

Initial Environmental Examination Report

Project Number: 33209-01
June 2009

Nepal: Community -Managed Irrigated Agricultural
Sector Project

Paliya Irrigation Subproject, Jhapa District

Project Proponent: Department of Irrigation
Prepared by Eastern Irrigation Development Division No. 1 (Jhapa)

This Initial Environmental Examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

ABBREVIATIONS

ADB	- Asian Development Bank
CMIASP -	Community-Managed Irrigated Agricultural Sector Project
CPMO	- Center Project Management Office
DADO	- District Agriculture Development Office
DB	- Design Branch
DDC	- District Development Committee
DOI	- Department of Irrigation
EB -	Environment Branch
EMP	- Environmental Monitoring Plan
FMIS -	Farmer-managed irrigation systems
ha -	Hector
IDD	- Irrigation Development Division
IDSD	- Irrigation Development Sub-division
IEE	- Initial Environmental Examination
IPM	- Integrated Pest Management
ISPM	- Institutional Strengthening and Project Management
km -	Kilo Meter
lps	- Liter Per Second
MEQCB	- Monitoring, Evaluation, and Quality Control Branch
MoEST	- Ministry of Environment of Science and Technology
NGO	- Non Governmental Organization
O&M	- Operation and Maintenance
PDMED	- Planning, Design, Monitoring and Evaluation Division
RCC	- Reinforce Concrete Cement
Rs.	- Rupees
SISP	- Second Irrigation Sector Project
SWD	- Surface Water Division
VDC	- Village Development Committee
VRB	- Village Road Bridge
WECS	- Water Energy Commission Secretariat
WUA	- Water User's Association
Zol	- Zone of Influence

WEIGHTS AND MEASURES

ha -	hectare
km -	kilometer
l -	liter
m -	meter
mo -	month
s -	second
t -	ton
yr -	year

CURRENCY EQUIVALENTS

(as of 31 March 2009)

Currency Unit - Nepalese Rupee (NR)

NR 1.00 = \$0.01226

\$1.00 = NRs 81.54

NOTE

In this report, "\$" refers to US Dollars.

GLOSSARY

Terai	The southernmost strip of land in Nepal, bordered to the north by Himalayan foothills and to the south by the Ganges River. The area was originally covered with tropical vegetation, but has been almost completely converted to agricultural production. The Terai is now the breadbasket of Nepal and is covered with farms.
Command Area	It is the agriculture or cultivable area which receives assured irrigation through canals, waters, courses, and field channels up to farmers field.

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I. INTRODUCTION

1. The Community-Managed Irrigated Agricultural Sector Project is designed to improve the agricultural productivity and sustainability of farmer-managed irrigation systems (FMISs) while strengthening the policies, investment plans, and institutions for irrigated agriculture, following the lessons learned during the Loan 1437-NEP: Second Irrigation Sector Project (SISP). The Project will be located in the Eastern and Central regions of Nepal and comprises two parts: (i) participatory irrigated agriculture development for FMIS; and (ii) institutional strengthening and project management (ISPM). Under the first part, 210 FMIS will be rehabilitated, resulting in improvements in irrigated agriculture over 34,000 hectares (ha) benefiting about 270,000 people. The second component comprises the development and implementation of improved institutional mechanisms for FMIS development, further improved policies and regulations, strengthening of the key stakeholders agencies and their linkages.

2. An initial environmental examination (IEE) was undertaken for the core subprojects based on data collected during the Detailed Design Period. The overall objective of the IEE is to analyze the adverse environmental impacts arising from site selection, design, construction, and operation of the Project if such effects occur and its mitigation to acceptable levels through implementation of a set of clearly defined and costed mitigation measures which have been included in the Project cost estimates. For each additional subproject, an IEE, and an environmental impact assessment (EIA) if warranted, will be carried out in accordance with the Bank's guidelines and relevant government's environmental requirements during the preparation of subproject feasibility studies.

3. This Initial Environmental Examination (IEE) Report for the Paliya Irrigation Subproject has been prepared to meet the Asian Development Bank's (ADB) requirements for environmental assessment process and documentation prior to Subproject approval, following the procedures in ADB's Environmental Assessment Guidelines (2003), and the Project's Environmental Assessment and Review Procedures and Arrangements.

II. DESCRIPTION OF THE SUBPROJECT

4. **Project Location.** The Proposed Paliya Irrigation Sub Project is located in Jyamirgadhi VDC, Jhapa district, Mechi Zone of Eastern Development Region. The command area lies in the ward no. 1,2,3,8 & 9 of Jyamirgadhi VDC. The subproject is located between the latitude and longitude of $26^{\circ} 37' 30''\text{N}$ to $26^{\circ} 35' 45''\text{N}$ and $88^{\circ} 07' 30''\text{E}$ to $88^{\circ} 07' 07''\text{E}$ respectively. The elevation of the area is about 107 - 102 m above MSL. The location of the system is shown in Figure 1.

5. **Accessibility.** The project area is easily accessible through a gravel motorable road, 4 km East-South from East-West Highway Ittabhatta Chowk which is also accessible from District Head Quarter, Chandragadi and is 15 km towards east. Most of the main canal reach and the branch canals can be approached through the existing village trail track.

6. **Existing Situation:** Paliya subproject is an existing FMIS. It was constructed in 1967 AD. The existing diversion weir is in bad shape and the water leaks through the weir. The farmers are facing difficulty in diverting water into their canal at required magnitude and frequency. Even the intake requires frequent repairs during each monsoon season for which the farmers contribute in terms of kind and cash every year. Similarly, they have been facing problems of canal regulation and water conveyance due to lack of regulating structures and reliable conveying networks.

7. **Command Area:** The gross command area is 270 ha and the net command area 227 ha. But at present only 130 ha is being irrigated. There is shortage of irrigation water at the tail area.

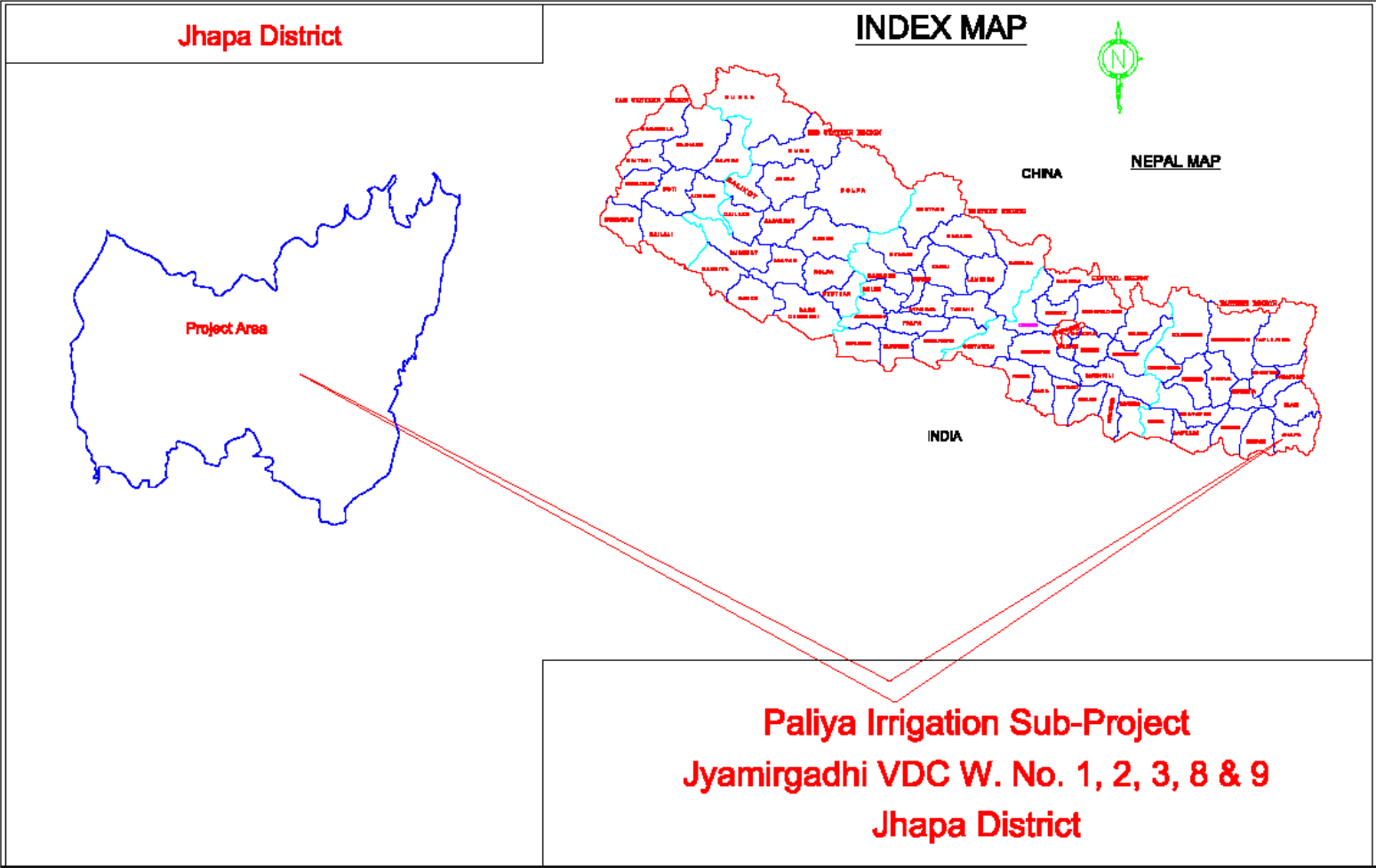
8. **Walkthrough Survey:** In order to assess the existing situation of the subproject and necessary proposed intervention for improving the water availability, a joint walk through survey along with farmers and the representative of NGO selected for supporting the institutional development of WUA was carried from January 12 to 14, 2009. The existing situation of the canal systems of the subproject and proposed interventions are presented in Annex 1. The problem in the system are:

- Water leaks from the diversion structure as well as intake structure
- Main canal also leaks at main locations
- There are no regulators in the canal to regulate the flow and
- There are no outlet structures

9. Even though there is flow in the river, the water could not be delivered to tail end because of above reasons.

10. **Project Components.** The major infrastructure improvements include the construction of the side intake at the Paliya Khola, repair of existing headworks, rehabilitation of canals such as canal lining, bank protection, canal reshaping construction of division boxes, outlets, cross drainage structures such as super passages, escape structures, VRB (5), Drop cum Cross Regulator (7), Drop structures (3), and canal protection structures. A layout map of the sub project area is presented in Figure 2. A salient features of the sub project is presented in Table 1.

Figure 1: Location Map of the Subproject



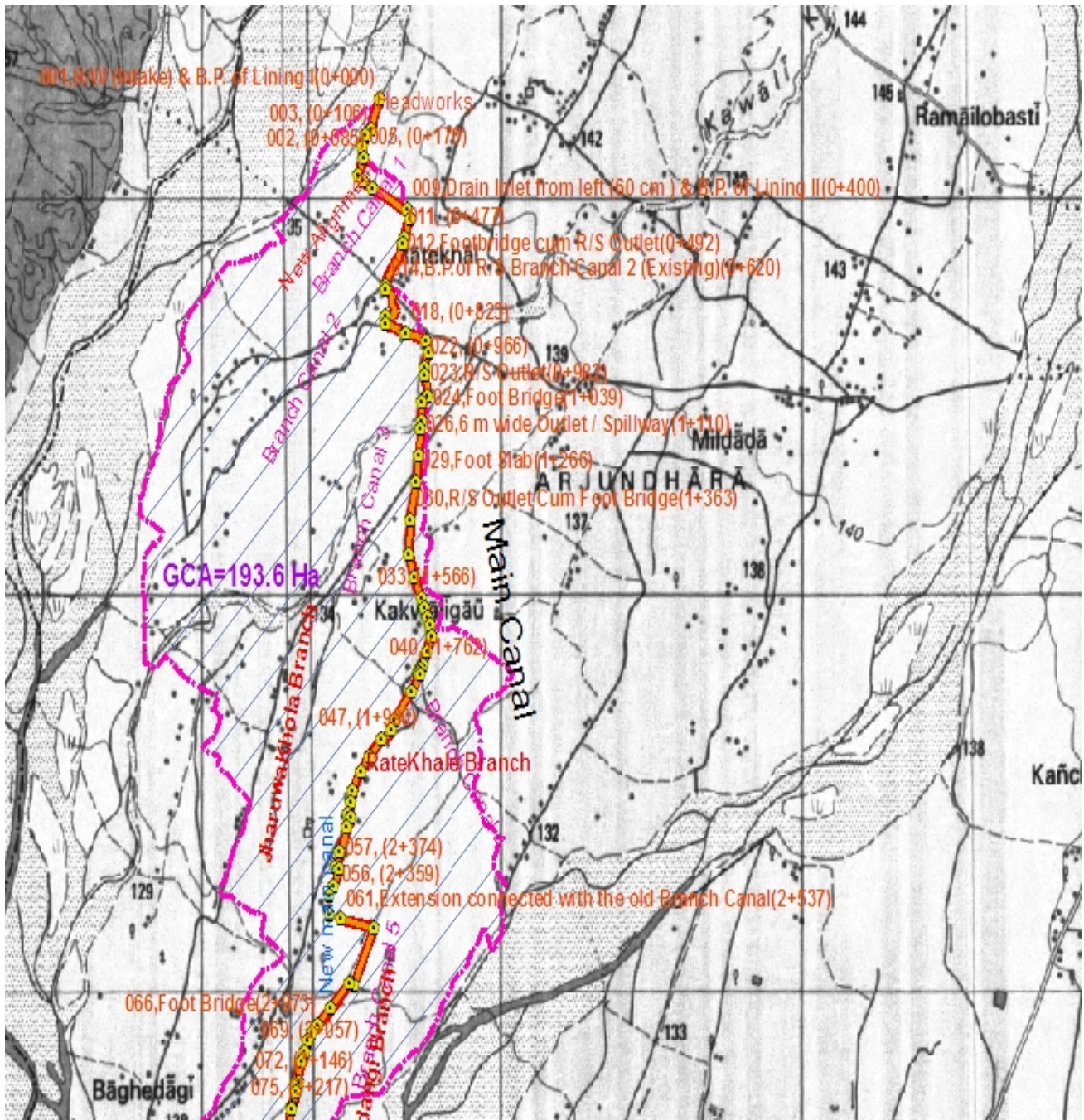


Figure 2: A Layout Map of the Sub project

Table 1: Salient Features of the Paliya Irrigation Subproject

1. Name of Subproject	Paliya Irrigation Subproject
2. Subproject Classification	Rehabilitation
3. Location (VDC and Ward No)	Jyamirgadhi-1, 2, 3, 8 & 9
4. District	Jhapa
5. District Headquarter	Chandragadhi
6. Zone	Mechi
7. Development Region	Eastern
8. Number of Households	300
9. General Elevation of the Subproject Area	102 msl
10. Slope and Topography of the Subproject Area	flat or level (0 to 3% slope)
11. Population	1,520
12. Total Canal Length	
a) Main Canal	4.2 km
b) Branch Canal	10 numbers/ 6.0 km
13. Gross Command Area	270 ha
14. Net Command Area	227 ha
15. Cropping Intensity	174% (present) & 204% (future)
16. Name Of Water Source	Paliya Khola
17. Type Of Water Source	Perennial
18. Catchment Area	22.5 km ² in Hydrological Region 7
19. Canal Type	Lined & Earthen
20. Canal Discharge	350 liter per second
21. Side Slope	1:1 (Earthen Canal)
22. Bed Slope	Shown in the L-Section in Detailed Design
23. Diversion Structure	Existing Permanent Intake/To be Repaired
24. Proposed Subproject Interventions	
Headworks	1 no.
- Drain Inlet	2 nos.
- Drain Outlet/Escape	1 nos.
- Superpassage	1 nos.
- Footbridge	8 nos.
- Fall/Cross Regulator	10 nos.
- VRB (slab in MC, HP in BC)	7 nos.
- Pipe H/R	19 nos.
- Field Outlet	64 nos.
25. Number of people directly involved during construction (estimate)	Skilled: 3,885 mandays Unskilled: 15,077 mandays
26. Construction/Rehabilitation Period (months)	7 months

Notes: VDC = Village Development Committee ; msl = meters above sea level; km = kilometers; ha = hectares; km² = square kilometers; RCC = reinforced concrete cement; VRB = Village Road Bridge

III. DESCRIPTION OF THE ENVIRONMENT

Physical Environment

11. **Topography.** The scheme is located in the Terai plain in an agricultural area with land that slopes gently from north to south at an elevation of 102 - 107 m above msl. The Paliya Irrigation subproject lies on the right bank of the Paliya Khola. The existing main canal is aligned along the ridges crossing the command area and irrigate to both side. The canals are earthen canals with enormous seepage loss so needs lining.

12. **Climate.** The project area has three distinct seasons, spring, monsoon, and winter. The climate of the subproject area is mainly sub-tropical and humid. It has hot and humid climate during summer and moderately high rainfall during the monsoon. There is no meteorological station in the project area itself, however, the nearest meteorological station at Gaida (Kankai) is used as reference. The recorded data of precipitation, maximum and minimum air temperature, and wind speed, relative humidity of Gaida (Kankai) and evapo-transpiration of Gaida is used for the analysis of crop water requirement. However, the river does not dry up completely since its long stretch is fed by perennial springs. Following are some important hydro-meteorological observations:

- Mean annual rainfall – varies from 6.1 mm minimum in November to 549.9 mm maximum in July;
- Mean monthly maximum temperature: varies from 23.8 °C in January to 33.6 °C in August
- Mean monthly minimum temperature: varies from 8.2 °C in January to 24.4 °C in July
- Minimum evaporation: 2.2 mm in January
- Maximum evaporation: 6.7 mm in May

13. **Soils.** The soil texture of the command area is silt clay and soil reaction is slightly acidic in nature. The nutrient content of the soil is medium with respect to Nitrogen, Potassium and Organic matter but the Phosphorus content is found to be high in the soils of the command area.

14. **Water Resources.** Paliya Khola is a perennial source. It originates from the community forest north from the headwork site in the Siwalik Zone. The catchments area at the headwork site is about only 22.5 km².

15. The watershed of the river is mostly covered with forest & cultivated land. Soil texture slightly varies from gravel boulder & light to heavy silt moving across the command area from west to the east. Due to highly rechargeable Siwalik zone lying to the west of the intake, there are a lot of spring sources which are adding discharge source of Paliya Khola.

16. Paliya Khola is a medium perennial source and there exists no functional stream flow gauging stations along the Paliya Khola basin. The discharge in the Paliya Khola measured by

the study team of Consultant is 490 l/s in the winter season (7 January, 2008). Nevertheless, no measured data are available indicating the mean monthly flows of the khola. The discharge was measured during the winter period when all FMIS upstream and downstream were withdrawing water by constructing obstruction of local materials across the khola.

Ecological Resources

17. **Vegetation and Forest.** There is no forest within the project command area. There exist no major trees within the inundation area of the headworks which are likely to be affected by the subproject activities. There are tea plantations in head and tail reach of the system within the subproject command area but they are not going to be affected by the subproject activities.

18. **Wildlife.** As reported by the local people, there are no wildlife habitats such in the project area and its vicinity.

19. **Aquatic life.** Among the aquatic species, hile, bam, and carp are found in the Paliya Khola.

Socio-economic Environment

20. The Paliya ISP covers three settlements or villages, namely Gomanari, Gaucharan, Bichamat, Kisankamat, Haldibari and Vindibasti Tole of ward no. 1, 2, 3, 8 and 9 of Jyamirgadhi VDC. The total number of households with some land holding in the project area is 280 with an average family size of 5.59 people and the population is estimated at 1565. The female headed households are small in percentage (9%). There are 34% landless households. Ethnically, the settlement has a mixed type of social structure. The settlement of Paliya has Brahmin/Chhetri (50%) as the ethnic majority. Among other ethnic communities, Janajati (48%), Dalit (1%) and Adibashi (1%) are the inhabitants of the command area. The settlement of Gomanari (upper reach of the system) have Chhetri as the majority. The incidence of poverty within the command area was found to increase from the head reach to the tail.

21. The main occupation of people in the area is farming. Apart from agriculture households supplement their income from livestock and from business activities. Most of the farmers rear ducks, goats and buffaloes for getting meat and milk, which is often sold in nearby markets to buy the articles of other primary needs. About 7.84% of households meet their needs by working as agriculture labour. The average daily wages of labour for men and women in the project area is 165-220 Nepalese rupees. The main source of agricultural labour for the command area is the Ultra poor group. There is sufficient labour force to meet the unskilled labour required for infrastructure construction.

22. The education level of the community is poor. Within the command area, One High school in Jyamirgadhi, One primary school and one boarding school each in Jyamirgadhi villages were noted. Majority of the households have access to electricity and ground water is utilised for drinking water purpose by hand pump.

23. Landless people work on wages and some of them take land on rent for farming on contractual basis. Most of the male members go to work in tea estate and tea processing factory. Those who could not get job earn their livelihoods from agriculture.

24. Mostly women are illiterate and hence their participation in the formal job market was found almost negligible. Though women have more responsibility for domestic chores, they also have a leading role in planting/sowing crops, threshing the harvested crop and taking care of the livestock.

IV. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS

25. **Delineation of geographical boundary of zone of influence (Zoi).** : The project area will be delineated under three category (i) high impact area: the permanent impact from the project such as permanent land loss and dewatered zone will be considered as high impact area. Such area will include the area where the project infrastructures will be located such as headworks, canal alignment and canal structures (ii) Moderate impact area: This will cover the area where land loss will be temporary during the construction period only. They will include camp sites, quarry sites; borrow areas, labour camp sites etc. (iii) low impact area: This will cover the adjoining areas within 200 to 500m (depending upon the settlement pattern) from the boundary of the sub project area of the VDC that are likely to be affected.

26. The subproject will be repairing and maintaining existing diversion structure, canal improvement and provision of outlets. This includes construction of one weir downstream of the old one and their protection by gabion works. River training work near diversion, maintenance of abutment wall and cut-off and gabion launching apron for the intake.

27. The screening of the potential impacts is presented in Table 2.

Table 2: Screening of Potential Impacts

SL	Parameters	Impact		Remarks
		Yes	No	
1	Environmental Problems due to Project Location			
1.1	Encroachment into Areas of Conservation Significance		√	There are no conservation areas (wetlands and protected forests) within the Subproject command area
1.2	Impediments to Movements of Wildlife, Livestock and People		√	Being an existing system there won't be any additional impediments.
1.3	Encroachment on Historical and Cultural Sites		√	There are no historical, cultural, and religious sites within the Subproject command area
1.4	Water Resource Conflicts		√	The Subproject irrigation system is a very old farmers-managed scheme. System for water use has been established and no records are available showing any evidence of misunderstanding or conflicts among users.
1.5	Flooding and Drainage Hazards	√		Absence of regulated intake causes intrusion of monsoon flood into the canal. The Subproject will provide necessary structures.
1.6	Displacement of People and Property		√	There will be no land acquisition for this Subproject.
2	Environmental Problems related to Project Design			
2.1	Watershed Erosion	√		The Subproject will provide river training and bank protection works to protect left bank of river. Additionally canal lining will be provided in seepage zones.
2.2	Downstream Water Quality Problems		√	The Subproject is a rehabilitation project therefore no other water sources (e. g. groundwater) will be utilized. Therefore quality of water supply will not change
2.3	Suitability of Natural Water for Irrigation		√	The water sources have been used prior to rehabilitation works. There will be no changes in water use during the Subproject implementation

SL	Parameters	Impact		Remarks
		Yes	No	
2.4	Over pumping of Groundwater		√	Groundwater will not be used in this Subproject.
2.5	Adequacy of Drainage Planning	√		Erosion at the outfall points has been noticed and correction proposed.
2.6	Disruption of Existing Farmer Cooperative Systems		√	There are no existing farmer's cooperatives within the command area.
2.7	Use of Chemicals in Agriculture and Horticulture	√		Use of chemical fertilizers and pesticides is likely to be increased due to the improved irrigated agriculture practice
2.8	Selection of Pesticides	√		Selection and use of pesticides may be a problem
2.9	Land Use Conflicts		√	The land use within the command area has been established prior to the implementation of the Subproject. No records are available showing misunderstanding or conflicts among different land uses.
2.10	Inadequacies in Water Distribution		√	Necessary improvement work in the system and improved efficiency of the canal system will increase the discharge in the canal. Inadequacy in water distribution will not occur.
2.11	Canal Management	√		The operation and maintenance (O&M) of the existing irrigation system including main canal has been in place prior to implementation of the Subproject. WUA so far have organized and managed quite well for O & M of this system.
2.12	Passageways	√		The existing passageways are not sufficient for movement of people and livestock. The Subproject will increase the number of crossings and passageways.
2.13	Scouring Hazards	√		The system has been in operation for many years. Scouring problems has not been reported. Canal beds are stable
3	Environmental Problems Related to Construction Stage			
3.1	• Excavation	√		The excavation will be required at the structure sites. Being an existing canal no new excavation will be required for canal.
3.2	• Construction material sites (Quarry Sites)		√	The construction work will require 503 m ³ sand and 959 m ³ of aggregates which can be fulfilled from the local market or local quarry. Operation of quarry site for the subproject may not be feasible.
3.3	• Work camp location and operation	√		The contractor will have to establish work camp for the construction activities
3.4	• Labour camp		√	Total labour requirement will be about 15,077 unskilled and 3,885 skilled. Assuming actual construction working season of 7 months, the average labour requirement per day would be 72 unskilled and 18 skilled. The most of the unskilled and some of skilled manpower will be fulfilled from the local area. Hence labour camp will not be operated. Some of the outside labour will be reside within the work camp itself.
3.5	• Stockpiling of materials	√		The construction material will be stored at the convenient locations for the construction activities.
3.6	• Operation of construction equipment and	√		No heavy construction equipments are

SL	Parameters	Impact		Remarks
		Yes	No	
	transport			needed. Only small dewatering pumps, mixers, vibrators, etc will be used which do not contribute major air pollution. Tractors, trucks and bullock carts would be used for material transportation.
3.7	• Occupational health and safety	√		Occupational health and safety of the workers might be of concern.
3.8	Temporary Closure of Irrigation System	√		Construction activities are likely to disturb the supply of irrigation water.
4	Environmental Problems Resulting from Project Operations			
4.1	Effect on downstream water use		√	The proposed intervention will not be abstracting more water than existing quantity. Hence effect on downstream users has not been foreseen.
4.2	Adverse soil modifications		√	The proposed subproject is the rehabilitation of the existing irrigation system, adverse soil modification will not occur due to the proposed subproject implementation.
4.3	Changes in groundwater hydrology	√		The Subproject will improve the irrigation system which will likely recharge the groundwater tables within the command area.
4.4	Mosquito Breeding	√		Water ponding within the command area may lead to increases in incidence of waterborne diseases and mosquito breeding.
4.5	Hazards associated with the use of toxic chemicals	√		Use of pesticides for the pest control could be hazardous to the people and live stock.
4.6	Hazards associated with the use of mineral fertilizer	√		Increased use of fertilizers likely due to improved irrigation system, These may find its ways to ground water and surface water which could be hazardous.
5	Realization of Enhancement Potentials			
5.1	Employment to the local people	√		Construction activities will require construction laborers. Local people will get opportunity in employment. In addition farmers have to share the construction cost which will be mostly usually in terms of labor force.
5.2	Community water supply in command area		√	The command area has existing water supply schemes (tubewells). Canal water is not used for domestic purpose and will not be used as such during Subproject implementation.
5.3	Aquaculture in command area		√	Farmers do not practice aquaculture within the command area. It is unlikely that this will be practiced in future also.
5.4	Livelihood programs for landless households	√		Construction activities will require both skill and unskilled laborers. The Subproject will also provide livelihood trainings to enhance economic conditions of landless households.
5.5	Feasibility of cooperatives	√		The Project will implement institutional development activities to strengthen capacity of water users associations which could function as a cooperative to support the farmers.

28. In many environmental assessments there are certain effects that, although they will occur during either the construction or operation stage, should be considered as impacts primarily of the location or design of the project, as they would not occur if an alternative location or design was chosen. The two activities in which the Subproject interacts physically with the environment are during construction and operation, so these are the two activities which most significant environmental impacts can occur. The Subproject will not cause any significant adverse environmental impacts because: (i) most of the individual elements of the Subproject are relatively small and involve straightforward construction and operation, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving trenching and other excavation; and (iii) mitigation measures are devised for any negative environmental impacts.

29. These potential environmental impacts may be direct or indirect, and reversible or irreversible. The magnitude of the impacts may be high, medium or low and such impacts may be of site-specific, local, regional or of national nature. Furthermore, some impacts may be short-term, particularly related with the upgrading stage, medium-term and long-term duration.

V. POTENTIAL ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

Environmental Problems due to Subproject Location

30. **Flooding and Drainage Hazards:** The intrusion of monsoon flood is normal due to absence of regulated intake structure. The subproject will construct necessary structures at intake site. This is the positive impact with high magnitude local extent and long term duration.

Environmental Problem Related to Project Design

31. **Watershed erosion:** The river training and bank protection works at the headworks is going to prevent the erosion in the vicinity of the headworks and the cultivated land. Additionally canal lining in seepage zones will prevent canal erosion. This is the positive impact with high magnitude local extent and long term duration.

32. **Adequacy of Drainage Planning:** In general the command area is sloping from north to south and water flow is smooth. But there are some problems at the outfall points where erosion has been noticed. Necessary protection works have been proposed in consultation with the farmers. This is the positive impact of high magnitude, local extent and long term duration.

33. **Use of Chemicals in Agriculture and Horticulture:** The project area being located close to the big market like Dhulabari and Charali, chemical fertilizers is easily available. The use of chemical fertilizers is likely to increase as the project encourages improved agricultural practices. Excess use of chemical fertilizers in the field may percolate into the groundwater or run down into surface water along with the runoff. But the excess use of fertilizers would be very rare in practice. Considering the rareness of the occurrence, this impact has been considered of low magnitude, local extent and long term duration.

34. *The agricultural development plan has recommended the optimum dose of required chemical fertilizers for each of the proposed crops.*

35. **Selection of Pesticides:** Majority of farmers of the project area are not aware of the toxicity of the pesticides. Only few farmers are using pesticides. As reported, they have not undertaken any kind of integrated pest management (IPM) training. Hence, farmers need some training on integrated pest management. With this background, it could be assumed that impact associated with the pesticides will be low magnitude, local in extent and long term in duration.

36. *Include IPM training under agriculture development program. The cost of this training will be covered from ADP.*

37. **Canal Management:** The proposed project intends to operate one main canal and ten branch canals. The main canal will be carrying the water for all the branch canals. The operation and maintenance of the system will be the responsibility of the farmers themselves. Each of the canal system has their own canal management process, which has been practiced for many years. But operation and maintenance of the main canal will have to be worked out,

which should not be a problem as they have been practicing such works for many years. Hence this impact has been considered of low magnitude, local extent and long term duration.

38. *Water management plan will be developed for the operation of the system.*

39. **Passageway:** There are some passageways in the existing canals which is not adequate for movement of the people. Hence additional passageways, 8 foot bridges and 7 village road bridges have been proposed. This is a positive impact of high magnitude, local in extent and long term duration.

Environmental Problems Related to Construction Stage:

40. The Subproject will use labour-based, environment-friendly, and participatory approach, the important features of which are:

- Use of local people as labour, hand tools and small equipment, rather than heavy machinery for construction.
- Balancing cut and fill and reuse of excavated materials as construction materials, and thus not generating excess spoils as far as possible.
- Use of bio-engineering techniques: integrated use of vegetation, simple civil engineering structures, and proper water management systems for slope protection.

41. Significant adverse negative environmental impacts are not expected during the construction stage mainly because: (i) rehabilitation works can be constructed without causing major disruption to irrigation users; (ii) most construction will be conducted by small teams of farmers working on short lengths at a time so most impacts will be localized and short in duration; and (iii) the overall construction program will be relatively short for a project of this nature, and is expected to be completed in 7 months.

42. During the construction phase most of the potential negative environmental impacts are associated with the activities of the construction contractor(s). By including environmental management clauses in the individual contract documents, the potential for adverse impacts can be significantly reduced.

43. **Excavations.** Excavation will be at the structures locations and few quantities due to reshaping of main and branch canals. But as these are small quantity, excavation would not cause serious adverse effects that causes silt runoff, induced erosion and loss of cropland and vegetation. After construction, most of the excavated material would be reutilized in the back filling work.

44. *Mitigation measures include: (i) confine operations to the dry season; (ii) use of silt traps; and (iii) spoils of any in excess shall be disposed of in locations that will not promote instability and result in destruction of property, vegetation, irrigation and drinking water supply. Disposal near wetlands, protected areas, and other areas that will inconvenience or deprive local*

residents of their livelihood shall not be allowed. Acidic and saline spoils shall not be spread into agricultural land.

45. **Work Camp Location and Operation.** Potential environmental impacts include (i) temporary air and noise pollution from machine operation; (ii) water pollution from storage and use of fuel, oils, solvents, and lubricants; (iii) unhygienic conditions from laborers.

46. *Mitigation measures include: (i) The Contractor shall consult with WUA and or VDC before locating project offices, sheds, and construction plants; (ii) camps shall not be located near settlements or near drinking water supply intakes; (iii) no trees shall be cut and removal of vegetation shall be minimized; (iv) water and pit latrines facilities shall be provided for laborers; (v) used oil and lubricants shall be recovered and reused or removed from site by the Contractor; (vi) at conclusion of the Subproject, all wreckage, rubbish, or temporary works that are no longer required shall be removed or given to local residents; (vii) all temporary structures, including office buildings, shelters, and latrines shall be removed; (viii) sites shall be restored to near natural or stable conditions; (ix) exposed areas shall be planted with suitable vegetation; and (x) the Subproject proponent shall report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of the works. Restoration of the work camp to its original condition will be covered from environmental management cost.*

47. **Stockpiling of Materials (Storage of topsoil, fill material, gravel, aggregates, and other construction materials).** Potential environmental impacts include (i) siltation and pollution of surface water resulting from uncontrolled runoff from storage piles; and (ii) disturbance to private property.

48. *Mitigation measures include: (i) stockpiling shall not be permitted during the rainy season unless covered by a suitable material; (ii) stripped material shall not be stored where natural drainage will be disrupted; (iii) protection of materials from erosion prior to rainy season; and (iv) storage on private property will be allowed only if written permission is obtained from the owner or authorized lessee.*

49. **Operation of construction equipment and transport:** As no heavy construction equipments are needed, the subproject activities will not contribute major air pollution and excessive noise. However airborne dust particles due to construction materials during transportation and stockpiling may result in deposition and possible damage to vegetation, crops, and water resources.

50. *Mitigation measures include: (i) stockpiled sand and soil shall be slightly wetted before loading particularly in windy conditions; (ii) vehicles transporting sand and soil shall be covered with a tarpaulin; and (iii) limit and control working practices through contract provisions such as: (a) avoid noise-generating activities at night; (b) consult with local community to inform them of the nature, duration, and likely effects of the construction work; (c) schedule work during dry season*

51. **Occupational health and safety:** In the construction sites, there will be movement of local peoples. Despite precautions, possibility of accidents could not be ruled out completely as many types of equipment will be under operation. Hence, construction activities may pose safety concern to local peoples as well as workers. Although the health and safety will be major

concern during the construction stage, magnitude of the impacts has been evaluated as low since provision of health and safety measures are mandatory in any of the construction contracts and due to small scale of construction. The extent will be site specific and duration will be of short term.

Accidental insurance will be covered for all construction workers and staff. An amount of Rs. 90,000.00 has been allocated for the buying the accident insurance policy of the workers. This cost shall be covered from the environmental management cost. In order to minimize the unwanted accidents and possible effects of dust and gaseous emission to construction workers, the project will ensure adequate safety measures such as provision of helmets, masks, ear plugs, road signs, warning signals etc. The provision of the safety gears also will be borne environmental management cost.

52. Temporary closure of irrigation system. The construction activity in the canal system is likely to disturb the supply of the irrigation water for a relatively short period.

53. Mitigation Measures: *The construction activities will be planned in consultation with the WUA members. The headworks construction will be carried out during the dry season and the alternative measures will be made to keep the canal in running conditions if the construction activities will be carried out during the canal operation time. Flexible hosing and/or diversion canals will be used to supply water to affected users. Cost of alternative arrangement for supplying the water will be part of the civil construction cost.*

Environmental Problems Resulting from Subproject Operations

54. Changes in Groundwater Hydrology. The application of the irrigation water in the field is likely to recharge the groundwater of the subproject area vicinity and the groundwater table will rise in general. But any substantial change in groundwater hydrology is unlikely due to the proposed project because the subproject area is already receiving the irrigation water. The proposed subproject is rehabilitation only. Hence the impact is considered of low magnitude, local in extent and long term in duration.

55. Mosquito Breeding. In an irrigation project, the water is flooded in the field especially during the paddy season, which could be the breeding ground for the mosquito, a carrier of diseases. But the proposed subproject is the rehabilitation of the existing irrigation system, which is already in operation. The proposed subproject is not going to have any additional effect on the environment. Hence the impact is considered of low magnitude, local in extent and long term in duration.

56. Hazards associated with the Use of Toxic Chemicals. Pesticides are the toxic chemicals that would be used in the agricultural crops whenever crops are infested by the insects. From the focused group discussion with the farmers, they seemed to be aware of the toxicity of the pesticides. Use of pesticides in the project area is minimum. Farmers need some IPM (integrated pest management) training so as to train the farmers in pest management without the use of pesticides. With this background, it could be assumed that impact associated with the pesticides (toxic chemicals) will be of low magnitude, local in extent and long term in duration.

57. **Hazards associated with the Use of Mineral Fertilizer.** The farmers have been using chemical fertilizers in the crops. But the quantity of usage is less than the recommended dose for the crops. The project intends to carry out training in the crops cultivation to increase the crops yield. Hence the use of chemical fertilizers is going to be increased with the project implementation. But given the proper training programs, the application dose will be optimum for the crops and it would not create any hazard as such. Hence the impact is considered of low magnitude, local in extent and long term in duration.

Realization of Enhancement Potentials

58. **Employment Opportunity to the Local People.** The construction of the subproject would require both skilled and unskilled labour. Semi skilled and unskilled labours are available in the subproject area as well as its vicinity. The subproject would provide employment opportunity to the local people. In addition, the farmers will have to make their contribution, which could be in kind and cash. The farmers preferred to make contribution by providing labour.

59. **Livelihood Programs for Landless Households.** There are 94 ultra poor/landless households in the project area who work as tenants for other households who own the land. The proposed project intends to enhance the economic condition of these households by implementing different livelihood programs.

60. **Feasibility of Cooperatives.** The existing irrigation system is being operated and maintained by the water users association. They have defined rules and regulations, which are followed by all the members. The rules and regulations are socially binding. The proposed CMIASP intends to implement a number of institutional development activities in strengthening capacities of the WUAs in agricultural production, and poverty alleviation of the project area. The WUA will have the key role to play in these activities. For the project implementation, a coordination committee is planned to be formed. The WUA could also function as the cooperatives to support the farmers in terms of making timely availability of agricultural inputs, marketing of the agricultural production, facilitating the micro credits.

VI. ANALYSIS OF ALTERNATIVES

61. The repair and maintenance of existing diversion structure of Paliya Irrigation System is proposed. Hence the proposed headworks site is justifiable.

62. Since the irrigation system is the traditional system, canals already exist and there are no alternative alignments for them. Even though the proposed irrigation subproject intends to use traditional irrigation canals (1 main and 10 branch), additional link canals are not required.

VII. INSTITUTIONAL ARRANGEMENTS

63. **Institutional requirements.** Nepal has an established legal and policy framework for environmental safeguarding in relation to projects. Environmental protection is overseen by the Ministry of Environment, Science and Technology (MoEST). It holds overall responsibility for environmental policy. The principal legislation for environmental safeguarding is the 1997 Environmental Protection Act (EPA) and its rules 1997, amended in 1999 and amendment in 2008. Implementation of the EPA is the responsibility of the MoEST and the sectoral ministries. For those projects having insignificant environmental impacts, the responsibility of undertaking and approving IEEs and implementing the subsequent environmental monitoring plan (EMP) are delegated to the concerned sectoral ministries. The DOI is under the MOWR. Both DOI and MOWR have environmental sections that liaise with each other. The Environmental Section within DOI was established in 1988 and is located within the Surface Water Irrigation Division (SWID).

64. The revised Schedule 1 of Section 2 of the EPR stipulates the environmental assessment requirements for irrigation schemes. It stipulates that an initial environmental examination (IEEs) is required for the rehabilitation of irrigation schemes which has new headworks or change in the main canal alignment. Since the proposed sub project is a simple rehabilitation of the existing FMIS, a formal IEE in accordance with EPR amendment 2008 will not be required.

65. **Institutional arrangements and responsibilities.** At the DOI headquarters level, a central project management office (CPMO) has been set up with class-I engineer as full time project director, and will be responsible for overall environmental management, under technical support and guidance from Environmental Section in SWID. At the regional level, regional project support unit (RPSU) has been established with director of the Regional Irrigation Directorate as project manager of each region and will be responsible for day-to-day implementation of the Project. RPSU will have an assigned staff to manage environmental activities with the assistance of the consultants. At the field level, subproject management unit (SMU) has been established in each division headed by the chief of the irrigation development division/ subdivision (IDD/IDSD), which will undertake field operations including environmental planning and monitoring under supervision by RPSU. Specific institutional responsibilities during the subproject implementation cycle are stipulated as below.

Table 3: Institutional Responsibilities for Environmental Management

Subproject Stage	Responsible Organization	Responsibilities
Overall	ISPM Consultants	Support capacity development of environmental planning, monitoring, and management
	EB in SWID	Guidance for environmental planning, monitoring, and mitigation
	MEQCB in PD MED	Management of monitoring and evaluation data
Screening RPSU/SMU		Screen the project results in light of environmental and other criteria
Planning RPSU/SMU/firms		Prepare IEE (included in SIP), minimize avoidable losses, incorporate mitigation measures, and prepare EMP
	CPMO-EB in SWD	Endorse IEE and SIP
	Subproject Appraisal Subcommittee	Approve IEE and SIP
	Ministry of Water Resources	Approve IEE (which fall under schedule 1,

Subproject Stage	Responsible Organization	Responsibilities
		section 2 of EPR 1997, amendment, 2008)
WUA formation	RPSU/SMU/NGOs/COs	Strengthen WUA including monitoring capacities
Detailed Design	RPSU/SMU/firms	Assist in preparing RP, incorporate EMP into engineering design and specifications
Construction Contractor		Implement required environmental measures
	RPSU/SMU/firms	Supervise contractor implementation of environmental measures
Agriculture and social support	RPSU/SMU/firms/NGOs Implement	specific environmental mitigation measures incorporated in the agriculture and social development plan.
Operational	DOI	provide budget to undertake annual monitoring and audit
	RPSU/SMU/NGOs (during Project)	Carry-out annual performance audit of completed schemes. Support additional mitigation measures as necessary.
	RID/IDD/IDSD/DDC/DADO (after Project)	Same as above
	WUAs	Monitor agriculture practice and impacts and report them to SMU.

Notes: DB=Design Branch; EB=Environmental Branch; MEQCB=Monitoring, Evaluation, and Quality Control Branch; PDMED=Planning, Design, Monitoring and Evaluation Division; SWD=Surface Water Division

VIII. ENVIRONMENTAL MANAGEMENT PLAN

66. The Environmental Management Plan (EMP) is prepared to guide implementation of mitigation measures and monitoring requirements. It includes institution and their roles, environmental management activities, environmental management organizational structure and budget for mitigation measures.

67. Essentially, it will be put into operation through data collection at subproject level by SMU with the engagement of private firms as necessary and/or WUA, monitored and supervised by RPSU through regular management review and field confirmation, and processing and analysis by Monitoring and Evaluation Branch of DOI in coordination with DOA. Environmental data will be shared with Environment Division. Monitoring costs have been incorporated into the design of the PPME system for the project. The findings of the monitoring activities will be incorporated in the regular PPME reports prepared by CPMO with the assistance of the consultants engaged under institutional strengthening and project management, and submitted to ADB.

68. Framework for implementing environmental management plan is shown by Table 4.

Table 4: Environmental Management Plan

S I	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
1	Environmental Problem due project location							
F	flooding and drainage hazards	Provide drain inlet structure	Design Office	Include in det. design	No cost	Design team	provision of drain inlet structure in the design	ISPMC
2	Environmental Problem related to project design							
	Watershed erosion	Repair and maintenance of headworks	Design Office	Include in det. design	No cost	Design team	provision of headworks repair and maintenance	ISPMC
	Adequacy of drainage planning	Provide protection at outfall points	Design Office	Include in det. design	No cost	Design team	provision of outfall protection	ISPMC
	Canal management	Prepare sub project specific water management plan and O & M Plan.	Design Office	included in det. design	No cost	Design team	Prepare site specific water management plan	ISPMC
	Passageway P	Provide passageway structures	Design Office	Include in det. design	No cost	Design team	provide passage as agreed with the farmers	ISPMC
H	hazards associated with the use of toxic chemicals	Avoid using pesticide to the extent possible. Use IPM technique to control pest	Design Office	Include in Agriculture Development Plan.	No cost	Design team	Include IPM training package in Agriculture Development Plan (ADP.)	ISPMC
3	Environmental Problem related to construction stage							
	Excavation	(i)confine operations in the dry season; (ii) use of silt traps; (iii) spoils shall be disposed of at the designated locations	Within the sub-project	designate the spoil disposal area	Part of civil construction cost	Imp: Contractor Mon: SMU/WUA	spoiled disposal sites	SMU/WUA
	Quarry sites							
	Work Camp Location and Operation: (i) temporary air and noise pollution from machine operation; (ii)	(i) work camp will be located away from the settlement area. (i) no trees shall be cut and removal of vegetation shall be minimized (iii)	Within the sub-project		Part of civil construction cost	Contractor	Location of the work camp	SMU/WUA

Table 4: Environmental Management Plan

S I	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
	water pollution from storage and use of fuel, oils, solvents, and lubricants; (ii) unhygienic conditions for laborers; (iv) disturbance to wildlife	used oil and lubricants shall be recovered and reused or removed from site. (iv) work camp will not be located in wildlife habitats, restriction and control of wildlife harassment, illegal hunting and poaching						
		(v) will make own arrangements for water and sanitation	Work camp		Included in environmental cost (Budget: Rs 50,000.00)	Imp: Contractor	disposal and sanitary facilities in the work camp	SMU/WUA
		(vi) Site will be placed back in the original site condition and shall report in writing that site has been restored to pre-project conditions before acceptance of the works.	Within the sub-project		Included in environmental cost (Budget: Rs. 50,000.00)	Imp: Contractor	Condition of the work camp site before the issue of completion certificate	SMU
	Stockpiling of Materials : (i) siltation and pollution of surface water resulting from uncontrolled runoff from storage piles; and (ii) disturbance to private property.	(i) stockpiling will not be permitted during the rainy season unless covered by a suitable material; (ii) stripped material will not be stored where natural drainage will be disrupted; (iii) protection of materials from erosion prior to rainy season; and (iv) storage on private property will be allowed only with the written permission from the owner.	Construction sites	ensure good construction practice	Part of civil construction cost	Imp: Contractor	Inspection of the construction material stocking site.	SMU/WUA
	Operation of construction equipment and transport : emission of air pollutants, high concentration of air borne dust resulting and excessive noise resulting annoyance and potential	(i) Stockpiled sand and soil shall be slightly wetted before loading particularly in windy conditions; (ii) vehicles transporting sand and soil shall be covered with a tarpaulin; and (iii) limit and control working practices through contract provisions.	Construction site	ensure good construction practice	Part of civil construction cost	Imp: Contractor	SM	U/WUA

Table 4: Environmental Management Plan

S	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
	hazard to human populations							
Oc	cupational health and safety	(i) Buy accident insurance to all workers. (ii) provide safety gears such as helmets, boots, ear plug, mouth mask to the worker and labours	Construction site	Provide safety gears	Included in environmental cost (Budget Rs. 90,000.00)	Imp: Contractor	insurance policy	Mon: SMU/WUA
T	emporary closure of irrigation system	Plan the headworks construction during dry season	Headworks		No cost	Imp: Contractor	Construction plan	Mon: SMU/WUA
		Make alternative arrangement to keep the canal running	Canals		Part of civil construction cost	Imp: Contractor	Enquiry on canal closure	Mon: SMU/WUA
Environmental Problems Resulting from Project Operations								
H	azards associated with the use of toxic chemicals	Avoid using pesticide to the extent possible. Use IPM technique to control pest	Command area	Pest control by IPM	No cost	Imp: Farmers	Use of pesticide in the crops	Mon: DADO
H	azards associated with the use of mineral fertilizer	Use recommended dose of inorganic fertilizers	Command area	Application of fertilizers	No cost	Imp: Farmers	Use of chemical fertilizer in the crops	Mon: DADO
Realization of Enhancement Potentials								
	Employment to the local people	Provide employment to local people in priority	Within sub project area	Hire local labour to the extent possible	No cost	Imp: Contractor	Payroll of contractor	Mon: WUA
	Livelihood programs for landless households	Provide Livelihood enhancement Program (LEP) training to the targeted people	Within sub project area	Training I	include in LEP cost	Imp: SMU	Training on LEP	Mon: WUA
F	feasibility of cooperatives	Provide institutional development training	Within sub project area	Training I	include in Institutional development plan cost.	Imp: SMU	Training on Institutional development training	Mon: WUA

IX. PUBLIC CONSULTATION AND DISCLOSURE

69. This IEE report has been prepared in close consultation with WUA members and lead farmers who participated in the walk through survey. The impact and proposed mitigation measures were discussed and agreed with farmers during the SIP endorsement by WUA general body meeting.

70. The walk through survey was carried out from 12th to 14th January 2009. Mr. Dhan Bahadur Basnyet, WUA Chairman, Mrs. Chitra Kala Dahal, WUA Vice Chairwoman and Mr. Chet Bahadur Raut, WUA Secretary participated in the Walkthrough Survey from WUA. The WUA endorsement meeting was conducted on 14th January 2009.

X. FINDINGS AND RECOMMENDATIONS

71. The principal findings are that the Subproject provides for inherently environmentally friendly irrigation interventions and contributes to significantly improved living conditions through (i) community emphasis on subproject design and implementation, (ii) extensive technical support in eliciting sustainable practices in irrigated agriculture and (iii) addressing institutional needs for sustained and equitable O&M.

72. The identified adverse environmental impacts will be addressed through proper planning, design, implementation, and O&M while incorporating identified mitigation measures. The screening process carried out in the IEE has not identified any significant negative environmental impacts likely to be caused by the Project. Environmental issues were considered throughout development of the Project and necessary changes were made to the designs to reduce or avoid impacts. Potential negative impacts associated with construction activities can be mitigated by the application of standard health, safety, and environmental clauses in contract documents, close supervision, and close attention to transparency in tendering, and to quality control and supervision on site. Mitigation measures for other impacts are provided in detail in the IEE.

XI. CONCLUSION

73. The project is not expected to give rise to any significant negative environmental impacts, and therefore does not require an ADB Environmental Impact Assessment.

74. The proposed subproject is rehabilitation of existing irrigation system, which is already in operation. Hence, the environmental impact during the operation phase will not be very much different than the existing situation. Rather the existing system lacks basic structures like intake, cross drains, the proposed intervention will be providing basic civil engineering structures for the operation of the canal. From the proposed intervention some adverse impacts of low magnitude have been identified during the construction stage but they are of short-term duration and could be easily mitigated. The proposed intervention will provide round year irrigation to the entire command area. Taking into consideration the adverse impact of low magnitude and extensive positive impacts, this subproject is recommended for implementation on the environmental perspectives. Mitigation of minor adverse environmental impacts can be carried out as an integral part of the Subproject, during both the detailed design and implementation stages. Appropriate measures will be included in the tender documents for the civil works.

Annex 1: Details of Proposed Intervention in the Subproject

Item No	Chainage WayPoints &		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To					
1 046	0+244		FB	Track Crossing	Damage by crossing	FB proposed	
2 047	0+287		Outlet	Improper Outlet	No controlled outlet causing bank erosions	Outlet bothside	
3 049	0+435		Inlet	Improper inlet	Add Discharge to the Canal	Drain Inlet Required	
4 051	0+509		VRB	Track Crossing	Damage by crossing Existing VRB (wingwall to be repaired)		
5 053	0+769		Outlet	Improper Outlet	No controlled outlet causing bank erosions	Outlet L/S	
6 054	0+774		CR, HR	Track Crossing	Damage by crossing	Proposed CR with FB	
7 056	0+973		Outlet	Improper Outlet	No controlled outlet causing bank erosions	Outlet B/S	
8 061	1+206		Inlet	Improper inlet	Add Discharge to the Canal	Drain Inlet Required	

Item No	Chainage & WayPoints		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To					
9 062	1+261		CR, HR	Track Crossing		Proposed HP Culvert, HR at L/S & CR	
10 064	1+325		VRB	Track Crossing	Damage by crossing	VRB proposed	
11 065	1+445		CR, HR, HP Culvert	Track Crossing		Proposed H P Culvert, HR at L/S & CR	
12 068	1+692		Outlet	Improper Outlet	No controlled outlet causing bank erosions	Outlet at R/B proposed	
13 069	1+773					Slab at parapet wall needed	
14 071	1+852		VRB	Track Crossing	Damage by crossing	VRB proposed	
15 073	1+975		FB	Track Crossing	Damage by crossing	FB proposed	
16 074	2+014		FB	Track Crossing	Damage by crossing	FB proposed	

Item No	Chainage & WayPoints		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To					
17 075	2+098		FB	Track Crossing	Damage by crossing	FB proposed	
18 076	2+137		VRB	Track Crossing	Damage by crossing	RCC slab Culvert proposed	
19 077	2+190		FB	Track Crossing	Damage by crossing	FB proposed	
20 078	2+217		FB	Track Crossing	Damage by crossing	FB proposed	
21 079	2+222		HP Culvert, HR, CR	Track Crossing		HP Culvert, HR, CR	
22 080	2+296		HR, Fall			Fall structure & HR	
23 081	2+399		FB	Track Crossing	Damage by crossing	FB proposed	
24 082	2+568		HR, CR	Existing fall (to be replaced)		Offtaking Structure, Existing fall (to be replaced)	

Item No	Chainage & WayPoints		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To					
25 084	2+678		FB	Track Crossing	Damage by crossing	FB proposed	
26 087	2+755		FB	Track Crossing	Damage by crossing	FB proposed	
27 088	2+803		FB	Track Crossing	Damage by crossing	Existing fall (to be replaced) with FB , O utlet BS	
28 089	3+010		VRB	Track Crossing	Damage by crossing	RCC slab Culvert proposed	
29 090	3+050		FB	Track Crossing	Damage by crossing	FB proposed	
30 091	3+086		FB	Track Crossing	Damage by crossing	FB proposed	
31 093	3+161		FB	Track Crossing	Damage by crossing	FB proposed	
32 095	3+322		HR, CR			Offtaking Structure at both side required	

Item No	Chainage & WayPoints		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To					
33 096	3+451		Outlet	Improper Outlet	No controlled outlet causing bank erosions	Outlet L/S with HP Culvert	
34 098	3+536		FB	Track Crossing	Damage by crossing	FB proposed	
35 099	3+549		FB	Track Crossing	Damage by crossing	FB proposed	
36 101	3+615		FB	Track Crossing	Damage by crossing	FB proposed	
37 102	3+661		FB	Track Crossing	Damage by crossing	FB proposed	
38 103	3+827		Outlet	Improper Outlet	No controlled outlet causing bank erosions	Outlet bothside	
39 104	3+879		FB	Track Crossing	Damage by crossing	FB proposed	
40 105	3+915		FB	Track Crossing	Damage by crossing	FB proposed	

Item No	Chainage & WayPoints		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To					
41 106	3+955		Outlet	Improper Outlet	No controlled outlet causing bank erosions	Outlet R/S with CR	
42 107	4+135		FB	Track Crossing	Damage by crossing	FB proposed	
43 108	4+144		FB	Track Crossing	Damage by crossing	FB proposed	
44 109	4+181		FB	Track Crossing	Damage by crossing	FB proposed	
45 1	10 4+195		Outlet	Improper Outlet	No controlled outlet causing bank erosions	MC ends ,Outlet	