

# Environmental Assessment Document

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## Initial Environmental Examination

Loan Number: 2102 NEP  
July 2009

### Nepal: Community-Managed Irrigated Agricultural Sector Project

### Nagin Sarkari Kulo Irrigation Sub-Project, Panchthar

Prepared by the Government of Nepal

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**INITIAL ENVIRONMENTAL EXAMINATION  
NAGIN SARKARI KULO IRRIGATION SUB-PROJECT, PANCHTHAR DISTRICT.**

**I. EXECUTIVE SUMMARY**

1. This initial environmental examination (IEE) was undertaken for the **Nagin Sarkari Kulo Irrigation Subproject** under Community Managed Irrigated Agriculture Sector Project under ADB Loan 2102 NEP 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.

2. The subproject does not pass through any environmentally sensitive ecological area. It is the rehabilitation of the existing irrigation scheme where the system is already in operation since many years. Apart from some construction related impacts, the subproject will have minimal impact on the environment. Hence the subproject has been categorized under Category B as per the Environment Assessment Policy, 2002.

3. This Initial Environmental Examination (IEE) was based on data collected during the Joint Walkthrough Survey. The objective of the IEE is to analyze the adverse environmental impacts arising from site selection, design, construction and operation of the subproject. The mitigation of any such effect to acceptable levels was sought through implementation of a set of clearly defined and costed mitigation measures which have been included in the cost estimates.

4. On the basis of the IEE, an Environmental Management Plan (EMP) is prepared listing the environmental impacts and their mitigation measures, as well as the agencies responsible for mitigation and monitoring. Most mitigation measures relate to construction activities, although the scale of the construction is small.

**II. SUBPROJECT DESCRIPTION**

5. The details of the subproject description have been presented in the main subproject preparation report. The main features of the subproject are presented in Table J-1.

**Table J-1: Salient Features of the Subproject**

1.	Name of the Subproject	:	Nagin Sarkari Kulo Irrigation Sub-project
2.	Sub-Project Classification	:	Rehab / Hill
3.	Location (Ward No. & VDC)	:	Nangin 3, 4, 5, 8 & 9
4.	District	:	Panchthar
5.	District Headquarter	:	Phidim
6.	Zone	:	Mechi
7.	Development Region	:	Eastern
8.	No. of Households	:	264
9.	DAG Households	:	68
10.	Population	:	1584
11.	Land holding		
	Landless	:	37
	Small /Marginal	:	108
	Middle	:	81
	Large	:	38
12.	Accessibility (Nearest Road Head)		
	Nearest Road head	:	Nagin (within Command Area)

		Phidim 12 Km Blacktop Road	
	Nearest Airport	:	Bhadrapur
	Nearest Market	:	Phidim
13.	Command Area Characteristics	:	Moderate Sloping Terrain
14.	Total Canal Length		
	Main Canal	:	5410 m
	Branch Canal (3 Nos)	:	2246 m
15.	Gross Command Area	:	135 ha
16.	Net Command Area	:	101 ha
	Existing Area	:	101 ha
	Extension Area (if any)	:	None
17.	Name of Source	:	Soti khola & Khung khola
18.	Type of Source	:	Perennial
19.	Catchment Area	:	0.3 & 1.33 Sqkm
20.	Canal Type	:	Earthen
21.	Canal Discharge	:	100 lps
22.	Side Slope	:	1:1
23.	Bed slope	:	1:500
24.	Existing Diversion Structure	:	Temporary Side Intake and Diversion
25.	Physical facilities proposed		
	Main and Branch canal works (m)		Reshaping                      Realignment                      Extension
	Main Canal	:	5410 m
	Branch Canals	:	2246 m
	- Headworks/Diversion Structure	:	Core Wall with Side Intake – 2 Nos
	Canal Lining (m)		Main Canal                      Branch Canal
	Both Side		547                                      115
	One Side	:	245                                      -
	HDPE Pipe	:	120
	- VRB (Nos)	:	1
	- Escape (Nos)	:	1
	- Retaining walls (m)	:	48 (3m height) 68 (2m height) as toe wall
	- Super passages (Nos.)	:	7 (3m span – 4nos. and 6m span –3 nos.)
	- Division Box (Nos.)	:	3
	- Outlet (Nos.)	:	17                                      14
	- Foot bridge (Nos.)	:	4
26.	Total estimated cost including contingency & VAT	:	NRs14,415,718.42
27.	Number of people directly involved during construction (from Quantity Estimate)		Skilled: 1,561 man-days Unskilled: 7,533 man-days
28.	Construction/Rehabilitation Period (months)		12 months

Notes: VDC = Village Development Committee; msl = meters above sea level; km = kilometers; ha = hectares; km<sup>2</sup>= square kilometers; RCC = reinforced concrete cement; VRB = Village Road Bridge

### III. DESCRIPTION OF THE ENVIRONMENT

#### Physical Environment

6. **Topography.** The command area is located in the Mahabharat range and characterized by moderately sloping terrain. The command area is dissected by 7 numbers of small drainage. The area is well drained and there is no water logging problem. The command area has an average elevation varying from 1560 m to 1200 m. The main canal is running along contour where as branch canals are across the contour.

7. **Soils.** The soils of the area are characterized by loamy texture with clay and gravel mixed and moderately well to excessively drained.

8. **Meteorology and Hydrology.** The water source for the irrigation system is Soti Khola & Khung Khola. No gauging data for this river/stream are available and the discharge has been assessed with the MIP flow assessment method. The hydrological data can be summarized as follows;

Catchment Area	0.3 & 1.33 Sq km
Climate	Temperate
Hydrological Region	4
Average Precipitation	2096 mm
Mean Daily Max. Temp	20.3 ° C
Mean Daily Min Temp	11.7 ° C
Name of source	Soti Khola & Khung Khola
Type of source	Perennial
Measured Discharge	350 l/sec (both Kholas)
Measured Date	24 July, 2009

9. **Source of Construction Materials.** Sand is available from Feme Them Khola at 6 km lead. Stone and gravel (hand-broken gravel) are locally available at 500 m lead. Timber is available from local Salleri Community Forest. Cement, reinforcement steel and fuel for vehicles/ equipments are available from market in Phidim at 12 km lead.

#### Biological Environment

10. **Vegetation and Forest.** There are a number of trees of different species of timber, fodder, and fuel wood within the subproject command area and the community forest. The main tree species in the area are Chilaune (*Schima wallichii*), Salla (*Pinus roxburghii*), Uttis (*Alnus nepalensis*), Katus (*Castanopsis indica*), Tite Chapo, Mahuwa (*Engelhardtia spicata*), Chiuri (*Bassia butyracea*), Siris (Red) (*Albizzia chinensis*), Bamboo (*Dendrocalmus strictus*), Dale Grass, Paiyun (*Prunus cerasoides*), Kutmiro (*Litsea polyantha*), Badahar (*Artocarpus lakoocha*),

Koiralo (*Bahunia variegata L.*), Dudhilo (*Ficus nerifolia*) and Lokta. However, the subproject activities will not affect any tree.

11. **Wildlife.** As reported by the local people, Porcupine (*Hystrix indica*), Deer, Kalij (*Lophura leucomelanos*), Jackal (*Canis aurevs*) and Wild Cat (*Panthera tigris tigris*) have occasionally been seen in the command area.

12. **Aquatic life.** Local people reported that Asala (*Schizothorax richardsonii*), Hile, Gadera and Kabre (*Glyptothorax trilineatus*) are found in the source river.

### **Socio-economic and Cultural Environment**

13. The total number of households in the subproject area is 264 of which 37 are landless, 108 households have less than 0.5 ha, 81 households have between 0.5 and 2.0 ha and 38 households have more than 2 ha land. With an average household size of 6.0 the total population in the subproject area comes to 1,584.

14. The overall literacy rate amongst the population is 31.7% with male literacy rate of 35.3% and female literacy rate of 28.3% which is comparatively lower than the national and district average.

15. The major occupation of 97% of the population is agriculture, with the most important secondary sources of income being Service. 14.3% of the household have year round food sufficiency while 28.2% of the household have food sufficiency for 6 to 9 month per year, 19.4% population have food sufficiency for 3-6 months and the remaining 38.1% population have food sufficiency for less than 3 months in a year..

16. The average annual household income in the subproject area is NRs 104,259 while the average annual expenditure is NRs 73,120.

17. With the assistance of related NGO employed by the CMIASP landless, marginal farmers single women headed households and disadvantaged group (DAG) residing in the subproject area have been identified. The total of 68 households out of 264 can be categorized as DAGs.

18. Women still play a disproportionately large role in agriculture production while their control over household assets and their role in decision making is not in proportion with their contribution to the house hold income. The average proportion of control by women over household assets is 33.4% and in decision making 43.6%.

## **IV. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS**

19. **Delineation of geographical boundary of zone of influence (Zol):** The subproject 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, labor camp sites etc. (iii) low impact area: This will cover the adjoining areas within 200 to 500 m (depending upon the settlement pattern) from the boundary of the sub project area of the VDC that are likely to be affected.

20. The screening of the potential impacts due to the subproject activities is presented in Table J-2.

**Table J-2: Screening of Potential Impacts**

SN	Parameters	Impact		Remarks
		Yes	No	
<b>1</b>	<b>Enhancement of Positive Impacts</b>			
1.1	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.
1.2	Community water supply in command area		√	The command area has existing water supply (spring water). Canal waters are not used for domestic purpose and will not be used after subproject implementation.
1.3	Aquaculture in command area		√	At present no farmer practice aquaculture within the command area. It is unlikely it will change even after subproject implementation.
1.4	Livelihood programs for landless households	√		Construction activities will require both skilled and unskilled laborers. The subproject will also provide livelihood trainings to enhance economic conditions of landless households.
1.5	Feasibility of cooperatives	√		The subproject will implement institutional development activities to strengthen capacity of water users associations which could function as a cooperative to support the farmers.
<b>2</b>	<b>Environmental Problems due to Subproject Location</b>			
2.1	Encroachment into Areas of Conservation Significance		√	There are no conservation areas (wetlands and protected forests) within the Subproject command area
2.2	Impediments to Movements of Wildlife, Livestock and People		√	Being an existing canal, there won't be any additional impediments.
2.3	Encroachment on Historical and Cultural Sites		√	There are no historical and cultural sites along the alignment of the canal and its vicinity.
2.4	Water Resource Conflicts		√	The source is not used for any other purpose. Hence water resource conflict is not foreseen.
2.5	Flooding and Drainage Hazards		√	The canal alignment and the command area are in hill slope, Hence flooding and drainage hazard are not major concern.
2.6	Displacement of People and Property		√	There will not be any land acquisition for the subproject.
<b>3</b>	<b>Environmental Problems related to Subproject Design</b>			

SN	Parameters	Impact		Remarks
		Yes	No	
3.1	Erosion and Landslide along Canal Alignment	√		Intakes will be provided to control discharge in the canal and prevent erosion. Necessary protection work (retaining/toe wall) would be provided at appropriate places along canal alignment to prevent erosion. Outlet structures will also control water flow and reduce erosion. Bioengineering measures are also proposed.
3.2	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
3.3	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
3.4	Over pumping of Groundwater		√	Groundwater will not be used in this Subproject.
3.5	Adequacy of Drainage Planning		√	The subproject being in hill slope drainage would not be a problem
3.6	Disruption of Existing Farmer Cooperative Systems		√	There are no existing farmers' cooperatives within the command area.
3.7	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.
3.8	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.
3.9	Canal Management	√		The operation and maintenance (O&M) of the existing irrigation system has been in place. The (O&M) of the canal has to be worked out.
3.10	Passageways	√		The existing passageways are not sufficient for movement of people and livestock. The Subproject will increase the number of crossings and passageways.
3.11	Scouring Hazards		√	The system has been in operation for some years. Scouring problems has not been reported. Canal beds are stable
<b>4</b>	<b>Environmental Problems Related to Construction Stage</b>			
4.1	Excavation	√		The excavation will be mainly at structure sites. Some excavation for canal would be required which would be done by WUA.
4.2	Construction material sites (Quarry Sites)		√	The construction work will require 356.9 m <sup>3</sup> sand, 203.9 m <sup>3</sup> aggregates and 888.2 m <sup>3</sup> stone which can be fulfilled from the local market or local quarry. Operation of quarry site may not be needed.
4.3	Work camp location and operation		√	Both WUA and contractor will establish work camp in locally rented house. Thus, new area for camp will not be required.

SN	Parameters	Impact		Remarks
		Yes	No	
4.4	Labor camp		√	The subproject requires 7 skilled and 32 unskilled workers for the construction period of 8 month. Most of the workers will be fulfilled from the local area. Hence labor camp need not be operated. Outside laborer will reside in local rented houses.
4.5	Stockpiling of materials	√		The construction material will be stored at the convenient locations for the construction activities.
4.6	Operation of construction equipment and transport	√		No heavy construction equipments are needed. Only small dewatering pumps, mixers, vibrators, etc will be used which do not contribute major air pollution. Tractors and trucks would be used for material transportation.
4.7	Occupational health and safety	√		Occupational health and safety of the workers will be addressed
4.8	Temporary Closure of Irrigation System	√		Construction activities are likely to disturb the supply of irrigation water in the existing system. Steps would be taken to minimize the effect to the farmers.
<b>5</b>	<b>Environmental Problems Resulting from Subproject Operations</b>			
5.1	Effect on downstream water use		√	Water in the source river is high compared to the water requirement of the system. Hence effects on downstream users have not been foreseen.
5.2	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.
5.3	Changes in groundwater hydrology		√	The Subproject being in hill area recharge of groundwater is unlikely
5.4	Mosquito Breeding		√	The command area being in hill, mosquito breeding is not a big concern.
5.5	Hazards associated with the use of toxic chemicals	√		Use of pesticides for the pest control could be hazardous to the people and livestock
5.6	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

21. 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 may incur most significant environmental impacts. 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.



22. 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 extent. 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

### Enhancement of Positive Impacts

23. **Employment Opportunity to the Local People.** The construction work of the subproject would require both skilled and unskilled labor. Semi skilled and unskilled labors are available in the subproject area and 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 labor. WUA will also be awarded with construction works up-to their capability with upper limit of NRs. 6 million.

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

25. **Agricultural Development and Commercialization that will increase Income Level.** Agriculture Development Plan (ADP) and Program will be provided to local farmers. The plan includes trainings, demonstration farming, agriculture extension and support to farmers through DADO. The cost will be included in ADP cost.

26. **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 subproject area. The WUA will have the key role to play in these activities. For the subproject 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.

### Environmental Problem Related to Subproject Design

27. **Erosion and Landslide along Canal Alignment.** Uncontrolled water enters the canal and over flow from it causing erosion in hill side and slide of canal section. The Subproject will provide two simple intakes with overflow escapes which will control discharge in the main canals. Necessary protection work (retaining/toe wall) would be provided at appropriate places along canal alignment to prevent erosion. Retaining wall will be provided along the chainage 0+000 to 0+030 along main canal 1 to prevent erosion of outer bank due to river. Toe wall will be provided along chainage 0+060 to 0+080 along main canal 1 to prevent slide of hill slope. There is uncontrolled flow in outlets due to absence of any structures. Outlet structures would

be provided to control water flow and prevent bank cut and erosion. Bioengineering measures are also proposed to stabilize the hill slope along the canal alignment. This is the positive impact of high magnitude, local extent and long term duration.

28. **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. This is positive impact of high magnitude, local extent and long term duration.

29. **Canal Management:** The proposed subproject intends to rehabilitate the existing canal system. The operation and maintenance of the system will be the responsibility of the farmers themselves. The canal system has its 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.

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

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

### **Environmental Problems Related to Construction Stage**

32. The subproject will use labor-based, environment-friendly, and participatory approach, the important features of which are:

- Use of local people as labor, 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.

33. Significant adverse 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.

34. 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.

35. **Excavations.** Major excavation will be at the structures locations. But as the structures are small, quantity of excavation would not cause adverse effects that cause silt run-off, induced erosion, loss of potential cropland, loss of vegetation. After construction, most of the excavated material would be reutilized in backfilling work.

36. *Mitigation measures include: (i) confine operations to the dry season; (ii) spoils 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. Productive top soil can be spread on agriculture field unless they are acidic and/ saline spoils.*

37. **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 (iv) disturbance to wildlife.

38. *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) work camp will not be located in wildlife habitats, restriction and control of wildlife harassment, illegal hunting and poaching; (v) water and pit latrines facilities shall be provided for laborers; (vi) used oil and lubricants shall be recovered and reused or removed from site by the Contractor; (vii) at conclusion of the Subproject, all wreckage, rubbish, or temporary works that are no longer required shall be removed or given to local residents; (viii) all temporary structures, including office buildings, shelters, and latrines shall be removed; (ix) sites shall be restored to near natural or stable conditions; (x) exposed areas shall be planted with suitable vegetation; and (xi) the Subproject proponent shall report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of the works.*

39. **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.

40. *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.*

41. **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.

42. *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*

43. **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.

44. *Accidental insurance will be covered for all construction workers and staff. An amount will be 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. Clean water and sanitary pit-toilets will be provided at work areas and camps. Mosquito net will be provided to all the laborers at camp.*

45. **Temporary closure of irrigation system.** The construction activity in the canal system is likely to disturb the supply of the irrigation water during construction period. Hence the provision of temporary closure of irrigation system will have to be made in consultation with WUA.

46. *Mitigation Measures: The construction activities will be planned in consultation with the WUA members. The intakes 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**

47. **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 are not aware of the toxicity of the pesticides. Use of pesticides in the project area is nearly non-existent. 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.

48. **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. Hence the impact is considered of low magnitude, local in extent and long term in duration.

## VI. ANALYSIS OF ALTERNATIVES

49. Since the canal system is an existing FMIS, alternate site for headwork, intake and alignment of canals were not considered. There were options of the type of diversion structure, intake and lining of the canal. Bed bar with gabion protection has been selected as diversion structure. Side intake with overflow escape has been selected for both intakes. There was number of options for the canal lining namely: soil cement lining, plastic sheet lining, geotextile lining and cement concrete lining. The farmers preferred to have cement concrete lining.

## VII. INSTITUTIONAL ARRANGEMENTS

50. **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 (MoEnv). It holds overall responsibility for environmental policy. The principal legislation for environmental safeguarding is the 1997 Environmental Protection Act (EPA) and its rules 1997 (amendment 2007). Implementation of the EPA is the responsibility of the MoEnv 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 Ministry of irrigation (MOI). Both DOI and MOI 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).

51. 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 (IEE) 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 2007 will not be required.

52. **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 in Table J-3.

**Table J-3: Institutional Responsibilities for Environmental Management**

Subproject Stage	Responsible Organization	Responsibilities
Overall	ISPM Consultants	Support capacity development of environmental planning, monitoring, and management
	EB is 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 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 Irrigation	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

53. 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.

54. 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.

55. Bioengineering measures and framework for implementing environmental management plan is shown by Table J-4.

**Table J-4A: Bioengineering Measures**

Chainage		Physical Feature (Location)	Potential Environmental Impact	Suggested Protection Measure		Estimates for bio-engineering measures	
From	To			Upslope	Downslope	Area (m <sup>2</sup> )	Cost (NRs.)
0+480	0+510	Minor slips	canal seepage/overtopping	Reforestation/re-vegetation	Masonry retaining wall	65	9,750
0+990	1+020	Minor slips	canal seepage/overtopping	Drainage & re-vegetation	Both side lining	30	4,500
1+150	1+170	Minor slips	water flow/saturation	Drainage & re-vegetation	Dry stone protection	52	7,800
1+745	1+755	Minor slips	canal seepage/overtopping	Reforestation/re-vegetation	Masonry retaining wall	65	9,750
2+110	2+118	Minor slips	canal seepage/overtopping	Reforestation/re-vegetation	Masonry retaining wall	50	7,500
2+330	2+335	Minor slips	canal seepage/overtopping	Reforestation/re-vegetation	Masonry retaining wall	65	9,750
2+950	2+955	Minor slips	canal seepage/overtopping	Reforestation/re-vegetation	Masonry retaining wall	66	9,900
<b>TOTAL</b>						<b>393</b>	<b>58,950</b>

\*Note: unit rate for bio-engineering at an average of NRs. 150/m<sup>2</sup>  
 This cost includes the maintenance of planting for 1 year (15% allowance)

**Table J-4B: Environmental Management Plan**

SN	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
<b>1</b>	<b>Enhancement of Positive Impacts</b>							
	Employment to beneficiaries	Provide work to WUA in accordance with their capability to maximum limit of NRs. 6 million	Subproject work	Equitable representation of APs/beneficiaries	No cost	WUA	Payroll of WUA	SMU//RPSU/CPMO
	Livelihood programs for landless households	Provide Livelihood enhancement Program (LEP) training to the targeted people	Command Area	Training	Include in LEP cost	SMU	LEP Training	WUA/RPSU/CPMO



SN	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
	Agriculture Development and commercialization to increase income level	Prepare Agriculture Development Plan (ADP). Provide training and support to farmers them through DADO	Command Area	Training, demonstration, agricultural extension	Include in ADP cost	DADO	No. of Training Response of farmers	PIU, MOAC, WUA, RPSU, CPMO
	Feasibility of cooperatives	Provide institutional development plan (IDP) training	Command Area	Training	Include in IDP cost.	SMU	IDP training	WUA/RPSU/CPMO
<b>2</b>	<b>Environmental Problem related to Subproject Design</b>							
	Erosion and Landslide along Canal Alignment	Provide intake, retaining walls and outlet structures	Along canal alignment	Include in det. design	No cost	Design team/ISPMC	provision of intake, retaining wall & outlets	RPSU/CPMO
		Bioengineering measures			NRs.58,950			
	Canal management	Prepare subproject specific water management plan and O & M Plan.	Design Office	Plan preparation	No cost	Design team/ISPMC	Prepare site specific water management plan	RPSU/CPMO
	Passageway	Provide passageway structures	Design Office	Include in det. design	No cost	Design team/ISPMC	provide passage as agreed with the farmers	RPSU/CPMO
<b>3</b>	<b>Environmental Problem related to Construction Stage</b>							
	Excavation	(i) confine operations in the dry season; (ii) spoils shall be disposed of at the designated locations	Within the subproject	designate the spoil disposal area	Part of civil construction cost	Contractor/WUA	spoil disposal sites	SMU/WUA/RPSU/CPMO
	unhygienic conditions from laborers	(v) will make own arrangements for water and sanitation	Work camp	Observation	Included in environmental cost (Budget: NRs.40,000)	Contractor/WUA	disposal and sanitary facilities in the work camp	SMU/WUA/RPSU/CPMO
	Disturbance to original site	(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 subproject	Observation	Included in environmental cost (Budget: NRs.40,000)	Contractor	Condition of the work camp site before the issue of completion certificate	SMU/WUA/RPSU/CPMO

SN	Impact	Mitigation Measures	Location	Method	Cost	Responsible agencies for Implementation	Monitoring parameters	Responsible Agency for Monitoring
	<b>Stockpiling of Materials:</b> (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	Contractor	Inspection of the construction material stocking site.	SMU/WUA/RPSU/CPMO
	<b>Operation of construction equipment and transport:</b> 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	Contractor	Dust level Noise level	SMU/WUA/RPSU/CPMO
	Occupational health and safety	(i) Buy accident insurance to all workers. (ii) provide safety gears such helmets, boots, ear plug, mouth mask to the worker and laborers	Construction site	Provide insurance Provide safety gears	(Budget: NRs.7,800) (Budget: NRs.46,800)	Contractor	insurance policy Safety gears	SMU/WUA/RPSU/CPMO
	Temporary closure of irrigation system	Plan intake construction during dry season Make alternative arrangement to keep the canal running	Intake site Canals	Construction plan Observation	No cost Part of civil construction cost	Contractor	Construction plan Inquiry on canal closure	SMU/WUA/RPSU/CPMO
<b>4</b>	<b>Environmental Problems Resulting from Subproject Operations</b>							
	Hazards associated with the use of toxic chemicals	Avoid using pesticide to the extent possible. (Use IPM technique)	Command area	Pest control by IPM	No cost	Farmers	Use of pesticide in the crops	DADO
	Hazards associated with the use of mineral fertilizer	Use recommended dose of inorganic fertilizers	Command area	Application of fertilizers	No cost	Farmers	Use of chemical fertilizer in the crops	DADO

\* insurance premium for NRs. 100,000 per worker = NRs. 200 per year (covers worker disability and death only)

\* safety gear cost = NRs. 1,200 per person

Note: The environmental cost of each subproject should be 2% of the total subproject infrastructure cost as stipulated in Financial Regulation Amend, 2066. The remaining fund after the above mentioned environmental cost would be placed as provisional sum.

**Table J-5: Cost Estimate for Environmental Enhancement and Mitigation Measures**

<b>SN</b>	<b>Environmental Management Measures</b>	<b>Activities</b>	<b>Estimated Budget (NRs.)</b>
<b>1</b>	<b>Beneficial Impacts Augmentation Measures</b>		
1.1	Training to IDD/IDSD staff; WUA construction monitoring committee on environmental monitoring and reporting	Training program combined with technical training on construction best practices	25,000
		<b>Sub-total (1)</b>	<b>25,000</b>
<b>2.</b>	<b>Adverse Impacts Mitigation Measures</b>		
2.1	Bio-engineering, if any	Grass plantation, Tree/Shrub plantation, Brush layering, Palisade, Rip-rap drain, Check-dam etc. in landslide and erosion area	58,950
2.2	Insurance to workers	NRs. 200 per year per worker	7,800
2.3	Safety gears to workers	NRs. 1,200 per worker	46,800
2.4	Compensation of properties	Under Resettlement Plan	All voluntary land donation
2.5	Rehabilitation of community infrastructure (water supply, foot path, roads, cattle trail, mule trail etc.)	Community infrastructure rehabilitation, reconstruction (LS)	N/A
2.6	Compensatory plantation	NRs. 100 per sapling to plant and guard them for 5 years by WUA	N/A
2.7	Occupational health and safety; first aid boxes; toilets and drinking water at work sites	Lump Sum	30,000
2.8	Site to be placed back in the original condition after finishing construction work	Lump Sum	30,000
		<b>Sub-total (2)</b>	<b>173,550</b>
<b>3</b>	<b>Provisional Sum</b>	<b>Sub-total (3)</b>	<b>N/A</b>
	<b>Total (1+2+3) for Environment Management</b>		<b>198,550</b>

## **IX. PUBLIC CONSULTATION AND DISCLOSURE**

56. 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 July 24 to July 25, 2009. The existing situation of the headworks and canals was noted by GPS tracking. A list of the required interventions was noted. The required interventions were prioritized in consultation with the participating farmer. On July 25, 2009, a formal meeting was held with the WUA members and agreed with them on the proposed interventions that could be undertaken by the subproject. All the highly prioritized interventions were included whereas the medium and low priority interventions were excluded.

57. The following representatives of engineers, and NGOs participated in the Walkthrough Survey:

1. Mr. Om Prakash Gupta - ISPMC
2. Mr. Amrendra Kumar Dev, Er. IDD, Panchthar
3. Mr. Ajay Kumar Mandel, Sub-Er. IDD, Panchthar
4. Mr. Subodh Pandey, Er. Softwel
5. Mr. Hari Nepal, Sahara Nepal, NGO Member
6. Mrs. Yam Prasad Meyangwa – WUA Chairman
7. Mr. Kamal Subedi – WUA Treasurer
8. Mr. Tek Bahadur Tamang – WUA Vice-Secretary
9. Mr. Dhan Bahadur Jabegu – WUA Member
10. Mr. Jiv Nath Fuyal. – WUA Member
11. Mr. Kedar Prasad Tawa - Lead Farmer
12. Mr. Dharam Prasad Subedi - Lead Farmer
13. Mr. Kamal Prasad Tamsuhang - Lead Farmer

## **X. FINDINGS AND RECOMMENDATIONS**

58. 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.

59. 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 adverse environmental impacts likely to be caused by the Subproject. Environmental issues were considered throughout development of the Subproject and necessary changes were made to the designs to reduce or avoid impacts. Potential adverse 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**

60. The subproject is not expected to give rise to any significant adverse environmental impacts, and therefore does not require an Environmental Impact Assessment beyond this IEE study.

61. 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 earthen embankment, outlets, 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 reversible, 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 against the 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.