



**Government of Nepal**  
**Ministry of Forests and Environment**  
**Environment and Biodiversity Division**

EX: PO Box: 3987  
Singha Durbar,  
Kathmandu

Letter No.:

**Date:** 24 July, 2023

Ref, No.: 55

Number of Letter Received and Date:

**Subject:** Approval of the Environmental Impact Assessment (EIA) report for the Patharaiya-Kandra Extension Canal Project construction proposal.

Ministry of Energy, Water Resources and Irrigation,  
Singha Durbar, Kathmandu.

With reference to the subject above, the Environmental Impact Assessment (EIA) report of the Patharaiya-Kandra Extension Canal Project proposed for construction in Lamkichuha Municipality Ward No. 8, Ghodaghodi Municipality Ward Nos. 1, 2, 3, 5, 7, 12, Bhajani Municipality Ward Nos. 1, 2, 3, 4, 6, 8, 9, and Joshipur Rural Municipality Ward Nos. 1, 2, 3, 4, 5, 6, 7, and Bardagoria Rural Municipality Ward No. 1, 2, 4, 5, 6 of Kailali District, Sudurpaschim Province, with Rani Jamara Kulariya Irrigation Project, Tikapur under the Department of Water Resources and Irrigation as its proponent, was received for approval as per the 9 June, 2022 decision of that Ministry through a letter (Ref. No. 1343) dated 14 June, 2022. It is informed that the EIA report, upon examination, has been approved by the 16 July, 2023 decision of the Government of Nepal, Ministry of Forests and Environment (Hon. Minister Level) in such way as to precisely and fully implement or cause to be implemented the commitments outlined in the report by the proponent Rani Jamara Kulariya Irrigation Project, Tikapur under the Department of Water Resources and Irrigation) pursuant to Section 7 (5) of the Environment Protection Act, 2019 and Rule 9 (8) of the Environment Protection Regulation, 2022 without contrary to the prevailing laws, subject to the following terms and conditions.

**Terms and Conditions:**

1. Any additional/new environmental impacts observed during the project implementation shall be mitigated or eliminated by the proponent at its own expense.
2. The project shall fully comply with all laws, rules, guidelines, standards, and circulars related to the environment and the project in connection with proposal implementation and operation.

3. Environmental monitoring and inspection reports shall be submitted every 6 months to this Ministry and other stakeholder agencies as per Rule 45 of the Environmental Protection Rules, 2077.
4. Construction work shall be carried out in a way that minimizes impact on the habitats and ecological systems of terrestrial and aquatic animals and vegetation in the project area, as outlined in the EIA report.
5. The waste materials generated during the project implementation shall be disposed of in a manner that avoids any negative impact in the future.
6. Information about the completion of project construction must be submitted to this Ministry and other stakeholder agencies.
7. The proponent shall be responsible for addressing the issues raised during the public hearing of the project at its own expense.
8. The proponent shall coordinate with the stakeholder agencies during project implementation.
9. Actions to mitigate the impacts on the downstream areas during project construction shall be carried out in coordination with stakeholders.
10. Voluntary consultations shall be conducted with the private owners whose lands are to be acquired during project construction.
11. The proponent shall strictly comply with the provisions of the Environment Protection Act, 2019, and the Environment Protection Regulation, 2022 during project implementation.
12. The proponent shall fully comply with the provisions of the Forests Act, 2019 and the Forests Regulation, 2022 during project implementation.
13. The long-term management of muck generated during canal extension shall be the responsibility of the proponent.
14. The proponent shall be liable for any damage or accident that may occur in the canal after its construction.
15. The proponent shall self-monitor and submit reports on the implementation of commitments outlined in the attached EIA to this Ministry every 6 months.

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Khilanath Dahal

Assistant Forest Officer

**CCs:**

- National Natural Resources and Fiscal Commission, Singha Durbar, Kathmandu
- Department of Environment, Babar Mahal, Kathmandu: *A copy of the report is attached*
- Rani Jamara Kulariya Irrigation Project, Tikapur under the Department of Water Resources and Irrigation: *A copy of the report is attached*

# **Environmental Impact Assessment Report of the Patharaiya-Kandra Extension Canal Project (Kailali District, Sudurpaschim Province)**



## **Submitted to**

Government of Nepal  
Ministry of Forests and Environment  
Singha Durbar, Kathmandu

## **Through**

Government of Nepal  
Ministry of Energy, Water Resources and Irrigation  
Singha Durbar, Kathmandu

## **Proponent**

Ministry of Energy, Water Resources and Irrigation  
Department of Water Resources and Irrigation  
Rani Jamara Kulariya Irrigation Project, Tikapur, Kailali  
May, 2023

# Executive Summary

## 1.1 Name and Address of the Proponent

The proponent of the proposed Patharaiya-Kandra Extension Canal Project is Rani Jamara Kulariya Irrigation Project, Tikapur, Kailali. The address of the proponent is as follows:

Ministry of Energy, Water Resources and Irrigation

Department of Water Resources and Irrigation

### **Rani Jamara Kulariya Irrigation Project**

Tikapur, Kailali

Email: [rjkip@hotmail.com](mailto:rjkip@hotmail.com)

Phone No.: 091-560410

## 1.2 Name and Address of the Consultant

Environmental Works and Services Pvt. Ltd., New Baneshwor, Kathmandu, is the consultant for this project. The address of the consultant is as follows:

### **Environmental Works and Services Pvt. Ltd.**

New Baneshwor, Kathmandu

Contact No.: 014104489/90

Email: [ews.ktm@gmail.com](mailto:ews.ktm@gmail.com)

## 2. Proposal

The proposed Patharaiya-Kandra Extension Project is located in Lamkichuha Municipality Ward No. 8; Ghodaghodi Municipality Ward Nos. 1, 2, 3, 5, 7, 12; Bhajani Municipality Ward Nos. 1, 2, 3, 4, 6, 8, 9; Joshipur Rural Municipality Ward Nos. 1, 2, 3, 4, 5, 6, 7; and Bardagoria Rural Municipality Ward Nos. 1, 2, 4, 5, 6 of Kailali District, Sudurpaschim Province. Geographically, its area lies between 28°26'46"N to 28°40'32"N and 80°54'39"E to 81°04'34"E. The project area is 140 to 176 m above sea level. The main canal starts from Lamkichuha Municipality Ward No. 8 and ends in Ghodaghodi Municipality Ward No. 2. The command area is bounded by the main canal in the north, Mohana River in the south, Patharaiya River in the east and Kandra River in the west.

The proposed project is divided into two parts – Patharaiya-Kandra Extension Canal West (PEC1) which is to be newly constructed and Patharaiya-Kandra Extension Canal South (PEC2) which is to rehabilitate the existing irrigation systems on the Patharaiya River. Under this project, three systems - Patharaiya Irrigation System, Bani Irrigation System and Bhajani Irrigation System will be restored and expanded, while the tail portions of Pirhawa Irrigation System, Rajabadhuwa Irrigation System and Laukabhouka Irrigation System have been taken as new areas of this project. Patharaiya-Kandra Extension Canal West (PEC1) is the main canal of the proposed Patharaiya-Kandra Extension Project. The length the Patharaiya-Kandra Extension Canal West (PEC1) is 12.95 km, with a width of 40 m. Four branch canals will also be constructed in Patharaiya-Kandra Extension Canal West Main Canal. The details of the branch canals are provided below.

- a) The length of Patharaiya-Kandra Extension Canal West Branch Canal-1-PEC1/S1 (Jagatpur Branch Canal) is 3.10 km, with a width of 10 m.
- b) The length of Patharaiya-Kandra Extension Canal West Branch Canal-2-PEC1/S2 (Bonja Branch Canal) 11.70 km, with a width of 10 m.
- c) The length of Patharaiya-Kandra Extension Canal West Branch Canal-3-PEC1/S3 (Bhajani Branch Canal) is 3.4 km, with a width of 10 m.
- d) The length of Patharaiya-Kandra Extension Canal West Branch Canal-4-PEC1/S4 (Kritipur Laukahabhaukaha Branch Canal) is 15.20 km, with a width of 10 m.

Similarly, there are 2 branch canals under Patharaiya-Kandra Extension Canal South (PEC2), which will be rehabilitated and expanded. The details of the branch canals are mentioned below.

- a) The length of Patharaiya-Kandra Extension Canal South Branch Canal-1 PEC2/S1 (Patharaiya Branch Canal) is 8.75 km, with a width of 10 m.
- b) The length of Patharaiya-Kandra Extension Canal South Branch Canal-2-PEC2/S2 (Bani Branch Canal) is 8.08 km, with a width 10 m.

For the operation of the proposed project, water from the bifurcation point of the main canal of the Rani Jamara Kulariya irrigation project, chainage 80875 km, Lamkichuha Municipality Ward No.

1. The gross command area of the proposed project is 28,170 hectares and the net command area is 17,511 hectares. The Patharaiya-Kandra Extension Project aims to irrigate 17,511 hectares of land and increase the farming intensity from 130% to 226%.

### **3. Rationale of Environmental Impact Assessment**

Clause (f) (2) (a) of Schedule 3 of the Environment Protection Regulation, 2022 provides a provision to conduct an Environmental Impact Assessment for irrigating an area of more than 2,000 hectares in the Terai and Inner Madhesh. The proposed project has a gross command area of 28,170 hectares and a net command area of 17,511 hectares. Since an environmental impact assessment is mandatory for this project, it has been conducted accordingly. In addition, as per Clause (a) (5) of Schedule 3 of the Environment Protection Regulation, 2022, an environmental impact assessment is required for using more than 5 hectares of forest area for purposes other than

constructing electricity transmission lines. With the proposed project needing 36.9 hectares of forest land, an environmental impact assessment is necessary, and has been conducted accordingly. The environmental impact assessment report has been submitted to the Ministry of Forests and Environment through the relevant ministry of the Government of Nepal, as required by Clause (a) of Section 3 (2) of the Environment Protection Act, 2019 for a proposal related to any development activity or project.

#### **4. Existing Environmental Conditions of the Project Area**

##### **4.1 Physical Environment**

The proposed project is situated in the Terai region, between 28°26'46"N to 28°40'32"N and 80°54'03"E to 81°04'34"E. The landscape in the entire project area is plain, offering fertile soil suitable for agriculture, with various sandy loam soils present. The soil fertility in this region is considered good.

The climate in the region is tropical, with summer temperatures reaching up to 43°C and winter temperatures dropping to 5°C. The average annual precipitation is 1641 mm, concentrated in four months, mainly from May to August. The monthly average humidity is 82.89, and the wind speed is 51.14 km/day in the project area.

##### **4.2 Biological Environment**

###### **(a) Vegetation**

###### **➤ Types of Forest (Based Climate and Plants)**

The proposed project area is located in the Western Terai region with a tropical climate, where tropical forests and vegetation thrive. There are primarily two types of forests in and around this area.

###### **➤ Sal (*Shorea robusta*) Forest**

In the proposed project area, the majority of Sal forests are found, along with mixed trees such as Saaj, Bhalayo, Rohini, and Bot Dhayaro.

###### **➤ Khayar-Sisau (*Senegalia catechu*-*Dalbergia sissoo*) Forest**

After the Sal forest (*Shorea robusta*), Khayar-Sisau (*Senegalia catechu*-*Dalbergia sissoo*) forest is found in the proposed project area, with other trees including Simal (*Bombax ceiba*), Karma (*Ardina cordifolia*), Siris (*Albizia lebbek*), and Jamun (*Syzigium cumini*).

Some of the tree species found in the project area are Sal (*Shorea robusta*), Saaj (*Terminalia elliptica*), Jamun (*Syzigium cumini*), Bhalayo (*Semecarpus anacardium*), Bot Dhayaro (*Lagerstroemia praviflora*), Simal (*Bombax ceiba*), Sisau (*Dalbergia sissoo*), Khayar (*Senegalia*

catechu), Siris (*Albizia lebbeck*), Badhar (*Artocarpus lakoocha*), Rohini (*Mallotus philippensis*), Kusum (*Schleichera oleosa*), Buckaino (*Melia azederach*), etc.

## **(b) Wildlife**

### **➤ Mammals**

Mammals such as Tiger (*Panthera tigris*), Rabbit (*Lepus nigricollis*), *Hystrix indica*, Muntiacus muntjak, Leopard (*Panthera pardus*), Jackal (*Canis aureus*), Ghoral (*Naemorhedus goral*), Red monkey (*Macaca mulatta*), *Herpestes urva*, and Boar (*Sus scrofa*) are found in the project area.

### **➤ Birds**

The project area is surrounded by forests, wetland areas, grasslands, the Dhobini River in the east, and the Patharaiya River in the west, creating a diverse habitat for birds. As a result, various types of birds can be found in the project area.

Among the birds found in the area are Kalo Titro (*Francolinus francolinus*), Kalij Lophura leucomelanos), Megalaima virens, Kafal Pakyo (*Cuculus micropterus*), Cuckoo Koili (*Cuculus canorus*), Koili (*Eudynamys scolopaceus*), Dhukur (*Spilopelia chinensis*), Luinche (*Gallus gallus*), Myna (*Acridotheres tristis*), Kingfisher (*Alcedo atthis*), Bakulla (*Bubulcus ibis*), Thulo Seto Bakulla (*Ardea purpurea*), Askote Bakulla (*Ardeola grayii*), Chhirbire Matikore (*Ceryle rudis*) etc.

### **➤ Amphibians and Reptiles**

The project area has also provided a habitat for various species of reptiles due to the forests, shrubs, grasslands, Dhobini River in the east and Patharaiya River in the west. Amphibians and reptiles found in the project area include Dhaman (*Ptyas mucosa*), Hareu (*Trimerurus oxycephalus*), Karet (*Bungarus caeruleus*), Cobra (*Naja kaouthica*), Indian Python (*Python molurus*), Hariyo Chheparo (*Calotes versicolor*), Mausuli (*Gekkonidae*) etc.

### **➤ Aquatic Animals**

Due to the Dhobini River in the east and the Patharaiya River in the west, the project area has provided habitat for various aquatic species. Among the aquatic species found in the project area are Sahar (*Tor putitora*), Bam (*Anguilla bengalensis*), Katle (*Neolissochelus hexagonolepis*), Kathedi, Gair, Thed, Kalauch, Asla (*Schizothorax richardsonii*) etc.

## **4.3 Social, Economic and Cultural environment**

The proposed project is located in Lamkichuha Municipality, Ghodaghodi Municipality, Bhajani Municipality, Joshipur Rural Municipality and Bardagoria Rural Municipality of Kailali District. According to the National Statistics Office (2023), the total population of the district is 911,155,

of which the number of males is 439,792 and the number of females is 471,363. The affected areas include Lamkichuha Municipality Ward No. 8; Ghodaghodi Municipality Ward Nos. 1,2,3,5,7,12; Bhajani Municipality Ward Nos. 1,2,3,4,6,8,9; Joshipur Rural Municipality Ward Nos. 1,2,3,4,5,6,7; and Bardagoria Rural Municipality Ward Nod. 1, 2, 4, 5, 6 of Kailali District. The details of the households and population of the affected Wards are presented in Schedule 12. The implementation of the project directly affects 63 households.

The directly affected households consist of 94 males and 98 females.

By ethnicity, there are 24 Tharu households, the highest number, followed by 17 Brahmin households, and 12 Kshetri households in the directly affected area.

In terms of religion, all households surveyed in the directly affected areas are Hindus.

Of the households surveyed in the directly affected area, 86 members are literate and 35 are illiterate.

In the directly affected areas, households rely on health posts and hospitals situated in Joshipur, Ghodaghodi, Sandepani, Mudha, Sukkhad, Bonia, and sometimes hospitals outside the district when they fall sick.

Common health issues in the directly affected households include diabetes, migraine, diarrhea, stomach ache, fever, gastritis, common cold, and cough, among others.

Regarding drinking water, 27 households use tube well water and 5 use tap water out of the households surveyed in the directly affected areas.

Out of the households surveyed in the directly affected areas, 31 have toilets while 1 does not.

For cooking fuel, 21 households use firewood, 8 use LPG/firewood, 3 use biogas, and 1 uses LPG. All households in the directly affected area use electricity from the Nepal Electricity Authority for lighting.

In terms of the means of communications, all households in the directly affected areas have mobile phones, with telecommunications services provided by NTC and NCELL.

Regarding employment/occupation/profession, the households in the directly affected areas are engaged in wage labor, agriculture, skilled employment, and foreign employment.

In terms of language, Nepali is spoken by 19 households and Tharu by 13 households in the surveyed affected area.

Regarding festivals, it was found that the Bada Dashain, Tihar, Ram Navami, Mahashivaratri, Haritalika Teej, Shri Krishna Janmashtami, Gaura Parva, Maghi and Aitbari are celebrated in the directly affected areas. Although different religions have their own festivals, people from all religions celebrate each other's festivals due to the changing nature of the society.



## **5. Environmental Impacts, and Impact Enhancement and Mitigation Measures**

### **5.1 Positive Impacts and Enhancement Measures**

#### **➤ Construction Phase**

##### **a) Local Employment Opportunities**

The proposed project requires 30 skilled, 150 unskilled and 15 semi-skilled workforce per day to complete the construction works within the target time. During construction, the proposed project will provide employment opportunities for the locals.

#### **Measures to Impact Enhancement**

- Skilled, unskilled and semi-skilled workers will get employment opportunities.
- Local tribal groups, poor and Dalits and women will be given priority for employment.

##### **b) Technical Skill Development**

To build the proposed project, various types of workers are required to operate the equipment and perform different types of construction works. Therefore, as local people will be involved in the construction work, they will be entitle to skill training to enhance their skills in the assigned work.

#### **Impact Enhancement Measures**

- To build the proposed project, it seems that various types of workers are required to operate the equipment and perform various types of construction work. For this, as the local people will be involved in the construction work, they will be able to receive skill-based training, so their skills will increase in this work.

#### **➤ Operation Phase**

##### **a) Increase in Production of Agricultural Crops**

The completion of the main, branch and sub-branch canals will provide water for round-the-year irrigation in 17,511 hectares area to the farmers who rely on rainwater, with the operation of the proposed canal. The availability of water for round-the-year irrigation will increase the production of agricultural crops. The current productivity of 3.1 metric tons per hectare will increase to 6.5 metric tons per hectare, more than doubling.

The production of food crops in the project area will increase by 17,511 hectares X (6.5-3.1) MT = 59,537.4 MT.

### **Impact Enhancement Measures**

- The completion of the main, branch and sub-branch canals will provide water for round-the-year irrigation in 17,511 hectares area to the farmers who rely on rainwater, with the operation of the proposed canal.
- The availability of water for round-the-year irrigation will increase the production of agricultural crops.
- The current productivity of 3.1 metric tons per hectare will increase to 6.5 metric tons per hectare.
- The production of food crops will more than double. The production of food crops in the project area will increase by  $17,511 \text{ hectares} \times (6.5 - 3.1) \text{ MT} = 59,537.4 \text{ MT}$ .

### **b) Trade and Business Development**

#### **Impact Enhancement Measures**

- With the completion of the project, there will be an increase in agribusinesses in the area. Retail and wholesale shops offering agricultural inputs (seeds, fertilizers, chemicals, tools, and machinery) and agricultural produce (grains, oilseeds, pulses, fruits and vegetables, honey, milk, and meat products) will definitely rise.

## **5.2 Negative Impacts and Mitigation Measures**

### **5.2.1 Physical Environment**

#### **➤ Construction Phase**

#### **a) Change in Land Use**

A total of 343.74 hectares of land will be required for the project. Out of this, 325.56 hectares will be needed permanently and 18.18 hectares temporarily. Of the permanent land, 36.9 hectares are located in forest area, 268.7 hectares in cultivable private land, 18.36 hectares in vacant land, and 1.57 hectares in settlement land. Similarly, the 18.18 hectares of temporary land are covered by cultivable private land.

#### **Mitigation Measures**

- As compensation for the 36.9 hectares of forest land needed for the construction of the proposed project, replacement land will be provided or a specified amount will be deposited into the Forest Development Fund in accordance with the approved guidelines.
- 268.7 hectares of cultivable land and 1.57 hectares of settlement land will be compensated in accordance with the Land Acquisition Act, 2034.

### **b) Establishment and Operation of Mining Areas, Crusher Operation Sites, Quarrying Areas, etc.**

Construction materials such as stone and gravel will be required for the proposed project's structures. The operation of mining areas, crusher operation sites, quarrying areas, and excessive material extraction will impact the local environment. Excavation will change natural water flow and lead to water, air, and noise pollution.

#### **Mitigation Measures**

- River materials will be collected and processed ensuring that it is limited to mining areas and crusher operation sites identified during the study.
- These activities will be performed in compliance with the approval of the President Chure Terai Madhesh Conservation Development Board, the Local Government Operation Act, 2017, and the Standards Related to Stone, Gravel, Sand Excavation, Sale and Management, 2022.
- Crusher will only be operated at such places identified during the on-site survey.
- The crusher operation sites will be located away from settlements, wildlife movement, and grazing areas.
- Prior consent and approval from relevant stakeholders will be obtained for crusher site operations.

### **c) Waste Discharge and Management**

Both solid and liquid waste are generated during the operation of the labor camp in the construction phase. Solid waste includes biodegradable and non-biodegradable waste, plastics, etc., released during food preparation, while liquid waste consists of wastewater to be discharged from the camps. Each proposed campsite will accommodate a maximum of 50 people. They will produce approximately 10 kg of solid waste, 25 kg of human excreta, and 5000 liters of wastewater per day in each camp. Inadequate waste management could impact the workers' health.

#### **Mitigation Measures**

- Separate bins will be used to collect biodegradable and non-biodegradable waste in the camp premises and active construction sites. Reusable materials will be utilized. Other waste will be disposed of in the waste management sites of the respective municipalities.
- Wastewater will be managed by installing a soak pit or septic tank in the campsite.

#### **d) Air Pollution**

During the construction phase, transportation and excavation of construction materials, as well as the use of heavy equipment, generate significant amounts of dust and fumes. The movement of vehicles in the project area is likely to increase the emission of dust and gases. Improper management of solid waste generated by construction workers will create odors in the project area, affecting air quality.

#### **Mitigation Measures**

- Construction materials will be transported covered with a tarp during transportation.
- Water will be sprinkled three times a day near the settlements during the construction work.
- All loaded construction materials on trucks entering the site will be covered.
- Trucks will be covered or fumigated/washed after unloading before leaving the site.
- Long-term storage will be covered to protect against water and wind erosion.
- The use of old vehicles will be banned.

#### **e) Noise Pollution**

Noise pollution during construction work may be higher than normal, but it will be limited to the workplace and gradually decrease as one moves away. Noise pollution and vehicular traffic in settlement areas will affect the sound level.

#### **Mitigation Measures**

- Workers in high noise areas will be provided with ear plugs or ear muffs.
- All types of vehicles will be regularly tested.
- Drivers will be prohibited from emitting unnecessary noise near the project area, settlements, and forests.
- The use of loud vehicles, old vehicles, and equipment will be banned.

#### **➤ Operation Phase**

#### **a) Cleaning and rehabilitation of mining areas, crusher operation sites, labor camps, excavation areas, construction material storage sites, spoil management sites, and others**

The mining area, crusher operation sites, labor camps, excavation areas, construction material storage sites, spoil management sites will require rehabilitation after their use.

## **Mitigation Measures**

- After the completion of the construction work, the mining areas, crusher operation sites, labor camps, excavation areas, construction material storage sites, spoil management sites, etc. will be cleaned and rehabilitated.
- The huts in the storage areas will be removed.
- The waste in the waste spoil management sites will be disposed of at the municipal waste management site in coordination with the municipality.
- After the completion of the construction work, plantation will be carried out in these places.

### **5.2.2 Biological Environment**

#### **➤ Construction Phase**

##### **a) Loss of Forest Area and Trees**

It is estimated that 36.9 hectares of forest land is required for the proposed project, and 2,739 trees and 1,161 rafter wood (ballaballi) needs to be cut from 14 community forests. The details regarding this are presented in Table 36 and Schedule 13.

## **Mitigation Measures**

- As compensation for the 36.9 hectares of forest land needed for the construction of the proposed project, replacement land will be provided under the Forests Act, 2019 and the Forests Regulation, 2022 or a specified amount will be deposited into the Forest Development Fund in accordance with the approved guidelines
- 39,000 seedlings will be planted at a rate of 1:10 as compensation for the 2,739 trees and 1,161 rafter wood (ballaballi), and will be taken care of for 5 years.
- 1,600 seedlings will be planted in one hectare. To compensate for the damaged trees, plantation of the species suitable to the same ecological belt will be carried out.
- Plantation will be carried out in coordination with project-affected community forests and the division forest office.

##### **b) Wildlife and Domestic Animals may get into Accidents**

Free movement of wildlife in the forest area will be disrupted during the construction phase. Old and young may be prone to accidents.

### **Mitigation Measures**

- Pits dug for excavation work will not be left open overnight. If this is not possible, they will be securely covered or a safe passage of escape will be provided for any animals that enter there.
- All excavation sites will be checked every morning.
- Low fencing will be used on the construction sites and no wildlife areas will be impacted by workforce activities.
- Temporary barriers will be used to prevent wildlife from entering waste disposal sites.

### **c) Illegal Collection and Use of Firewood from Forests**

As some part of the proposed project area is located in the forest area, there may be a high possibility of illegal firewood collection along with smuggling of non-timber forest products and herbs by the workers during the construction.

### **Mitigation Measures**

- Entry of outsiders or local people will be prohibited during the tree removal process where there is a possibility of illegal collection of firewood.
- Throughout the construction period, gas will be provided to the workers for cooking and they will be restricted from entering the forest.
- Workers will be advised not to collect and use firewood.

### **d) Forest Fires**

Cooking and other activities in the labor camp may lead to forest fires.

### **Mitigation Measures**

- Workers will be prohibited from smoking in the forest area. Forest fire awareness boards will be displayed. Burning activities will be prohibited.
- Workers will be made aware of the possibility of fire.

➤ **Operation Phase**

**a) Impeding the Movement of Wildlife and Domestic Animals and Causing Accidents**

Since some parts of the proposed project area is located in the forested area, the free movement of wildlife and domestic animals will be obstructed after the operation. There is a risk of wildlife and domestic animals drowning or dying during the canal operation.

**Mitigation Measures**

- Animal crossing bridges and ramps will be constructed at the locations specified in Table 31 and Schedule 15 to facilitate the movement of wildlife and domestic animals.
- The Wildlife-friendly Infrastructure Construction Directives, 2022 will be complied with during the implementation of the proposed project.

**5.2.3 Economic, Social, and Cultural Environment**

➤ **Construction Phase**

**a) Damage to Cultivable and other Lands**

The proposed project will permanently will require 268.7 hectares of cultivable land and 1.57 hectares of settlement land. Cultivable land may suffer damage due to project activities.

**Mitigation Measures**

- Compensation will be provided for the 268.7 hectares of cultivable land and 1.57 hectares of settlement land in accordance with the Land Acquisition Act, 2034,
- A Compensation Determination Committee will be formed for this purpose.

**b) Loss of Agricultural Products (Standing Crops and Fruits)**

The proposed project will permanently require 268.7 hectares of cultivable land. The use of cultivable land will result in damage to standing crops and fruits, leading to a loss of 832.9 metric tons of agricultural products.

**Mitigation Measures**

- The proponent/construction entrepreneur will compensate for the damaged agricultural products based on prevailing market rates.
- A Compensation Determination Committee will be formed for this purpose.

### **c) Use of Private and Community Structures**

The proposed project will directly impact 163 houses, 1 toilet, 4 animal sheds, 1 kitchen, 1 chicken coop, 92 electricity poles, 2 temples, 4 schools, and a brick factory.

#### **Mitigation Measures**

- Compensation for the 163 houses will be provided in accordance with the Land Acquisition Act, 2034. A Compensation Determination Committee will be formed for this purpose.
- The affected structures will be relocated, with the advice of relevant agencies.
- Electric poles will be relocated in coordination with the Nepal Electricity Authority.
- Other infrastructure and properties will be transferred in coordination with the locals and stakeholders.

### **d) Discord and Strife between the Guest (Worker) Community and the Host Community**

A significant number of workers will be needed during the construction phase of the project. However, the required workforce may not be met solely from within the community. Therefore, workers from various locations may be brought in to work alongside local workers, potentially leading to conflict due to increased competition for the use of local resources.

#### **Mitigation Measures**

- Preference will be given to the locals for employment opportunities to prevent conflict.
- A grievance handling system will be arranged to address problems in the course of construction work and construction entrepreneurs will resolve the grievances.

### **e) Gender Discrimination**

During the project construction, individuals will be employed for excavation and transportation of construction materials, and other related tasks. Construction entrepreneurs and sub-contractors are likely to discriminate women in terms of wages.

#### **Mitigation Measures**

- Equal employment opportunities and wages will be provided to both men and women.
- The project will ensure equal opportunities for men, women, and marginalized groups based on their capacity.



## ➤ **Operation Phase**

### **a) Human Loss**

During the operation of the canal, there is a high risk of accidents for the people living in the settlements located in the proposed watershed area. This could result in significant harm to the people in that area.

### **Mitigation Measures**

- The proposed canal is designed as a covered canal in the settlement area.

## **6. Alternative Analysis**

It includes an analysis of alternative ways to mitigate adverse project impacts. The design of the proposed project is based on the "Planning and Design Strengthening Project (PDSP) Manuals" of the Department of Water Resources and Irrigation. The relationship between bed width and water depth, as well as the freeboard of irrigation, have been determined in accordance with international standards and guidelines, PDSP Manuals, and designs adopted in similar projects in the Terai region of Nepal. Appropriate engineering designs and site-specific measures have been adopted to minimize environmental impacts. Preference will be given to locally available construction materials to reduce costs and make maintenance work easier.

## **7. Environmental Management Plan**

Environmental management is a crucial aspect of planning, construction management, minimizing negative impacts, and enhancing positive impacts. Construction of the project will only proceed in compliance with the Environmental Management Plan, and the responsibility for environmental management will lie with the project and the relevant ministry. The estimated total cost for environmental management is Rs. 14,350,000.

## **8. Conclusion**

All potential impacts resulting from the project's implementation are of a nature that can be mitigated. The proposed enhancement and mitigation measures for environmental management are straightforward, and the completion of the main, branch, and sub-branch canals will help farmers in the overall development of agriculture, solving regional imbalances and serious irrigation problems.

Therefore, the project will involve implementing all of the mitigation alternatives mentioned in the report, as well as the proposed alternatives determined through their analysis.