

Initial Environmental Examination Report

Loan Number: 2102 NEP
June 2009

Nepal: Community-Managed Irrigated Agricultural Sector Project

Sadhuwa Irrigation Subproject, Parsa District

Project Proponent: Department of Irrigation
Prepared by Central Irrigation Development Division No. 4 (Parsa)

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	- Hectare
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 is such effect occurs 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 Sadhuwa 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 Sadhuwa Khola subproject is located in Basdilwa VDC of Parsa district of the Central Development Region of Nepal. It is located in between the latitude and longitude of 27° 06' 58"N to 27° 10' 0"N and 84° 53' 15"E to 84° 56' 41"E, respectively. The headworks lies in ward No.-1 of Basdilwa VDC. The elevation of the area is about 97.00 m above MSL. Its location map is shown in Figure 1.

5. **Accessibility.** The subproject area is easily accessible through a gravel motorable road (12 km south-west from Jitpur, which is 16 km north from Birganj). Most of the main canal and the branch canals can be approached through the existing village road. The nearest market is at Jitpur.

6. **Existing Situation:** The project is the rehabilitation of a FMIS off taking from Sadhuwa River. The name of the source at upstream is Amodevi River whereas downstream the source is known as Madhuwa River. The source is perennial fed by a number of springs located in the Amodevi forest. The Sadhuwa system is providing irrigation facilities to areas on both sides of the river by canals offtaking from the headworks. These canals had been diverting water from the river for many years by constructing earthen and brushwood bund across the river. The repeated construction of the headworks requires big efforts of the farmers. About 80 people work for 6 days to build the bund by engaging two tractors with trailer to carry the soil and brushwood from the forest located 10 km north of the headworks. It was reported that farmers had to repair the earthen bund 3-4 times a year because it is breached by floods. The erosion at the headworks has made the construction of the dam more difficult every year. The system is being operated on rotation during the winter and dry season, when it is operated by the water distributor locally known as "Bhagaita". There are a number of canals offtaking from the Sadhuwa River further downstream of the headworks. Each of these systems builds a dam across the river. The location of diversion of these existing systems seemed to have been planned such that water is available for the downstream systems. The protection of the Amodevi forest is very important and crucial for the sustainability of the irrigation systems in the Sadhuwa River, which has been realized by the farmers in the area. The forest is being managed and protected by the people of 14 VDCs in partnership with district forest office named as Sabhaiya Partnership Forest Management Group.

7. The people from Basdilwa have their traditional water rights on the water to be diverted into the system; however, farmers of Musaili also get irrigation water for ward No. 4, 5, and 6 from the eastern main canal of this subproject. At the same time, Musaili People receive water also from the Madhuwa River Bandh. Ratanpur people do not have their traditional rights over the water to be diverted from the Sadhuwa Bandh (from where water used to be diverted and the site for the proposed headworks). People from Basdilwa have no problem in sharing water with Musaili.

8. There are no irrigation schemes upstream from the present proposed headworks. Madhuwa earthen Bandh is the nearest one lying at about 1.0 km d/s from the proposed subproject (Sadhuwa Bandh). Madhuwa Bandh also has its command area on both sides of the river and farmers have developed irrigation canals on left and right sides of the river. At present both Sadhuwa and Madhuwa Bandh are in operation but in very poor state both in terms of

intake and the conveyance structures. The complete stretch of river is contributing water in the source; hence no scarcity of water has been noticed at Madhuwa Bandh ISP even when the Sadhuwa bandh at U/S is under full operation.

9. In general, field to field irrigation is practiced on the basis of water availability in the source. Only during water scarcity do they irrigate their fields by constructing temporary field channels to minimize loss of water. Water is being distributed on the basis of water availability in the source, traditional water rights, land holding size and the level of contribution in maintenance. The operation and water distribution part is done by water distributor, who is locally known as "Bhagaita". 'Bhagaita' is water distributor who controls not only the operation of intake and outlets but also does water distribution in the canal during operation and identifies damages in the system.

10. During monsoon all canals use water simultaneously. However, in lean supply period rotation is in practice. The severity of the need is also kept in view while allocating water to different canals. The scarcity of water is faced normally in the months of April/May/June.

11. **Command Area:** The gross command area of the subproject is 238 ha and the net command area 202 ha. . A layout map of the sub project area is presented in Figure 2.

12. **Project Components.** The major infrastructure improvements include the construction of a permanent headworks consisting of concrete weir, intake and river bank protection works, canal reshaping, branch canal offtakes, bridges/culverts, and cross drainage structures such as aqueducts, drops etc. Detail of existing situation and proposed interventions in the subproject is presented in Annex 1. A list of proposed structures in the main canal and branch canals is presented below

Main Canal Structures

Type	Numbers
Head Regulator	2
Aqueduct	3
Slab culvert	2
Pipe culvert	10
Canal siphon	1
Tail Structure	2

Branch Canal Structures

Branch Canal Structure Type	Numbers
Drop structures	4
Footbridge	5
Head regulators, sub-branch outlets and unit outlets	56

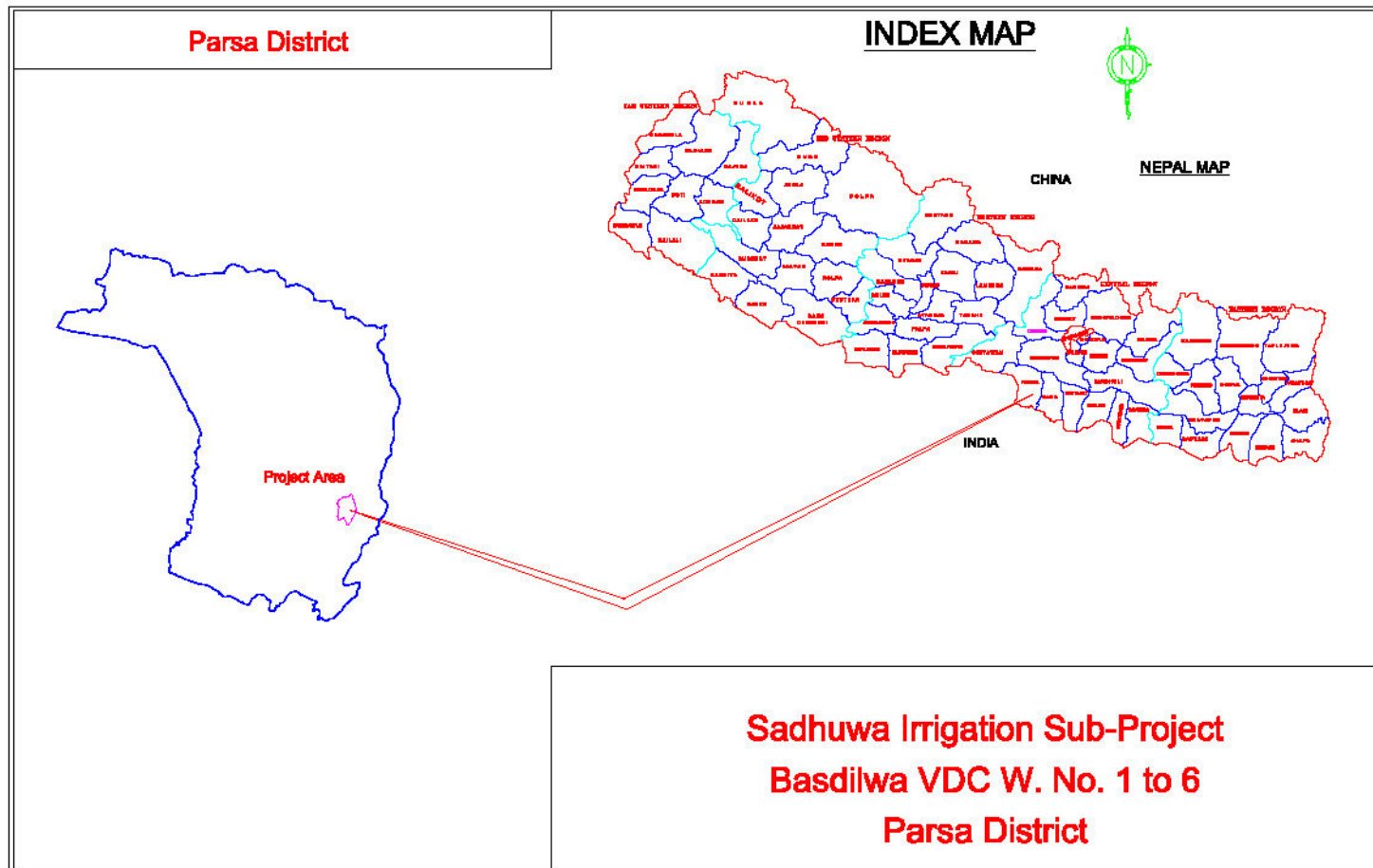


Figure 1: Location Map of the Subproject

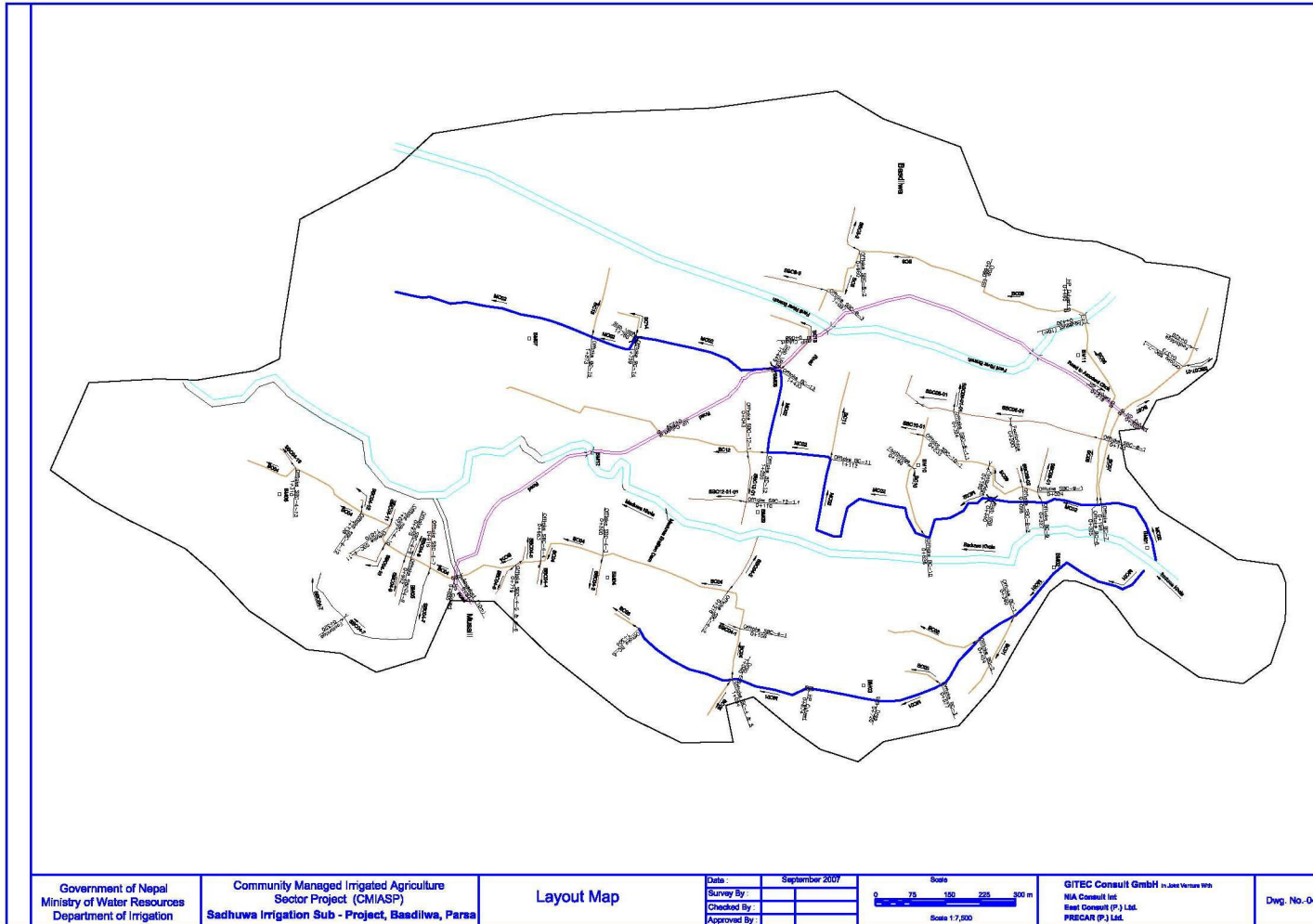


Figure 2: A Layout Map of the Sub project

Table 1: Salient Features of the Sadhuwa Irrigation Subproject

1. Name of Subproject	Sadhuwa Irrigation Subproject
2. Subproject Classification	Rehabilitation
3. Location (VDC and Ward No)	Basdilwa, 1 to 6
4. District	Parsa
5. District Headquarter	Birganj
6. Zone	Narayani
7. Development Region	Central
8. Number of Households	242
9. General Elevation of the Subproject Area	100 msl
10. Slope and Topography of the Subproject Area	flat or level (0 to 3% slope)
11. Population	1,917
12. Total Canal Length	
a) Main Canal	1.304 (MC1) & 2.354 (MC2)
b) Branch Canal	3.533 km
13. Gross Command Area	238 ha
14. Net Command Area	202 ha
15. Cropping Intensity	201% (present) & 232% (future)
16. Name Of Water Source	Sadhuwa Khola
17. Type Of Water Source	Perennial (Spring Source)
18. Catchment Area	4.25 km ²
19. Canal Type	Earthen & RCC Lined
20. Canal Discharge	137 lps (MC1) & 296 lps (MC2)
21. Side Slope	1:1
22. Bed Slope	Shown in the L-Section in Detailed Design
23. Diversion Structure	Concrete Weir with Under Sluice
24. Proposed Subproject Interventions	
Headworks	1 no.
- Slab VRB/HP Culvert	10 nos.
- Aqueduct	2 nos.
- Field Outlet	30 nos.
- Foot Bridge	5 nos.
- Drop Structure	3 nos.
25. Number of people directly involved during construction (estimate)	Skilled: 3,823 man days Unskilled: 19,665 man days
26. Construction/Rehabilitation Period (months)	22 months

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

III. DESCRIPTION OF THE ENVIRONMENT

Physical Environment

13. **Topography.** The scheme is located in the Terai plains in an agricultural area with land that slopes gently from north to south at an elevation of just under 100 m above msl. The Sadhuwa Khola subproject command area lies on both banks of the Sadhuwa River. The existing main canals after reaching the command area tend to be contour canals with the branch canals running down the slight ridges and irrigating to both sides. The canals are earthen with little seepage loss and do not need lining.

14. **Climate.** 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 is at Parwanipur (Station No: - 0911), and is used as reference. Mean annual rainfall – varies from 5.9 mm minimum in Nov to 442.7 mm maximum in July. About 80% of the precipitation occurs in monsoon season from July to September. Following are some important hydro-meteorological observations:

- Mean monthly maximum temperature: varies from 21.6°C in January to 35.6 °C in May
- Mean monthly minimum temperature: varies from 8.4°C in January to 26.0 °C in July
- Minimum evaporation: 1.8 mm in January
- Maximum evaporation: 6.9 mm in May

15. **Soils.** The subproject area has moderately drained light textured soil. Soil texture slightly varies from light to heavy silt moving across the command area from north to the south. The fertility status of the soil is found to be poor to medium in major nutrients of Nitrogen, Phosphorous and Potassium and very poor to poor in organic matter content (0.05 to 6.3%). The soil reaction is dominantly neutral. The micro-nutrient deficiency is generally observed for zinc in case of Paddy. The soil characteristics (texture, drainage, pH etc) are judged good for the existing and proposed crops.

16. **Water Resources.** The perennial Sadhuwa Khola with following flow characteristic is the main water source for the subproject. The catchment area is relatively small at only 4.25 km². The reach of the river upstream of the headworks has considerable perennial spring flows feeding into it, providing substantially more water than is normally expected from streams with such a small catchment area. According to the feasibility study conducted in early 2007, the lowest mean monthly flow is 152 lps in the month of April while the maximum mean monthly flow is expected to reach 5,337 lps in the month of August.

Ecological Resources

17. **Vegetation and Forest.** There is no national forest or community forest within the project command area. There are a number of trees of different species of timber, fodder, fuelwood and fruits within the project command area and homesteads but they are not going to be affected by the project activities.

18. **Wildlife.** As reported by the local people, there are no wildlife habitat as such in the project area and its vicinity. Some jackals and monkeys have been seen within the project command area whereas wild boar and leopard are also reported to be occasional visitors.

19. **Aquatic life.** Fish species like Maugura, Garai, Common carp and Bam have been reported in the Sadhuwa River. These species are mostly local habitat and found all along the river stretch. The fish population behind the earthen dam is reported to be quite high. When the earthen dam is breached the fish catch is reported to be quite high. It could be as high as 200 kg of different species.

Socio-economic Environment

20. Basdilwa and Musaili are the two major settlements located at the head and tail reach of the system, respectively. Basdilwa has higher concentration of indigenous Tharu¹ population but they are not in cultural minorities. There are a larger number of large land holders, and therefore rich or medium farmers, in Basdilwa than in Musaili. The ultra poor are scattered evenly in both settlements. Most of Dalit (occupational caste groups) are ultra poor and vice versa.

21. The main occupation of people in the area is farming. The sample household survey revealed that 87% of households depend on agriculture for their livelihood. Apart from agriculture, 5.4% households supplement their income from business and 7.8% by service. Most of the farmers rear ducks, goats and buffaloes for getting meat and milk, which is often also sold in nearby markets to buy the articles of other primary needs. About 18% of households meet their needs by working as agriculture labour.

22. The labour force from Rich and Middle Level families is more involved in urban based business and foreign employment while those from the poor group are highly mobile from farm to nearby urban industry. 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. 80.5% of sample hh were found fully employed for more than 300 days a year, while 13.2% are unemployed.

¹ ADB defines "indigenous peoples" as groups with social or cultural identities distinct from that of the dominant or mainstream society. "Indigenous Peoples" is a generic concept that includes cultural minorities, ethnic minorities, tribal people, natives, and aboriginals.

23. The education level of the community is poor. Within the command area 1 High school in Solakpur and 1 primary school each in Prasauni and Prasautipur villages were noted. School drop-out is common, even from the primary school located within the village, to join the labour force for family support. But compared to the adjacent Upper Baugi subproject, the literacy rate of farmers of Sadhuwa was found to be much higher at 81.6%. Literacy was found lowest amongst Dalits. Only 2-3 women from the entire area have completed SLC level education. As expressed in the FGD, only a few daughters have studied up to 9th grade and over 95% dropped out after getting married. Among the ethnic groups, the literacy was found higher in Tharu community. On average, a household has 1.04 school going female child as compared to 1.67 boys.

24. 22.4% of the households own Pucca house (cement mortared) while others have thatched huts. 34.7% households have access to electricity. There is no community drinking water supply system. Tubewells with hand pumps are the only source of drinking water. The population has access to primary health facilities as 1 health post is located in the ward no. 8 at Bhedyahi Tole of the VDC.

25. A majority (92%) of farmers produce enough food for themselves. Large farmers meet all their food requirement from their produce, while marginal and landless meet only 33.3% of their food requirements. Those who reported insufficiency of food meet their requirements by working within and outside the village.

26. There has been a change in the age of marriage in recent years. The age of marriage has increased to 17-18 years unlike 12-14 about a decade or two before. Most of the communities in Terai are suffering from dowry system of marriage. It is a system in which a bridegrooms' family has to offer or pay a large amount of cash or kind to the bride's family during marriage. *Tharu* community did not have this system until a few years ago. This practice is increasingly adopted even by Tharus these days.

27. The participation of both men and women in the social affairs has been increasing. Women had participated in casting votes in the previous election whereas men were involved in candidacy and voting also. Jan Jagriti, Basdilwa is a local NGO working in the VDC. Private microfinance institutions (MFIs) like Chimeki and Swabalamban banks are other agencies active in this area. These MFIs target women and provide loan in groups and also provide opportunities for saving.

IV. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS

28. **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.

29. The project will be constructing a permanent weir across the river about 2.0 m above the existing bed level of the Sadhuwa Khola, which will be inundating a small area at the upstream. Area of inundation and stability of the inundation area would be the major environmental impact under the physical parameters. 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	√		The canals carry the surface runoff, would require escape structure. Erosion at the out fall at the drainage.
1.6	Displacement of People and Property	√		A concrete weir and enlargement of canal would inundate mostly public area Private land would be voluntarily provided by farmers without compensation
2	Environmental Problems related to Project Design			
2.1	Watershed Erosion	√		The construction of permanent headworks is going to prevent erosion in the vicinity of headworks and cultivated land.
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
2.4	Over pumping of Groundwater		√	Groundwater will not be used in this

SL	Parameters	Impact		Remarks
		Yes	No	
				Subproject.
2.5	Adequacy of Drainage Planning	√		Some problems at outfall points. Protection will be provided in consultation with WUA.
2.6	Disruption of Existing Farmer Cooperative Systems		√	There are no existing farmers' 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 816 m ³ sand 1,552 m ³ of aggregates and 1,117 m ³ block stone which can be fulfilled from the local market or local quarry. Operation of quarry site for the sub project 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 19,665 unskilled and 3,823 skilled man days. Assuming actual construction working season of 15 months, the average labour requirement per day would be 44 unskilled and 8 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 out side labour will be reside within the work camp it self.
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 will be addressed.
3.8	Temporary Closure of Irrigation System	√		Construction activities are likely to disturb the supply of irrigation water for a short period.
4	Environmental Problems Resulting from Project Operations			
4.1	Effect on downstream water use		√	There are number of irrigation systems offtaking from Sadhuwa Khola at d/s. however there is plenty of water after diversion by Sadhuwa subproject.
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 hazardous
5	Realization of Enhancement Potentials			
5.1	Employment to the local people	√		Construction activities will require construction labors. 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 at present. However they may take up this practice after subproject.
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.

30. 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.

31. 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 Problem Related to Project Location

32. **Flooding and Drainage Hazards:** The area is already irrigated. The water flow in the canal is unregulated. The excess water in the canal is overtopped from many places. There are erosion problems at a number of places where the water from the agriculture land flows out into the natural drains. The proposed intervention will be regulating the flow in the canal with the provision of escape structures. The proposed project will be guiding the critical drainage outfalls by providing the outfall structures. These interventions will be positive impact of high magnitude, local extent and long term duration.

33. *The escape structures will be provided at the appropriate locations so that the excess water in the canal can be discharged safely into the natural drains and a number of drainage outfall structures will be constructed in consultation with the farmers.*

34. **Displacement of People and Property:** The proposed pond level at the headworks site is above the field level of the surrounding land. Hence the construction of the headworks is likely to submerge 4.1 ha of land upstream of the weir. However, the flood embankment will reduce the flooded area to 1.28 ha. Some of the canals will be enlarged or reshaped. The enlargement will be quite small not exceeding 30 cm on either side. People agreed to make the enlargement without any compensation. This impact is considered low in magnitude, local extent and long term duration.

35. *Embankment along both river banks has been proposed to prevent water entering into the farmland.*

Environmental Problem Related to Project Design

36. **Watershed erosion:** The construction of the permanent headworks is going to prevent the erosion in the vicinity of the headworks and the erosion of the cultivated land. This is the positive impact of high magnitude, local extent and long term duration.

37. **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. Some protection will be provided in consultation with the farmers. This is the positive impact of high magnitude, local extent and long term duration.

38. **Use of Chemicals in Agriculture and Horticulture:** The project area being located very close to the big market like Birgunj, a border town with India, the availability of chemical fertilizers is very convenient. As reported, even the vendors bring them to farmers' door step at the comparatively lower price smuggled from India. The use of chemical fertilizers is likely to be increased as the project encourages irrigated 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.

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

40. **Selection of Pesticides:** Majority of farmers of the project area are aware of the toxicity of the 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.

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

42. **Canal Management:** The proposed project intends to operate two main canals and 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.

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

44. **Passageway:** There are some passageways in the existing canals which is not adequate for movement of the people. Hence additional passageways, 5 foot bridges and 10 slab culvert/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:

45. 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.

46. 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 18 months.

47. 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.

48. **Excavations.** Excavation will be at the headworks and 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 cause 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.

49. *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.*

50. **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.

51. *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.*

52. **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.

53. *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.*

54. **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.

55. *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*

56. **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.

57. Accidental insurance will be covered for all construction workers and staff. An amount of Rs. 52,000.00 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.

58. **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.

59. **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

60. **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.

61. **Mosquito Breeding.** In an irrigation project, the water is flooded in the field especially during the monsoon 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.

62. **Hazards associated with the Use of Toxic Chemicals.** Pesticides are 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. As reported the farmers bury the pesticides bottles after use. They are not reused for any purpose. A number of farmers reported having undergone the IPM (integrated pest management) training in which the farmers are trained 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.

63. **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 subproject 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 subproject 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

64. **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.

65. **Livelihood Programs for Landless Households.** There are 193 ultra poor/landless households in the subproject area who work as tenants for other households who own the land. The proposed subproject intends to enhance the economic condition of these households by implementing different livelihood programs.

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

66. Since the proposed subproject is an existing FMIS, there is no other option for the headworks site and canal alignment. There were options of the type of headworks and lining of the canal. A concrete weir has been proposed in consultation with the WUA members and canal lining has not been proposed as surface of the canal is stable and seepage loss through canal is negligible.

VII. INSTITUTIONAL ARRANGEMENTS

67. **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 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).

68. 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.

69. **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 PDMED	Management of monitoring and evaluation data
Screening	RPSU/SMU	Screen the project results in light of environmental and other criteris
Planning	RPSU/SMU/firms ²	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,

		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

70. 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.

71. 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.

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

Table 4: Environmental Management Plan

S	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
1	Environmental Problem due project location							
	Displacement of People and Property	Affected households have agreed to give away the land without any compensation.	Design Office	MOU agreement	No cost	SMU	MOU Agreement	ISPMC
	Flooding and drainage hazards	Provide escape structures	Design Office	Include in det. design	No cost	Design team	provide escape structures in the design	ISPMC
2	Environmental Problem related to project design							
	Watershed erosion	Provide permanent headworks	Design Office	Include in det. design	No cost	Design team	provision of permanent headworks	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	Provide passageway structures	Design Office	Include in det. design	No cost	Design team	provide passage as agreed with the farmers	ISPMC
	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	spoil disposal sites	SMU/WUA
	Quarry sites							
	Work Camp Location and Operation: (i) temporary air and noise pollution from machine operation; (ii) water pollution from storage and use of fuel,	(i) work camp will be located away from the settlement area. (ii) no trees shall be cut and removal of vegetation shall be minimized (iii) used oil and lubricants shall be recovered and reused or removed	Within the sub-project		Part of civil construction cost	Contractor	Location of the work camp	SMU/WUA

Table 4: Environmental Management Plan

S	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
	oils, solvents, and lubricants; (iii) unhygienic conditions from laborers.	from site.						
		(iv) will make own arrangements for water and sanitation	Work camp		Included in environmental cost (Budget: Rs 30,000.00)	Imp: Contractor	disposal and sanitary facilities in the work camp	SMU/WUA
		(v) 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, 30,000.00)	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 airborne dust resulting and excessive noise resulting annoyance and potential hazard to human populations	(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		SMU/WUA
	Occupational health and safety	(i) Buy accident insurance to all workers. (ii) provide safety gears	Construction site	Provide insurance &	Included in environmental	Imp: Contractor	insurance policy	Mon: SMU/WUA

Table 4: Environmental Management Plan

S	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
		such helmets, boots, ear plug, mouth mask to the worker and labours		safety gears	cost (Budget Rs. 52,000.00)			
	Temporary closure of irrigation system	Plan the head work construction during dry season	Head works		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								
	Hazards 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
	Hazards 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	Include in LEP cost	Imp: SMU	Training on LEP	Mon: WUA
	Feasibility of cooperatives	Provide institutional development training	Within sub project area	Training	Include in Institutional development plan cost.	Imp: SMU	Training on Institutional development training	Mon: WUA

IX. PUBLIC CONSULTATION AND DISCLOSURE

73. This IEE report has been in close consultation with WUA members and lead farmers who participated in the walk through survey. The walk through survey was carried out from 7th to 10th February 2009. The existing situation of the headworks and canal was noted by GPs tracking. A long list of the required intervention was noted. The required intervention was prioritized in consultation with the participating farmer. On 10th February, 2009 itself a formal meeting was held with the WUA members and agreed with them on the proposed intervention that could be under taken by the project. All the highly prioritized interventions were included whereas the medium and low priority interventions were excluded.

74. A list of the WUA members is presented here below:

S. N.	Name	Designation	Village
1	Mr Dharmendra Pd. Tharu	Chairman	Basdilwa-2
2	Harendra Pd. yadav	Vice-Chairman	Musaili-6
3	Devpoojan Pd Gauro	Secretary	Basdilwa-1
4	Mr Tulasi Pd Mahato	Treasurer	Basdilwa-1
5	Mr Shyam Babu yadav	Member	Musaili-6
6	Mr Indradev Mahato Tharu	Member	Basdilwa-1
7	Mr Dev Bahadur Safi	Member	Basdilwa-1
8	Mr Ramoon Ram	Member	Basdilwa-3
9	Ms Ram Dulari Devi	Member	Musaili-5
10	Ms Sunar Bati Devi	Member	Basdilwa-5
11	Ms Panchiya Devi	Member	Musaili-6

X. FINDINGS AND RECOMMENDATIONS

75. 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.

76. 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

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

78. 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

A. Main Canal 1

Item No	Chainage & WayPoints		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To					
1	0+000		Headworks				
2	0+026		VRB (5M)	Road canal crosses the	Road Crossing	VRB (H)	
3	0+779		VRB (5M)	Road canal crosses the	Road Crossing	VRB (H)	
4	1+054					Start of Main canal 2	
5	1+206					Existing Canal End	
6	1+283		Branch Canal	Diversion command area for	Fulfill demand of Command area	Branch L/S	
7	1+748		Branch Canal	Diversion command area for	Fulfill demand of Command area	Branch L/S	
9	2+548		Pipe Culvert (5m)	Road Crosses the Canal	Road Crossing	Pipe Culvert (5m)	
10	2+998		Pipe Culvert (Existing)	Road Crosses the Canal	Road Crossing	Pipe Culvert	

Item No	Chainage & WayPoints		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To					
11	3+016		Branch L4 Start	Diversion for command area	Fulfill demand of Command area	Branch L/S	
12	3+378		Branch Canal	Diversion for command area	Fulfill demand of Command area	Branch L/S	
13	4+197		Pipe Culvert, Branch Canal	Road Crosses the canal	Road Crossing	VRB Pipe Culvert and Branch Canal	
14	4+568		Pipe Culvert (7.5m), Hulaki road	Road Crosses the canal	Road Crossing	Pipe Culvert	
15	4+886					End of Main canal 1	

Main Canal 2 (1+054 of Main Canal 1)

Item No	Chainage & WayPoints		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To					
1	0+000					Start of Main canal 2	
2	0+360		Branch canal start	Diversion for command area	Fulfill demand of Command area	Branch Canal	
3	0+727		Pipe Culvert (5m), Branch canal start	Road Crosses the canal	Road Crossing	VRB Pipe Culvert (5m), Branch Canal	
4	0+952		VRB (3m)	Road Crosses the canal	Road Crossing	Pipe Culvert (5m)	
5	1+168		Branch Canal Start	Diversion for command area	Fulfill demand of Command area	Branch Canal	

Item No	Chainage & WayPoints		Structure	Condition	Severity of the Problems on System Operation	Solution (Priority: H, M, or L)	Sketch
	From	To					
6	1+258		VRB(5m)	Road Crosses the canal	Road Crossing	VRB (5m)	
7	1+319		VRB (5m)	Road Crosses the canal	Road Crossing	VRB (5m)	
8	1+426		VRB (5m)	Road Crosses the canal	Road Crossing	VRB (5m)	
9	1+588		VRB (5m)	Road Crosses the canal	Road Crossing	VRB (5m)	
10	1+804		VRB (5m)	Road Crosses the canal	Road Crossing	VRB (5m)	
11	2+017		Outlet, VRB (6m)	No Structure, uncontrolled	No controlled outlet causing bank erosions	Outlet (H) and VRB (6m)	
12	2+265		VRB (3m)	Road Crosses the canal	Road Crossing	VRB (5m)	
13	3+289		Branch canal Start	Diversion for command area	Fulfill demand of Command area	Branch Canal	
14	3+680					End of Main canal 2	