sundergarh district on 29<sup>th</sup> October 2011. It was attended by Apex committee president Mr. Baidyanath Toppu, Presidents and Secretaries of the different Pani Panchayats, Assistant Engineer Mr. Pradipta Singh and Junior Engineer Mr. Kuturu Kisan and other farmers and office bearers, list of participants enclosed as Annexure 8a.

The following are the outcome of the interaction:

- Canal silted up and breaches at sections causing lot of seepages
- Minor and sub –minors all are silted and mostly with full of weeds
- Requested for lining of canal and provision for guard walls at some sections to protect the canal and arrest seepages etc.,
- Request was made for repairing of structures
- Requested for additional VRB and FB
- Due to rapid industrialization of the area they say the crops are getting damaged due to emission of fumes and dust from the industries
- Need awareness on latest farm equipments to improve agricultural productivity
- Not receiving timely support from agricultural department in receiving fertilizers and improved agricultural practices etc.,

The National Environmental Specialist has enquired about the proposed project activities and the members said they are aware of the activities and eagerly awaiting for the work to commence and the Pani Panchayat had said they do not have any building etc where they can meet, absence of building mostly dampening the spirits of the people who assemble. Upon enquiry about the Wild animal habitats etc, the members said there are no wild life habitats in the command area, only the catchment area has some forest cover, so the elephant visits sometimes at the dam site and even some times in the periphery villages, even the crops are damaged by the elephant.



The villagers or participants had said there are no cultural or religious or historical sites however the environment specialist had also verified the presences of these during field visit, there are no structures within the ROW. During the walk through and interactions it came out farmers are cultivating after the toe line with in ROW. The Pani Panchayt requested DoWR should demarcate the ROW and the encroachers would be requested to stop further cultivation in the future. So the SIO was requested to demarcate in consultation with PP. However there are no land acquisition cases pending.

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Severe drought or floods are not found in the project affected villages but the villagers had informed between 2008 to 2010 there was a drastic change or reduction in the rainfall. The climatic changes are noticed as per the villagers. No salinity or fluoride is reported in the area.

The project villages cultivate paddy and red gram during kharif and maize, mustard, wheat, sunflower and groundnut etc., during rabi. The productivity of the paddy in irrigated conditions is around 15 quintals and the rain fed conditions it's around 7 to 8 quintals. The farmers are not aware of latest agricultural practices and they requested for some awareness programs and demonstrations in the area. The farmers are mostly dependent on organic fertilizers and pesticides. The average usage of fertilizers per acre is as: DAP – 30 kgs, Urea – 25 kgs and Potash - 15 kgs. Some farmers tried vermi compost but were not successful since they could not get proper and timely advice. The farmers are not using any safety gadgets while spraying pesticides but recently they started using clothes as masks while spraying.

Most of the villagers are dependent upon ground water for drinking and the general ground water depth is ranging from 200 to 250 feet. Due to heavy industrialization of the area the farmers said there is lot of shortage of labour and the villagers said they do not have any objection if the contractor hires outside labour. The villagers said they are ready to bear the temporary disturbance caused due to canal repair and they said the pollution would be less than the surrounding industrial pollution. The villagers also said the dumping of industrial and mines waste near the canal also and this may pollute the canal water.

No major conflicts are noticed with in the area, there are some minor conflicts at present due to the shortage of water, they said after the repairs these conflicts may reduce. The seasonal diseases like malaria and diahorrea are notice in the area. Overall the farmers, PP are waiting for the works to commence and they are ready to cooperate during the work.

LIST OF PARTICIPANTS OF PUBLIC CONSULTATIONS – OCTOBER 2011

29/10/11

KANSBAHAL PP Interaction

S. NO.	Name of the Participant	Designation	Signature	S. NO.
1-	Baidyanath Toppo	President APET		19
2-				20
3.	Nabe Benod Kujur	Secretary (Pftt)		21
4.	Sebastine Ekka	President unit-9		22
5.	Sangem Terkey	President unit-04		23
6.	Mangal Kando	Secretary OM P.P. Unit-01		24
7.	Santi Prakash Miza	Secretary P.P. Unit-02		25
8.	Nistan Kando	Secretary S.P.P. Unit-2		
9.	Biswanath Kujur	President of OM - P.P. Sagfere		
10.	Ganesh Karketta	P.P. Shobhaki Unit-07		
11.	Pholmos Terkey	President unit-3 Baktishakunda PP		
12.	Sahadev Chormako	Treasurer unit-2 Baktishakunda PP		
13.	Rengta Ekka	Treasurer unit-5 Kakabara P.P.		
14.	Bijay Lakra	Secretary unit-09		
15.	Nicholas T. K. Juv	Treasurer unit-09		
16.	Tarcious Xalxo	Treasurer OM P.P. (1)		
17.	Suresh Xalxo	Treasurer S.P.P. Unit-2		
18.	Panspa Lakra	President unit no-6		
19.	Gracencia Lakra	Treasurer Unit no-6		



**ENVIRONMENTAL MONITORING - CHECK LIST - CONTRACTORS**

(To be filled by the Contractor)

**Monthly Report**

Reporting Month: .....

**I. Package Description**

1.1	Contract Package	
1.2	Name of the Contractor	
1.3	Name of the Sub-project	
1.4	Work Completed for the Month	Earth work/ Concrete work/ Masonry / Others Specify
	Earth Work -Filling	Qty..... Loc.....
	Earth Work -Cutting	Qty..... Loc.....
	Concrete work	Qty..... Loc.....
	Lining	Qty..... Loc.....
	Turfing	Qty..... Loc.....
	Service Road	Qty..... Loc.....

**II. Establishment of Contractors Camp**

Yes / No

**1 Usage of Camp**

Plant / Machines/ Labour

**1.1 If Plant**

Crusher unit/ HMP/ WMM / Any Other

If material purchased from Vendor

Name of the Vendor

**1.2 If Machinery stocking**

Yes / No

Sl.No	Type of Machinery in Operation	Number	Fitness/ PCB certificate obtained	Remarks - Repair under taken at camp / sent to Garage
1	Paver			
2	Rollers			
3	Excavators			
4	Dumpers			
5	Vehicles ( Tractors/ Trucks)			
	Others			
6				

**1.3 If Labour**

Permanent / Transit

S.No	Particulars	Remarks
i	Total Number of Labourers employed?	
ii	Number of Male labourers?	
iii	Number of female labourers?	
iv	Number of local labourers?	
v	Name the village from where the labour come from?	
vi	Number of migrant labourers?	
vii	Number of dwelling units in the camp?	

viii	Type of dwellings ?	Pucca : No. Kutchha :No.
ix	Water Supply provided?	
x	Drinking water supply provided?	Tube well/ Open Well/ Tanker/ etc
xi	Number of Toilets provided?	
xii	Type of Toilet ?	Leach pit / Soak Pit / Septic tank
xii	Number of Bath rooms provided?	
xiii	Are Separate Bath rooms provided for women?	Yes / No
xiv	Washing plat forms provided?	
xv	Drainage facility provided?	
xvi	Crèche facility provided?	
xvii	Availability of Health centre ?	Nearest
xviii	First Aid Facility Available?	
xix	Health Camp / HIV awareness conducted?	Yes / No If yes provide details
xx	Fuel used in the Camp?	Fire wood/ Kerosene/ LPG
xxi	Does the Camp has Workshop for Repair?	Yes / No
xxii	Any Oil Spill taking Place?	Yes / No
xxiii	Oil / Grease traps / solid plat forms provided?	Yes / No

1.4 Storage of Fuel

Temporary/ Permanent

1.5 Type of Fuel Stored?

HSD/ Petrol

1.5.1 License Obtained?

Yes/ NO

1.6 Any Blasting Material Stored?

Yes/ NO

1.6.1. License Obtained ?

Yes/ NO

### III. Borrow Area Management

1. No. of Borrow Area approved?

2. No. of Borrow Area Rehabilitated/ Re-developed?

3. Permission Obtained for Borrow areas

Private - land Owner /

Govt. Land – Panchayat /Revenue

(Note: Attach Copies of Permission Letter)

#### 4.Details of Borrow Areas

Sl. No.	Description	B.A. - 1	B.A. - 2	B.A. - 3
4.1	Capacity of the Borrow Area			
4.2	Percentage of the capacity exhausted			
4.3	Total quantity of the Earth Excavated (in cum.)			
4.4	Quantity of Top Soil Removed from the Borrow Area			
4.5	Location of stored top Soil that was removed			
4.6	Quantity of Top Soil Stored at the beginning of the month			
4.7	Quantity of Top Soil utilized at the end of the month			
4.8	Location(s) where Top Soil has been utilized (Specify on a Location Plan)			

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**IV. Haulage Road** **Existing Road/ Temp Road Created**

1. Maintenance of Haulage Road done ? Yes / No
2. Dust Suppression Measures taken ? Yes / No

**V. Quarries Under Operation** Yes / No

1. If Yes, Number of Quarries in Use and locations?
2. If No, Name of Vendor, the material Purchased and SPCB Certificate of Vendor to be Enclosed?
3. Are the Vehicles used for Supplying material covered ? Yes / No

**VI. Erosion Control Measures:** Silt Traps/ Construction in Lean Season / Compaction Taken up

**VII. Dump Sites:** Identified - Yes / No  
Low lying areas Used - Yes/ No  
Disposal Sites - identified - Yes/ No

**VIII Storage of Material:** Adj . to Canal / ROW/ etc  
1. **Blockage of Natural drains** Yes / No

**IX Dust Control Measure:**

Sl.No.	Dust Control Devices	Dust control devices are available. – Yes/ N
1	Sprinkling of Water	Sprinkling of water carried out. Yes/ No
2	Cover on the vehicles	Yes/ No
3	Cover on stack materials	Yes/ No

**X. Noise Control Measure:**

S.No.	Measure	Remarks
1	Machines establishes in Habitation	Yes / No
2	Away from Habitations	Yes / No
3	Machines Sent for Maintenance regularly	Yes / No

**XI. Safety Measures Taken:**

Sl. No.	Description	
1	Whether first aid post established at site?	Yes/No
2	Whether safety helmets given to all workmen at site?	Yes/No
3	Whether safety belts / ribbons used at work site	Yes/No
4	Whether gum boots, tarring unfits, spectacles etc. given to person handling bitumen?	Yes/No

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**XII. Environmental Monitoring Details**

Sl.No	Type of Test	No. of Locations	Date of Test last conducted	Remarks
1	Ground Water			
2	Surface Water			
3	Silt			
4	Soil			

**Signature of the Contractor / Representative**  
**Name of the Contractor**  
**Date**

**Signature of the SIO Staff**  
**Name of the SIO Staff**  
**Date Verified**

**ENVIRONMENTAL MONITORING – CHECK LIST -WUA**

(To be filled by the WUAs)

**Monthly Report****Reporting Month: .....****I. Package Description**

1.1	Contract Package	
1.2	Name of the WUA	
1.3	Name of the Sub-project	
1.4	Work Completed for the Month	Earth work/ Concrete work/ Masonry / Others Specify
	Earth Work -Filling	Qty..... Loc.....
	Earth Work -Cutting	Qty..... Loc.....
	Concrete work	Qty..... Loc.....
	Lining	Qty..... Loc.....
	Turfing	Qty..... Loc.....
	Service Road	Qty..... Loc.....

**II Material purchased from Vendor****Ye Yes / No****Granite****Yes / No****Sand****Yes / No****Morrum****Yes / No****III. Details of the Vendor****IV. Labour Employed****Yes / No**

S.No	Particulars	Remarks
i	Total Number of Labourers employed?	
ii	Number of Male labourers?	
iii	Number of female labourers?	
iv	Number of local labourers?	
v	Name the village from where the labour comes from?	

**V. Storage of Fuel****Yes / No****VI. Borrow Area Management**

4. No. of Borrow Area approved?

5. No. of Borrow Area Rehabilitated/ Re-developed?

6. Permission Obtained for Borrow areas

Private - land Owner /

Govt. Land – Panchayat /Revenue

**(Note: Attach Copies of Permission Letter)**

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#### 4.Details of Borrow Areas

Sl. No.	Description	B.A. - 1	B.A. - 2	B.A. - 3
4.1	Capacity of the Borrow Area			
4.2	Percentage of the capacity exhausted			
4.3	Total quantity of the Earth Excavated (in cum.)			
4.4	Quantity of Top Soil Removed from the Borrow Area			
4.5	Location of stored top Soil that was removed			
4.6	Quantity of Top Soil Stored at the beginning of the month			
4.7	Quantity of Top Soil utilized at the end of the month			
4.8	Location(s) where Top Soil has been utilized (Specify on a Location Plan)			

#### VII Haulage Road

#### Existing Road/ Temp Road Created

- |                                       |          |
|---------------------------------------|----------|
| 3. Maintenance of Haulage Road done ? | Yes / No |
| 4. Dust Suppression Measures taken ?  | Yes / No |

#### VIII. Quarries Under Operation

#### Yes/No

4. If Yes, Number of Quarries in Use and locations?
5. If No, Name of Vendor, the material Purchased and SPCB Certificate of Vendor to be Enclosed?
6. Are the Vehicles used for Supplying material covered ? Yes / No

#### IX. Dump Sites:

#### Identified - Yes / No

Low lying areas Used - Yes/ No  
Disposal Sites - identified - Yes/ No

#### X. Storage of Material:

Adj . to Canal / ROW/ etc

#### XI. Blockage of Natural drains

Yes / No

#### XII. Dust Control Measure:

Sl.No.	Dust Control Devices	Dust control devices are available. - Yes/ N
1	Sprinkling of Water	Sprinkling of water carried out. Yes/ No
2	Cover on the vehicles	Yes/ No
3	Cover on stack materials	Yes/ No

---

**XIII. Noise Control Measure:**

<b>S.No.</b>	<b>Measure</b>	<b>Remarks</b>
1	Machines establishes in Habitation	Yes / No
2	Away from Habitations	Yes / No
3	Machines Sent for Maintenance regularly	Yes / No

**XIV. Safety Measures Taken:**

<b>Sl. No.</b>	<b>Description</b>	
1	Whether first aid post established at site?	Yes/No
2	Whether safety helmets given to all workmen at site?	Yes/No
3	Whether safety belts / ribbons used at work site	Yes/No
4	Whether gum boots, tarring unfits, spectacles etc. given to person handling bitumen?	Yes/No

**XV. Environmental Monitoring Details**

<b>Sl.No</b>	<b>Type of Test</b>	<b>No. of Locations</b>	<b>Date of Test last conducted</b>	<b>Remarks</b>
1	Ground Water			
2	Surface Water			
3	Silt			
4	Soil			

**Signature of the WUAs Representative**  
**Name of the WUA**  
**Date**

**Signature of the SIO Staff**  
**Name of the SIO Staff**  
**Date Verified**

Annexure 10

**PARAMETERS FOR GROUND WATER ANALYSIS AS PER IS 10500:1991**

S.No	Parameter
<b>Essential Characteristics</b>	
1	Colour Hazen Units, Max
2	Odour
3	Taste
4	Turbidity NTU, Max
5	pH Value
6	Total hardness( as CaCO <sub>3</sub> ) mg/L, Max
7	Iron (as Fe) mg/L, Max
8	Chlorides (as Cl) mg/L, Max
9	Residual, free chlorine mg/L, Max
<b>Desirable Characteristics</b>	
10	Dissolved solids mg/L, Max
11	Calcium (as Ca) mg/L, Max
12	Copper (as Cu) mg/L, Max
13	Manganese (as Mn) mg/L, Max
14	Sulphate (as SO <sub>4</sub> ) mg/L, Max
15	Nitrate (as NO <sub>3</sub> ) mg/L
16	Fluoride (as F) mg/L, Max
17	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH) mg/L, Max
18	Mercury (as Hg) mg/L, Max
19	Cadmium (as Cd) mg/L, Max
20	Selenium (as Se) mg/L, Max
21	Arsenic (as As) mg/L, Max
22	Cyanide (as CN) mg/L, Max
23	Lead (as Pb) mg/L, Max
24	Zinc (as Zn) mg/L, Max
25	Anionic Detergents (as MBAS) mg/L, Max
26	Chromium (as Cr 6+) mg/L, Max
27	Polynuclear aromatic hydrocarbons (as PAH) g/L, max
28	Mineral Oil mg/L, Max
29	Pesticides mg/L, Max
	DDT/ Endosulphan/ phorate/ carbofuran/ monocrotophos
30	Radioactive materials a). Alpha emitters Bq/L. Max b). Beta emitters Bq/L Max
31	Alkalinity mg/L. Max
32	Aluminium (as Al) mg/L, Max
33	Boron, mg/L, Max
34	E-coli

**Annexure 10a**

**PARAMETERS FOR SURFACE WATER ANALYSIS AS PER IS :2296:1992**

Sl.No	Characteristics
1	Dissolved Oxygen (DO)mg/l, min
2	Biochemical Oxygen demand (BOD)mg/l, max
3	Total coliform organisms MPN/100ml, max
4	pH value
5	Colour, Hazen units, max.
6	Odour
7	Taste
8	Total dissolved solids, mg/l, max.
9	Total hardness (as CaCO <sub>3</sub> ), mg/l, max.
10	Calcium hardness (as CaCO <sub>3</sub> ), mg/l, max.
11	Magnesium hardness (as CaCO <sub>3</sub> ), mg/l, max.
12	Copper (as Cu), mg/l, max.
13	Iron (as Fe), mg/l, max.
14	Manganese (as Mn), mg/l, max.
15	Chlorides (as Cl), mg/l, max.
16	Sulphates (as SO <sub>4</sub> ), mg/l, max.
17	Nitrates (as NO <sub>3</sub> ), mg/l, max.
18	Fluorides (as F), mg/l, max.
19	Phenolic compounds (as C <sub>2</sub> H <sub>5</sub> OH), mg/l, max.
20	Mercury (as Hg), mg/l, max.
21	Cadmium (as Cd), mg/l, max.
22	Selenium (as Se), mg/l, max.
23	Arsenic (as As), mg/l, max.
24	Cyanide (as CN), mg/l, max.
25	Lead (as Pb), mg/l, max.
26	Zinc (as Zn), mg/l, max.
27	Chromium (as Cr <sup>6+</sup> ), mg/l, max.
28	Anionic detergents (as MBAS), mg/l, max.
29	Barium (as Ba), mg/l, max.
30	Free Ammonia (as N), mg/l, max
31	Electrical conductivity, micromhos/cm, max
32	Sodium absorption ratio, max
33	Boron, mg/l, max
34	Pesticides
i)	DDE
ii)	DDT
iii)	Endosulfan
iv)	Endosulphan Sulfate
v)	Monocrotophos
vi)	Carbofuran
vii)	Phorate
35	COD
36	Turbidity
37	Aluminium as Al
38	Sodium as Na %
39	Residual Sodium Carbonate (RSC)

**PARAMETERS FOR SOIL / SILT ANALYSIS**

<b>S.No</b>	<b>Parameter</b>
1	pH
2	EC
3	Organic Carbon "C"
4	Texture
5	Phosphorous ( P)
6	Potassium ( K)
7	Sulphur (S)
8	Calcium (Ca)
9	Magnesium (Mg)
	Heavy metals
10	Chromium (Cr)
11	Lead (Pb)
12	Cadmium (Cd)
13	Fluoride (Fl)
14	Nickel ( Ni)
15	Arsenic (Ar)
16	Mercury (Hg)
	Micro-nutrients
17	Boron (B)
18	Copper(Cu)
19	Iron (Fe)
20	Manganese (Mn)
21	Molybdenum (Mo)
22	Zinc(Zn)
	Pesticides
23	DDT
24	Endosulphan
25	Phorate
26	Carbofuran
27	Monocrotophos

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# PHOTO PLATES



Kansbahal Dam



Right Main Canal Intake



Left Main Canal Intake



Right Main Canal RD 2+900 (PP 1)  
(300m length re-sectioned, Feb 2008)



Left Main Canal, RD 6+371 (Head Reg-Kumarkela Mr-II, PP 4)  
(Canal has widened due to dispersive, friable soils)



Left Main Canal, RD 8+851 (Head Reg – Ranibandha Mr-II, PP 6)  
(D/S of main road bridge. New X-reg & measuring flume proposed here)



Left Main Canal, RD 8+851 (Head Reg – Ranibandha Mr-II, PP 6)



Left Main Canal, RD  $\pm$ 19-20km (PP 7 & PP 8)  
(Cracking of embankment leading to frequent breaches. Flume lining proposed)



Tail of Left Main Canal (PP 9)  
(PP Nr 9 has not received water since 1994: just 2 years after completion)



Ranibandha Minor II, RD 1+700 (PP 6)  
(Concrete lining from RD 1.3-1.7km completed 2002/03)



Ranibandha Sub-Minor I  
(PP 5)



Ranibandha Sub-Minor I (PP 5)  
(Unauthorised embankment cut / outlet)



Padajampali Sub-minor (left) and new lined CAD Channel (right)  
(PP 7)



Fly Tipping of "sponge" iron waste along LMC



Harvesting of Rabi (summer) rice, 14 May 2008 (PP 1)  
(Men & Women)



Harvesting of Rabi (summer) rice, 14 May 2008 (PP 5)



Rabi (summer) Rice Paddy, PP4  
View of Cement Factory in distance (just outside command area)



Non-cropped command area (PP 6)



Kharif cultivated paddy rice straw stacked above ground  
(PP 8 – 9)



Pichhra Nullah (between PP 6 & 8)



Dug Well in PP 8 not from from Pichhra Nullah  
(Depth of water table 3m, 15 May 2008)



PP Meeting / Discussion, 14 May 2008-05-20  
(at DoWR Office at Kansbahal Dam Site)