

NEPAL ELECTRICITY AUTHORITY

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN OF GRID TIED SOLAR POWER PROJECT, BLOCK NO. 1, NUWAKOT (5.1MW)



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February, 2018



ABBREVIATIONS AND ACRONYMS

BS	:	Bikram Sambat (Nepali Era)
CSR	:	Corporate Social Responsibility
DADO	:	District Agriculture Development Office
DCC	:	District Coordination Committee
DFO	:	District Forest Office
DoED	:	Department of Electricity Development
ESMF	:	Environment and Social Management Framework
ESMP	:	Environment and Social Management Plan
EPR	:	Environment Protection Rules, 1997
ESSD	:	Environment and Social Studies Department
GoN	:	Government of Nepal
GSEEP	:	Grid Tied and Solar Energy Efficiency Project
GRC	:	Grievance Redress Cell
GRM	:	Grievance Redress Mechanism
HHs	:	Households
IEE	:	Initial Environmental Examination
MoEn	:	Ministry of Energy
MoEST	:	Ministry of Environment, Science and Technology
NEA	:	Nepal Electricity Authority
PAS	:	Project Affected Settlement
PMO	:	Project Management Office
WB	:	World Bank
<u>Units</u>		
ha	:	Hectare
km	:	Kilometer
kV	:	Kilo Volt
m ²	:	Square meter
MW	:	Megawatt



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1 INTRODUCTION

1.1 Background

Nepal with the installed capacity of 900MW power generation connected to the national grid vis a vis a much higher level of peak demand which stood at 1559.7MW in 2016/17 suffers from serious power shortage every year (source: Annual Report, NEA). In response to the constantly growing power shortage, the Government has emphasized on the development of other potential resources particularly of Renewable Energies such as biomass, biogas, solar and wind along with hydropower for the production of electricity and meet the growing energy demand of the country in short term as well as long-term basis. To solve the present energy crisis, and enhance the energy network system of the country, Government of Nepal (GoN) has allocated budget under the title of “Renewable Energy and Capacity Expansion Project” under the soft loan of the World Bank (WB) and co-financing of the GoN in the fiscal year 2071/72. So, Nepal Electricity Authority (NEA), government owned institution has initiated the exploration of sites for the solar power development under project **Grid Tied Solar Power Project (GTSP)**. **According to survey license obtained from Department of Electricity (DoED), project is entitled as Grid Tied Solar Power Project, Block No 1, Nuwakot. It will be under Grid solar and energy Efficiency Project (GSEEP)**. This is one of the major projects to produce electricity through solar energy (renewable energy) and thus strengthen and meet growing electricity demand of Nepal. The project produces clean and pollution free energy and thus is environment friendly.

1.2 Project Description

The project site Block No 1; Raatmatey and Keraghari area of Devighat powerhouse (PH), is selected for installation of PV solar farmhouse with a capacity of 5.1MW. The project site is located at Keraghari and Raatmatey area of Bidur Municipality-6 (the then Charghare VDC) of Nuwakot district. The name of the settlement around the project area is Multhala settlement. A total of 7.57ha land will be required for the project, which is already owned by NEA for the construction of Devighat Hydro power project in FY 2036/37 (1984 AD). The project site has sub-tropical climate, influenced by monsoon rains (June-September) and has summer months from March to May. The site has easy access to road as well as water resource. It is an open terraced land sloping due south at an angle of about 30°. There is no forest within the site, two temporary structures and has not got any monuments of historical nature of that of religious importance within the site.



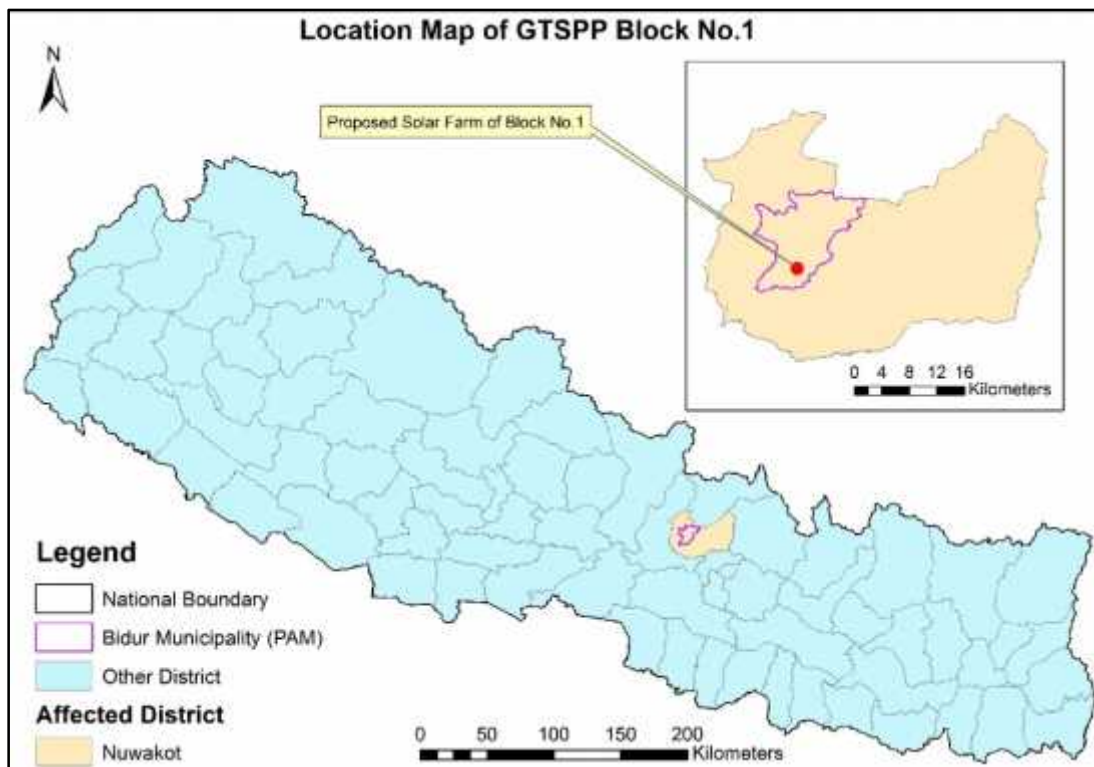


Figure 1-1: Project Location Map



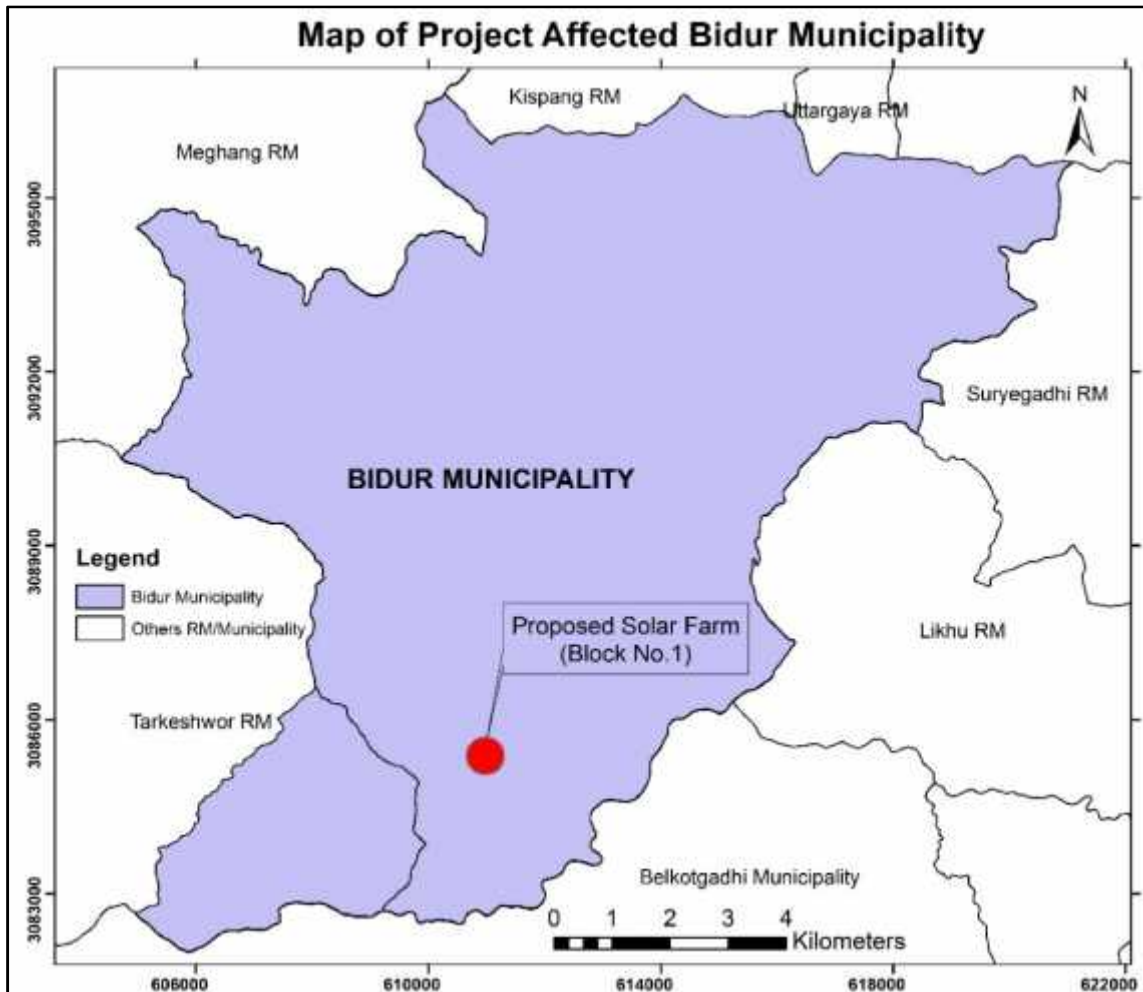


Figure 1-2: Project Affected Bidur Municipality showing Keraghari and Raatmatey Area



Figure 1-3: Google image of Keraghari and Raatmatey area

1.3 Construction Planning

The implementation of the proposed project comprises installation, erection, testing and commissioning works of solar panels. The estimated years of project completion is one years starting from March, 2018.

1.3.1 Preliminary Works

Preliminary works for the proposed project consist of contract award, the detail design study and mobilization of the contractors. The detail design study will carry out the spotting of solar panels, preparation of longitudinal profiles, geological field test and laboratory testing, etc.

1.3.2 Land

The project shall permanently acquire approximately 7.57ha of land for solar panels erection and other physical facilities. For the erection of solar panels, approximately 6.81ha land will be needed and the remaining 0.76ha land will be used for other physical facilities such as construction of control buildings, water control mechanism and so on. Since the area is under the ownership of NEA, there is no need to acquire land from public. However, some locals (5/6 HHs) have been cultivating sesame (oil seed crop) in some patches of the land in Raatmatey area as the land is not used by NEA for other purpose. The crop has been harvested already. There is a TL pole of 33kV inside this area. Similarly, in the Keraghari area, 3 families are farming banana in around 0.69ha of land since the past 4/5 years without permission from NEA. .Due to the project activities, these people will be affected as they lose part of their earnings from banana plantation. Since, these people have their own land for farming; the impact of the project will not be significant. In the same way, there is enough land under NEA around the area, thus the storage facilities shall be done within its own land.

1.3.3 Requirement of Workforce

During the stages of the construction period of the project, altogether approximately 140 people will be employed including 100 unskilled, 15 semi-skilled and 25 skilled human reosurces. Most of the unskilled manpower will be hired locally as per available skill and experiences; approximately 80-85 manpower are hired locally whereas only 10-15 manpower will be migrant workers.The workforce will be used for a maximum of 8 months during construction period.

1.3.4 Materials

The main materials required for construction works related with the solar farm project will be as follows;

- Solar modules; Polycrystalline (pc-Si)
- Inverters (String/Central)
- Power supply
- Mounting Structures
- Aggregate
- Cement
- Sand



- Water

The requirement of the project materials are presented in the following table.

Table 1-1: Requirement of the Project Materials to the Project

S.N.	Description	Number	Model
1	Solar modules; Polycrystalline (pc-Si)	93000	RSM60-6-270p
2	Inverters (String/Central)	14	SG125/SG2500
3	Mounting Structures	3875	Steel Structure

The power supply needed for construction activities will be tapped from the existing 33kV TL which is within the boundary of project site. aggregate, cement and sand is needed in very minimal amount for the construction of controlled building, staff room and toilet. The required amount of cement will be acquired from local manufacturers. Likewise, sand will be purchased from local market. Coarse aggregates will be produced at site from excavated materials or purchased from the nearby market. The excavated foundation material can be used as a backfill required for the foundation of mounting structure. The water required to clean solar panels is approximately 7000-20000lt. per MW plans. On the basis of this, total water requirement for this project is 35,000-100,000lt. The panels is planned to clean once a week. The project will arrange this quantity of water by pumping from Trishuli River or by deep boring.

1.3.5 Construction Method

Simple land labeling works to be done, not so major land excavation and cutting filling will be done for this project. There is no use of concrete batching plant for this project. Backhoe Loaders, Ramming Machine and Excavator are used during construction. There is no blasting only drilling for piling works will be done.

1.4 Objectives, rationale and Methodologies for Preparing ESMP

Objectives

The objective of the Environment and Social Management Plan (ESMP) is to identify the potentially significant environmental issues and risks of the proposed project and to suggest appropriate mitigation measures to mitigate and/or minimize the adverse impacts so that the project is implemented in an environmentally sound manner. The other general objectives of the study are to:

- Identify, predict and describe/ assess potential environmental and social impacts from the installation of the Solar farm
- Define the roles and responsibilities of all parties involved in project environmental and social management (including monitoring mechanism which should be consistent with the provisions in the project's ESMF);
- Identify and describe measures for impact avoidance, minimization, and mitigation and their costs;
- Define environment and social management mechanism to ensure the implementation of mitigation measures and monitoring programs; and establish a supervision, monitoring and reporting as well as grievance handling mechanism.



- Consult with potentially affected people, community and stakeholders and help to identify/ understand people's concerns and suggestions and address them, if relevant.

Rationale

Based on the recommendation identified from screening report, the ESMP is prepared to address the impacts on the particular aspects and describe different measures to mitigate those impacts.

Methodology

This ESMP report is prepared in accordance with the screening report of the project, field study, consultation with local people/stakeholders and officials. Various methodologies are used to prepare the ESMP; they are:

- Field Investigation
 - ❖ Identification of settlements nearby project area.
 - ❖ Meetings/Consultations/Public Participation
 - ❖ Verification of secondary data/ information and collection of data/ information from the field.

The project team visited the site in 2074/09/11 to 2074/09/13. During site visit, two consultation meetings were conducted at project sites (Raatmatey and Keraghari area) involving project affected people. Altogether, 39 local people were participated in the meeting, with 35 males and 4 females. The detail of the meeting is given in Annex I. The team also visited to district level line offices such as Ward No 6, Bidur Municipality, Bidur Municipality office, District Coordination Committee (DCC), District Forest Office (DFO) and District Agriculture Development Office (DADO).



2 EXISTING ENVIRONMENTAL AND SOCIAL SETTINGS

The proposed project area is located at Keraghari and Raatmatey area of Bidur Municipality-6(the then Charghare VDC) of Nuwakot district. For the study of existing environmental and social settings, the study area is defined as the area for the erection of the solar panels and other physical facilities. The settlement area, forests or other vegetation and places having built up infrastructures or facilities that falls within the boundary of project site is also under the study area.

2.1 Physical Environment

The topography, land use, climatic condition, geomorphology and geology, seismology, air, water and noise condition, watershed and drainage pattern, solar potential and air traffic that shall be influenced due to the construction of this project has been discussed in each topic ahead.

2.1.1 Topography

The proposed sites of Block No.1 are located in the mid-hills of Nepal. The sites are mild sloped terrain facing south. The altitudinal variation of the Raatmatey site is between 560masl and 590masl and Keraghari site is between 540masl and 560masl at Bidur municipality of Nuwakot.

2.1.2 Landuse

A total of 7.57ha land will be covered by the solar farm. The site is located about 45m above the Trishuli River. The land is owned by NEA and consists mostly the barren land and banana farming in Keraghari site whereas Raatmatey site consists of mostly barren land and few patches of land had been cultivated with seasonal crops (sesame) which has already been harvested and now there is no any production within this land. Banana farming has been done in 0.69ha of land. There is 33kV TL inside these sites.

2.1.3 Air Quality

The proposed solar sites are located about 4km far away from Pasang Lhamo highway and accessible via Battar-Charghare-Khadgabhanjyang road. The transportation density and frequency of the vehicles along the road is very low, so the noise pollution levels are very low and can be considered as fairly good. The construction and improvement works for the road are undergoing. The main source of air pollution is due to vehicular movement along the road. Therefore, the overall status of air quality at the solar site can be considered to be good and within the range of acceptable limits.

2.1.4 Noise Quality

Noise pollution is very less in the area. Only the vehicular movement is causing noise pollution in and around the solar site. The noise level near multhala settlement is found to be 44dB which is within the range determined by Ministry of Environment, Science and Technology (MoEST) in National Standard of Sound Quality, 2069.



2.1.5 Water sources and Drainage Patterns

The main river which drains the project area is Trishuli River which is snow fed. Chainpur Khola is one of the tributary of Trishuli River from where Munthala settlement uses drinking water via water pipe for 9 months. Terrain of Raatmatey and Keraghari areas is moderate slope so the chances of water logging are minimal. Moreover, there is kholsi at west of each sites which also drain the project area. However, the formation of gullies within the Raatmatey site is observed.

2.1.6 Soil Erosion and Land Stability

During field visit of the Block No.1, landslide and some gullies formation are observed in Raatmatey site. The terrain of vegetated areas outside the boundary of the project area near landslide are steep slope so there is a chance of further landslide. Some cracks due to earthquake and inactive landslide are present in the Keraghari site.



a) Landslide occurred in Raatmate Site

b) Gullies Formation in Raatmate Site



c) Inactive Landslide in Keraghari Site

Figure 2-1: Landslides and Gullies present in Block No 1

2.2 Biological Environment

Vegetation and forest resources, ethno botany, mammals and birds and rare and protected species of flora and fauna found in the project area are studied in biological environment.

2.2.1 Vegetation and Forest Resources

Vegetation around the project area covers sub-tropical type of forest. Raatmatey area is primarily composed of red soil. There is no natural forest/vegetation found in the Raatmatey area during site visit and uncultivated portion of the land is covered by invasive shrub, mainly Banmara (*Eupatorium sp.*). Some 34 Sal trees (*Shorea robusta*) (DBH >10cm) are found in southern and western side of the area. The details of the potential loss of such flora is presented in the Table 2.2.

Similarly, common shrubs found in and around the project area are Sajiwon (*Jatropacurcas sp.*), Banmara (*Eupatorium sp.*), Ghangaru (*Pyracanthacrenulata sp.*) etc.

Keraghari area is also composed of red soil mainly dominated by cultivated banana trees (*Musa paradisiaca*). About 1000 banana trees are planted in the area. Similarly, around 200 Bakaino trees (*Melia azedarach*) are planted in the area between banana trees. Religious Bar, Pipal and Kadam trees forming chautara like structure are located in the south-most side of the project area which may be lost due to project activities. The description is provided as below:

Table 2-1: List of chautara forming trees found in Project area

S.N.	Location	Name of tree	Scientific name	Perimeter/ Girth (m)	Height (m)
1	Keraghari	Bar	<i>Ficus benghalensis</i>	2.6	12
2	Keraghari	Pipal	<i>Ficus religiosa</i>	2.64	15
3	Keraghari	Kadam	<i>Anthocephalus chinensis</i>	1.22	14

Shrubs found in the project area (Keraghari and Raatamatey area) are alupate jhar, *Galinsoga parviflora*, Sajiwon (*Jatropacurcas sp.*), Banmara (*Eupatorium sp.*), Ghangaru, Lajjawati jhar (*Mimosa pudica*) etc.

2.2.2 Ethnobotany/ Plant Resources Use Pattern

There is not much significant major timber yielding plant around the project area. Common plant resources use pattern in Keraghari area is presented as below:

Table 2-2: List of Common plant resources found in Project area

S.N.	Common name	Scientific name	Usage
1	Nilkanda	<i>Duranta repens</i>	Fodder, support for climbers



2	Koiralo	<i>Bauhinia variegata</i>	Animal bedding, Exudates, Fodder, Fruit and nuts
3	Bel	<i>Aegle marmelos (L.) Correa</i>	Animal bedding, Beverage, Drying/tanning, Exudates
4	Aap	<i>Mangifera indica</i>	Fruits and nuts
5	Litchi	<i>Litchi chinensis</i>	Fruits and nuts
6	Barrow	<i>Terminalia bellirica</i>	Animal bedding, Beverage, Fodder
7	Badhahar	<i>Artocarpus lakoocha</i>	Exudates, Fodder, Fruit and nuts
8	Emili	<i>Tamarindus indica</i>	Beverage, Fruit and nuts, spices, condiments and other flavorings
9	Kapur	<i>Cinnamomum camphora</i>	-
10	Orange	<i>Citrus reticulata</i>	Fruits and nuts
11	Lapsi	<i>Choerospondias axillaris</i>	Fruits and nuts
12	Mewa	<i>Carica papaya</i>	Fruits and nuts
13	Amala	<i>Phyllanthus emblica</i>	Fodder, Fruits and nuts
14	Amba	<i>Psidium guajava</i>	Fodder, fruits and nuts, Drying/tanning
15	Bakaino	<i>Melia azedarach</i>	Animal bedding, Exudates, Fodder
16	Kimbu	<i>Morus australis</i>	Drying/tanning, Fibre and fiber yielding, Fodder

2.2.3 Wildlife (Mammals and Birds)

Common mammals spotted in the project area (Keraghari and Raatmatey area) are Jackal (*Canis aureus*), Rabbit (*Lepus nigricollis*), Squirrel (*Funanbulus sp.*), Chituwa (*Panthera pardus*), Ban biralo (*Felis chaus*), Bat (*Pteropus giganteus*), Langur (*Semnopithecus entellus*). Common bird species are Crow (*Corvus splendens*), Chibe (*Dicrurus hottentotus*), Sparrow (*Passer domesticus*), Dhukur (*Streptopelia chinensis*), Koili (*Surniculus lugubris*), Suga (*Psittacula cyanocephala*) and Lampuchhre (*Cissa erythrorhyncha*) etc. Reptiles include snake, lizard etc.

2.2.4 Rare and Protected Species of Flora and Fauna

One species banned for felling, transportation and export i.e. Sal (*Shorea robusta*) occur in the vicinity of Raatmatey area. None of the protected species of fauna (birds and mammals) are reported in the project site. The proposed area is not located within national park, wildlife sanctuary, buffer zone or conservation area. The area is not the suitable habitat for birds and mammals. So, habitat fragmentation is not caused due to implementation of the project.

2.3 Socio-economic and Cultural Environment

Multhala, Bidur Municipality-6 is the nearest settlement from the project site which is within 50m from project location (Raatmatey area). Though this settlement is not directly affected by the project activities and its component, but it is indirectly affected by the project such as air and noise pollution, impacts on the pedestrians of the settlement. There are approximately 70 HHs in the settlement with majority of Brahmin (60 HHs), Tamang (8 HHs) and Dalit (2 HHs) community. Hindu is the major religion followed by Buddhism in the settlement.



The economic character of Multhala settlement is based on agriculture and wage labor. The agriculture lands of the area are productive. Rice, wheat, maize and vegetables are the major crops produced in the area. Furthermore, animal husbandry is another major source of income of the local villagers. Nowadays, poultry farming is the emerging occupation for the people of the project area. There is the water supply pipe line in the Multhala settlement which provides drinking water facilities. However, during dry season, there is very scarcity of water in the settlement and people have to go to depend upon the water of Trishuli River.

There is 33kV transmission line pole within the project site (both Raatmatey and Keraghari area). The road that goes through the settlement is Battar-Charghare-Khadgabhanjyang road which is an earthen road. The road is being developed by the GoN for the interlinking of Dhading with Nuwakot and in near future will be a paved road. There are no any cultural and historical sites within and nearby the project site



3 ASSESSMENT OF IMPACTS AND MITIGATION MEASURES

3.1 Land Use and Land Take

The land use changes due to the erection of the solar panels in the permanent land. A total of 7.57ha land will be covered by the solar farm. However, the land is under the ownership of NEA, thus no individuals will directly be affected by the project activities and no mitigation measure is required.

3.2 Air Quality

Impacts:

a. Construction Phase

The construction activities consist of site clearance including clearance of banana farming, cut-fill work for the levelling and grading of the land. These activities will generate dust in the surrounding area of Multhala settlement. Apart from these activities, movement of transporting vehicles carrying the construction materials along Battar-Charghare-Khadgabhanjyang road will generate fugitive as well as combustion emissions and will cause temporary impact on air quality and thus may cause problem on health of construction workers and people of Multhala settlement. Gas emissions and particulate matter from project vehicles and equipment will also decrease air quality. However, this impact is very low in magnitude.

b. Operation Phase

No impact on air quality is envisaged during the operation phase.

Mitigation measures:

a. Construction Phase

- Water will be sprayed through tanker on the earthen road along the Multhala settlement once a day to reduce the dust problem during construction period, particularly when construction materials is being transported to the project sites.
- Maintenance of all vehicles and construction machinery will be done.
- Appropriate protective equipment against noise (e.g. respirators) will be provided for the workers.

b. Operation Phase

No mitigation measures is required in this phase as there is no impact in air and noise quality at this phase.

3.3 Noise Quality

Impacts:

a. Construction Phase

During the construction phase, noise will be generated by the construction vehicles (grader, excavator, and dumper). The impacts will be felt in Multhala settlement. Noise sensitive receptor such as health post, school are far away from the project sites. The school (Mandredhunga Pra. Vi.) is about 600m northeast from the proposed project sites.



b. Operation

Noise generated during the operational phase will generally result from vehicular traffic which is expected to be negligible.

Mitigation measures:**a. Construction Phase**

- Maintenance of all vehicles and construction machinery will be done.
- Earmuffs or plugs to the workers will be provided as per the requirement.
- The construction work will be limited to daytime as far as possible.

b. Operation

No mitigation required during this phase.

3.4 Waste Management

Impacts**a. Construction Phase**

The improper disposal of solid waste like cement bags, iron bar and other leftover construction materials and wastes from workers might cause sanitary problem to the Multhala settlement and also to workers involved. There will be no use of batteries for the proposed solar project so the impact due to battery wastes is eliminated.

b. Operation Phase

The personnel who work during operation period will generate domestic solid waste. There will be no other waste types generated during operation period.

Mitigation Measures**a. Construction Phase**

- Domestic type solid wastes are biodegradable which will be managed by burying in pit.
- Recyclable wastes (such as glass, paper, plastic, etc.) will be collected separately to be sent for recycling. Separate waste containers (drums, bins, skips or bags) will be provided for different types of waste.
- No waste will be disposed along public road or in the surrounding area of Multhala settlement.
- Construction workers will be instructed for proper storage and handling procedures of construction waste and other solid wastes.

The contractor will be responsible for the establishment of the waste management system during construction period.

b. Operation Phase

The domestic wastes will primarily consist of organic food waste because this is easily biodegradable and non-hazardous. It will be managed by burying in pits and subsequently covering with soil.



3.5 Light reflection

a. Construction Phase

There is no impact of light reflection during construction phase.

b. Operation Phase

The panel of solar PV is designed to maximize absorption and minimize reflection to increase electricity production efficiency. To limit reflection, solar PV panels are constructed of dark, light-absorbing materials and covered with an anti-reflective coating. The light reflecting percentage of solar PV is as little as 2% of the incoming sunlight. Thus, there will not reflection of light from solar panels. From the study of various assessments relating to solar panels installation as well as the site visit of solar installation areas of Nepal (Training center, Nepal electricity Authority and Chovar site), it is concluded that the glare and reflectance levels from a given PV system are decisively lower than the glare and reflectance generated by the standard glass and other common reflective surfaces in the environments. (Source: *PV Systems: Low levels of Glare and Reflectance vs. Surrounding Environment*).

Mitigation Measures

a. Construction Phase

No mitigation measure is required at this phase.

b. Operation Phase

No mitigation measure is required at this phase.

3.6 Erosion and Land Stability

a. Construction Phase

The improper management of the drainage system during construction period may further lead to the expansion of existing gullies, formation of new gullies and cause instability problems such as soil erosion, landslides in the project area (Raatmatey area).

b. Operation Phase

There is no impact on land stability during this phase.

Mitigation Measures

a. Construction Phase

- Gabion wall (length=28m, height=18m) need to be constructed as a retaining structure from the foot of the landslide up to its crown which is present at east boundary of Raatmatey area.
- Drainage structures need to be provided within the project boundary for proper management of drainage system of the project site.

b. Operation Phase

No mitigation measures are required.



3.7 Impact on Standing Trees and vegetation

a. Construction Phase

Standing trees and vegetation in the boundary of Raatamatey areamay be lost during the construction of the project. Site clearance comprises of removal/clearance of shrubs and herbs species in the area. Detail of the possible loss of trees is given in the following table.

Table 3-1: Total loss in terms of plant species

S.N	Local Name	Botanical Name	Average DBH (cm)	Number
1	Kyamuna	<i>Cleistocalyx operculata</i>	55	1
2	Aanp	<i>Mangifera indica</i>	60	1
3	Sal	<i>Shorea robusta</i>	15	11
4	Sal	<i>Shorea robusta</i>	12	1
5	Sal	<i>Shorea robusta</i>	18	1
6	Sal	<i>Shorea robusta</i>	23	1
7	Sal	<i>Shorea robusta</i>	26	2
8	Sal	<i>Shorea robusta</i>	10	2
9	Sal	<i>Shorea robusta</i>	15	1
10	Sal	<i>Shorea robusta</i>	30	1
11	Sal	<i>Shorea robusta</i>	20	7
12	Sal	<i>Shorea robusta</i>	14	4
13	Chilaune	<i>Schima wallichii</i>	40	1

Source: Field Visit, 2017

b. Operation Phase

Since the operation of the project will permanently occupy land, the ground vegetation cover would be lost due to project activity.

Mitigation Measures

Since the removal of trees and other vegetation is within the premises of NEA owned land, the procedures specified in the section 4 of the "Standard for removing government trees, 2071" will be followed. In accordance with the Standard for removing Government Trees, 2071, the concerned agency should cut the trees in its own cost and sell the forest products in accordance with the prevailing laws and acts and deposit the income royalty. For the purpose of this standard, Examination Committee will be comprised of 7 members with District Forest Officer as a Coordinator. With the request for removing such trees, the committee will monitor the area and the trees to be cut. In addition, the committee will recommend number and standard for compensatory plantation. The cost for such monitoring will be the responsibility of related office/project. Thus, no compensatory plantation or other mitigation measures are proposed for this impact.

3.8 Impacts on Settlement

Impacts



a. Construction Phase

Nuisance: During the project construction phase, the traffic flow will arise from the transportation of solar panels and other construction materials. Since, there is Multhala settlement near the project site (within 50m), there may be the chances of road accidents and also there may be the issues of pedestrian safety. The settlement shall be disturbed due to civil works for solar panel installation activities.

b. Operation Phase

No impacts on settlement during this phase are found.

Mitigation measures**a. Construction Phase**

The impacts and possible traffic accidents will be prevented or minimized through different measures.

- Consultation meeting with local community members regarding the awareness towards the safety issues by the project once prior to construction and twice during construction period,
- Placing traffic signs and limiting the maximum speed of vehicles.

b. Operation Phase

No mitigation measure is required at this phase.

3.9 Health and Safety

Impacts**a. Construction Phase**

There is no impact on the health of the people of nearby settlement due to project activities. However, there is minimal risk of electric shock (less than 5%) and occupational injuries to the construction workers during wiring/fitting process. Thus the project should take into consideration for health and safety of the workers.

b. Operation Phase

There will be no prominent impact on this phase.

Mitigation Measures**a. Construction Phase**

- An on-site medical facility and first-aid will be provided for the construction phase to cater for primary health care needs of personnel.
- Personal protective equipment (Hard hats, gloves and steel-toed shoes with rubber soles) for workers will be provided, when necessary, to minimize health and safety risks.

b. Operation Phase

No mitigation measure is required at this phase.

3.10 Loss of Crops

Impacts:**a. Construction Phase**

Though the ownership of land is under NEA, where the solar panels will be erected, some part of it is cultivated by locals. In the Raatmatey area, few patch of land had been cultivated with seasonal crops (sesame) by 4/5 families; however, these crops has already been harvested and now there is no any production within this land. And in Keraghari area, there are banana grooves (approximately 1000 numbers) cultivated by 3 families in around 0.69ha of land for their additional earning. Due to the project activities, these people will be affected as they lose their additional source of earnings.

b. Operation Phase

No impact is found in this phase.

Mitigation Measures

a. Construction phase

- Pre information to the locals (in Raatmatey area) will be given for not cultivating any crops prior to construction.
- For the loss of banana grooves, cash compensation, based on local market prices for the produce of one year calculated as per the norms of District Agriculture Development Office (DADO), will be provided to the affected families.

The estimated cost for the loss of banana grooves based on the consultation with the local people is given in following table.

Table 3-2: Cost of crop loss

S.N	Particulars	
1	No of plants	1000
2	Cost per plant	Rs 450
	Total	Rs. 450,000

The estimated loss of crops (banana) is Rs. 450,000. However, the project will provide the compensation for the loss of production with close coordination with DADO and the compensation will be provided before the construction work start.

3.11 Loss of Structure

Impacts

a. Construction Phase

There is one temporary house within the proposed site (Keraghari area). A landless squatter family has been living in this temporary house since last four years. The owner of the house is Khilanath Rimal. The house needs to be shifted in other place for project activities. There is also an abandoned pig farm within the Keraghari area. The owner of the farm is staying in Battar and there are no any activities since the last one year in the farm. The farm will be demolished during the construction of the solar plant.

b. Operation Phase

There is no impact on structure during this phase.

Mitigation Measures

a. Construction Phase



- Pre information will be given to the families to take all the re-useable materials prior to the construction work.
- The squatter family will receive compensation for the structure loss at replacement cost without depreciation or deduction for salvage material. The family will also get 3 months of rental allowance.
- Transportation allowance will also be provided to the family.
- In case of abandoned pig farm, 50% of the total cost of structure will be provided to the family.
- Priority will be given to the affected family for the employment in the project.

The total mitigation cost for the loss of structures is estimated to be NRs. 490,000. The family will get the compensation in cash before the project starts its construction work.

Table 3-3: Cost for structure loss

S.N	Particulars	Cost (NRs)
1	Temporary house	
	Cost of structure loss	250,000
	Rental allowance	30,000
	Transportation allowance	10,000
2	Pig farm	200,000
	Total	490,000

3.12 Labor influx and Labor camp

Impact:

a. Construction Phase

The project should make camp for construction labors. The labor camp will be established within NEA's premises (outside the project area), however the location is not still finalized. There will be the issue of health and sanitation of labors within the camp. Thus, the project should take into consideration for the construction of toilets for male and female workers separately and biodegradable wastes produced by workers should be buried in pits. In the same way, influx of outside labor may affect the social and cultural life style of the local people.

b. Operation Phase

There is no impact during this phase as all labor force will returned back and labor camp will be demolished.

3.13 Corporate Social Responsibility

During the consultation with local people, it was reported that Multhala settlement located near by the project site has been facing drinking water scarcity. During the dry season, people have to go to Trishuli River for water which is about an hour distance. Therefore, as a part of CSR, project will provide financial support to the community for deep boring in the settlement to ease the scarcity of drinking water in the area. For this approximately NRs. 2,000,000 has been estimated.



3.14 Environment Mitigation Plan

The identified impacts due to project activities and the mitigation measures are explained in the given table.



Environmental Impact and Mitigation Matrix

S.N	Issues	Impacts	Mitigation Measures	Location	Timing of Action	Estimated Mitigation Cost (NRs)	Institutional Responsibility	
							Implementation	Supervision
A. Construction Phase								
1	Land use and Land take	A total of 7.57ha land will be covered by the solar farm which is under the ownership of NEA.	No mitigation measure is required.	-	Not required	Not required	Not required	Not required
2	Air Quality	The construction activities consist of site clearance including clearance of banana farming, cut-fill work for the levelling and grading of the land will generate dust in the surrounding area of Multhala settlement. Movement of transporting vehicles carrying the construction materials	Water will be sprayed on the earthen road along the Multhala settlement once a day. Maintenance of all vehicles and construction machinery will be done. Mufflers to all vehicles will be provided. Appropriate protective equipment against noise (e.g. respirators) will be provided for the workers.	Construction site.	Construction phase.	Project Cost	Contractor	ESSD/NEA
3	Noise Quality	Noise will be generated by the construction vehicles (grader, excavator, and dumper)	Maintenance of all vehicles and construction machinery will be done. Earmuffs or plugs to the workers will be provided as per the requirement. The construction work will	Construction site.	Construction phase.	Project Cost	Contractor	ESSD/NEA



			be limited to daytime as far as possible.					
3	Waste managements	The improper disposal of solid waste like cement bags, iron bar and other leftover construction materials and wastes from workers might cause sanitary problem to the Multhala settlement and also to workers involved.	Domestic type solid wastes will be managed by burying in pit. Recyclable wastes (such as glass, paper, plastic, etc.) will be collected separately to be sent for recycling. Separate waste containers (drums, bins, skips or bags) will be provided for different types of waste. No waste will be disposed along public road or in the surrounding area of Multhala settlement. Construction workers will be instructed for proper storage and handling procedures of construction waste and other solid wastes.	Construction sites and camp site.	Construction phase.	Project Cost	Contractor	GSEEP/ESSD
5	Erosion and Land Stability	The improper management of the drainage system during construction period may further lead to the expansion of existing gullies, formation of new gullies and cause instability problems such as soil erosion,	Gabion wall (length=28m, height=18m) need to be constructed as a retaining structure from the foot of the landslide up to its crown which is present at east boundary of Raatmatey area. Drainage structures need to be provided within the	Construction sites	Construction phase.	Project Cost	Contractor	GSEEP/ESSD



		landslides in the project area (Raatmatey area).	project boundary for proper management of drainage system of the project site.					
6	Impact on Settlement	Increase of traffic flow leads to the chances of road accidents and other pedestrian issues.	Consultation meeting with local community members regarding the awareness towards the safety issues by the project ; Placing traffic signs and limiting the maximum speed of vehicles.	In area surrounding the construction site.	Once prior to construction and twice during construction period.	Project Cost	Contractor	NEA/ESSD
6	Health and Safety	There is minimal risk of electric shock (less than 5%) and occupational injuries to the construction workers during wiring/fitting process.	An on-site medical facility will be designed to cater for primary health care needs of workers; Personal protective equipment (Hard hats, gloves and steel-toed shoes with rubber soles) for workers will be provided;	Construction site and surround settlement.	Construction phase.	Included in Project Cost	Contractor	NEA/ESSD
7	Loss of crops	Loss of additional income to the locals for banana grooves planted in some patch of proposed site (Keraghari area).	Cash compensation, based on local market prices for the produce of one year calculated as per the norms of District Agriculture Development Office, will be provided to the affected families.	Keraghari area	Preconstruction phase.	450,000	Project	NEA/ESSD
8	Loss of structure	One temporary house used by a landless squatter family	Pre information will be given to the families to take all the re-useable materials.	Keraghari area	Preconstruction phase	490,000	Project	NEA/ESSD



		<p>and one abandoned pig farm within the proposed site (Keraghari area) are affected by the project.</p>	<p>The squatter family will receive compensation for the structure loss at replacement cost without depreciation or deduction for salvage material. The family will also get 3 months of rental allowance. Transportation allowance will also be provided to the family.</p> <p>In case of abandoned pig farm, 50% of the total cost of structure will be provided to the family.</p> <p>Priority will be given to the affected family for the employment in the project.</p>					
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4 MONITORING AND REPORTING MECHANISM

Monitoring is an essential aspect of environmental and social management plan. An Effective monitoring of the whole project cycle, will assist for the implementation of monitoring plan and coordination of work of the project with concerned stakeholders as well as identify the unexpected problems/outcomes that might come in physical, biological and socio-economical sector and facilitate the correction of those. Land use pattern, settlement, health and safety, infrastructure, implementation of the mitigation measures are the few areas of monitoring.

NEA is responsible for regular monitoring and reporting of the implementation of the project. Ministry of Energy (MoEn), Department of Electricity Development (DoED) and local bodies will also be involved during the monitoring.

The environmental monitoring will be carried out at all the project impact areas in a regular or intermittent schedule.

The experts from ESSD will visit project site at periodic interval for the environmental monitoring of the project and prepare the monitoring report. The project manager office (PMO) will be responsible for the distribution of report to the concerned agencies. The detail of monitoring parameters, schedule, method and agencies to be consulted during construction and operation phases for physical, biological and socio-economic and cultural environment is presented in table given below.

4.1.1 Environmental Monitoring Plan

A monitoring program, required for the project to evaluate the application and effectiveness of mitigation measures, is formulated in three phases.

a. Preconstruction Monitoring

Since the construction work of the project will start immediately, preconstruction monitoring is not required for the proposed project.

b. Construction Monitoring

Impact and compliance monitoring will be conducted during this phase of project development.

Impact Monitoring

Impact monitoring will be carried out to assess actual level of impact due to project construction.

The impact monitoring includes:

- monitoring of the impacts of the project on physical, biological and socioeconomic & cultural environment of the area;
- monitoring of the accuracy of the predicted impacts;
- identify the emerging impacts due to project activities or natural process and develop remedial action; and
- monitoring of the effectiveness of mitigation measures.

Compliance Monitoring

The compliance monitoring will be conducted to monitor the compliance of the proposed mitigation measures and monitoring activities. The compliance monitoring will mainly focus on;

- compliance of the tender clause;
- compliance of the mitigation measures;
- timely and adequately implementation of Environmental Management Plan; and
- overall environmental and social performance of the project.

Table: Monitoring Plan

S.N.	Parameter	Indicators	Method	Location	Schedule
A	Construction Monitoring				
Impact Monitoring					
1	Air Quality	Dust around the project area	Observation	Construction site, Battar-Charghare-Khadgabhanjyang road along Multhala settlement	Weekly during construction
2	Noise Quality	Construction vehicles	Standard of MoEST	Construction area	Weekly during construction
3	Waste Management	Unpleasant odour and visual impact	Observation	Labor camp/ construction sites	Weekly during construction
	Erosion and Land stability	Management of drainage system	Observation	Construction area	Monthly during construction
4	Crop loss	No. of banana trees	Observation of the area, discussion, counting	Keraghari area	Construction period
5	Compensation	Structures loss	Observation of the area, discussion with affected families	Keraghari area	Construction period
6.	Health and Safety issues	Impacts on health of the workers; No. of accidents	Inspection of the construction place; Records of accidents	Project area	Continuous during construction period
8	Employment	No. of local people employed by project	Records kept by management	Project area	Continuous during construction period and annually during operation
9	Infrastructure development		Observation, consultation with public	Project area	Construction period
Compliance Monitoring					
1	Allocation of adequate budget for implementation of environmental mitigation measures and monitoring works	Yes/No	Review, inquiry and consultation	Kathmandu Office	Preconstruction phase



4.1.2 Environment Mitigation and Monitoring Cost

Environment Mitigation Cost

Total environmental mitigation and CSR cost is estimated to be NRs 2,940,000 which is only 0.31% of the total project cost.

S.N	Activities	Amount (NRs)
1	Loss of crops	450,000
2	Loss of structure (temporary house)	490,000
4	CSR	2,000,000
	Total	2,940,000
	Total Project Cost	957,330,000
	% Project Cost	0.31%

Environment Monitoring Cost

The monitoring costs have been estimated in Table 4-1. The total cost for the monitoring activities (for construction phase) has been estimated as NRs. 2,723,150/-.

Table 4-1: Monitoring Cost of the Proposed GTSP Block No. 1

S.N.	Item	No. of Persons	Man-month			Rate/Month (NRs.)	Amount (NRs.)
			Office (100%)	Field (150%)	Total		
Construction Phase							
1	Manpower						
	Sr. Environment Expert	1	1	-	1	41,000	41,000
	Coordinator	1	4.5	1.5	6	35000	236,250
	Civil Engineer	1	2.5	1.5	4	35000	166,250
	Environmentalist	1	2.5	1.5	4	35000	166,250
	Socio-economist	1	2.5	1.5	4	35000	166,250
	Electrical Engineer	1	2	-	2	35000	70,000
	Liaison Officer	1	1	-	1	30,550	30,550
	Support Staff	2	6		12	30,500	366,000
	Cost of line agencies monitoring					LS	10,000
	Sub Total	9	34				1,243,150
Out of Pocket Expenses							
	TA/DA					LS	500,000
	Vehicle hire/ Maintenance					LS	500,000
	Report Production					LS	100,000
	Computer and Printer					LS	120,000
	Community Consultation					LS	100,000
	Miscellaneous					LS	150,000
	Sub-Total						1,470,000
Total of Construction Phase Monitoring							2,723,150

4.2 Grievance Redress Mechanism (GRM)

Grievance redress mechanism must be established to allow project affected families/households (PAFs/HHs), community or other stakeholder to appeal any disagreeable

decisions, practices and activities arising from compensation for assets, environmental and community concerns related to project. GRM for any infrastructure project provides an effective approach for complaints and resolution of issues made by the affected community in a reliable way. Considering this, a Grievance Redress Cell (GRC) must be established at project site. The GRC for the proposed project has already been established on 2072/05/11 as per the requirement of Environment and Social Management Framework (ESMF) at project site to address the social issues associated with the project. The following manpower are the members of GRC;

Project Coordinator	Coordinator
Project Manager, GTSP	Member Secretary
Officer from Bidur Municipality	Member
Secretary, the then Charghare VDC	Member

The field level GRC will be formed after the commencement of work in the site. Till then the project level GRC will look after the grievance if any. The GRC maintains registration books to look into complaints and concerns about ownership disputes, inheritance of assets, distribution of compensation among heirs, missing affected assets etc. The GRC seeks to resolve the issues quickly in order to expedite the receipt of compensation, without resorting to expensive and time-consuming legal actions. The budget for setting up the grievance cell has been provided by the PMO itself.

In addition to the above, if there are any grievances related to environmental management issues in the project area, the GRC also records these grievances and suggestions and pass it on to the PMO for necessary action and follow-up.

4.3 Implementation of Mitigation/Enhancement Measures and Monitoring Activity

The proponent has prime responsible for implementing the proposed mitigation/enhancement measures and the monitoring activities. Proponent has an obligation to carry out all these activities along with cost.

Annex I
Project Related Photographs and
Minutes of Consultation Meeting



Figure I: Keraghari area



Figure II: Raatmatey area



Figure III: Affected House



Figure III: Abandoned Pig Farm



Picture I: Consultation Meetings at Project Site



नेपाल विद्युत प्राधिकरण
वातावरण तथा सामाजिक अध्ययन विभाग

नेपाल विद्युत प्राधिकरणद्वारा प्रस्तावित ग्रिड सोलार तथा इर्नर्जि इफिसियन्स आयोजना अन्तर्गत ग्रिडमा आवद्ध सौर्य विद्युत आयोजना कार्यान्वयन गर्दा आयोजना प्रभावित क्षेत्रमा पर्ने सबै वातावरणीय प्रभावहरूका बारेमा ने.वि.प्रा., वातावरण तथा सामाजिक अध्ययन विभाग, भक्तपुरबाट प्रारम्भिक वातावरणीय परिक्षण (IEE) प्रतिवेदन तयार गर्ने सिलसिलामा खटिआएका वातावरणीय अध्ययन टोली तथा स्थानियवासी, सरोकारवालाहरू विच निम्न मिति, समय र स्थानमा छलफल गरी निम्नलिखित रायसुझाव संकलन गरियो।

स्थान : जिल्ला : सुनसरी नगरपालिका: विद्युत न.प्रा. (साविकको गा.वि.स. चारबेटा-२
वडा नं./ठाउँ : ६ मिति : २०७४/०९/११ समय : २ बजे

उपस्थिती

क्र.सं.	नाम थर	पद/पेशा	ठेगाना/संस्था	सम्पर्क नं	हस्ताक्षर
१.	दाशरथ रिजाल	कृषि	वि.न.पा. ६	९७०५५४४	
२.	सुदिप कटवाल	कृषी	वि.न.पा. ६	९७४९०७६६६६	
३.	तारा नन्दा रिजाल	कृषी	वि.न.पा. ६		
४.	जयप्रकाश रिजाल	कृषी	वि.न.पा. ६	९७७६७२६६२	
५.	केशव रिजाल			९७७७७७७७	
६.	तेज प्रकाश रिजाल	कृषी	वि.न.पा. ६	९७७७७७७७	
७.	नरेश रिजाल		११ ११		
८.	मधु रिजाल	कृषी	वि.न.पा. ६		
९.	रविन्द्र नन्दा रिजाल				
१०.	सुदिप रिजाल	विद्यार्थी	११ ११		
११.	अनिल रिजाल	विद्यार्थी	वि.न.पा. ६		
१२.	अनिल रिजाल	विद्यार्थी	" "		
१३.	केशव रिजाल				
१४.	तेज कटवाल				

रायसुझाव :

- न.वि.प्रा.को वातावरण लागीको समझना आएकोले आयोजना निर्माण गर्दा आयोजनाले वातावरण लागीको समझना (विच खाँड) गरिदिने आयोजनाको सबैको सहमति रहेको।



नेपाल विद्युत प्राधिकरण
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नेपाल विद्युत प्राधिकरणद्वारा प्रस्तावित ग्रिड सोलार तथा इनर्जि इफिसियन्स आयोजना अन्तर्गत ग्रिडमा आवद्ध सौर्य विद्युत आयोजना कार्यान्वयन गर्दा आयोजना प्रभावित क्षेत्रमा पर्ने सक्ने वातावरणीय प्रभावहरूका बारेमा ने.वि.प्रा., वातावरण तथा सामाजिक अध्ययन विभाग, भक्तपुरबाट प्रारम्भिक वातावरणीय परिक्षण (IEE) प्रतिवेदन तयार गर्ने सिलसिलामा खटिआएका वातावरणीय अध्ययन टोली तथा स्थानियवासी, सरोकारवालाहरु विच निम्न मिति, समय र स्थानमा छलफल गरी निम्नलिखित रायसुभाव संकलन गरियो ।

स्थान : जिल्ला : सुनसरी नगरपालिका : सिरा (साविकको गा.वि.स. ७/१/६)
वडा नं./ठाउँ : ६/२/१/१ एकीकृत मिति : २०७४/०९/१२ समय :

उपस्थिती

क्र.सं.	नाम वर	पद/पेशा	ठेगाना/संस्था	सम्पर्क नं	हस्ताक्षर
१.	राम वहाडु चौधरी	कृषि	सि.स.प.स.		राम
२.	बुद्ध वहाडु चौधरी	कृषि	२२ २२	९४४९९९१५२९३	बुद्ध
३.	केदार प्र. रिजाल	००	०० ००	९९५५५५५५५५	केदार
४.	गणेश वहाडु चौधरी	००	००		गणेश
५.	हरि वहाडु चौधरी	००	००		हरि
६.	लिडा प्रसाद रिजाल	००	००	९९९९९९९९९९	लिडा
७.	नारायण रिजाल	००	००		नारायण
८.	सोम प्रसाद रिजाल	००	००		सोम
९.	जगत वहाडु चौधरी	००	००	९९९९९९९९९९	जगत
१०.	सुभाष चौधरी	००	००		सुभाष
११.	नारायण चौधरी	००	००		नारायण
१२.	जगत वहाडु चौधरी	००	००		जगत
१३.	जगत वहाडु चौधरी	००	००		जगत
१४.	रामकुमार चौधरी	००	००		रामकुमार

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नेपाल विद्युत प्राधिकरण
वातावरण तथा सामाजिक अध्ययन विभाग

नेपाल विद्युत प्राधिकरणद्वारा प्रस्तावित गिड सोलार तथा इर्नाजि इन्फिसियन्स आयोजना अन्तर्गत गिडमा आबद्ध सौर्य विद्युत आयोजना कार्यान्वयन गर्दा आयोजना प्रभावित क्षेत्रमा पर्ने सबन्धे वातावरणीय प्रभावहरूका बारेमा ने.वि.प्रा., वातावरण तथा सामाजिक अध्ययन विभाग, भक्तपुरबाट प्रारम्भिक वातावरणीय परिक्षण (IEE) प्रतिवेदन तयार गर्ने सिलसिलामा खटिआएका वातावरणीय अध्ययन टोली तथा स्थानियवासी, सरंकारवालाहरू विच निम्न मिति, समय र स्थानमा छलफल गरी निम्नलिखित रायसुझाव संकलन गरियो ।

स्थान : जिल्ला : सुनसरी नगरपालिका : दिङ्गुर (साविकको गा.वि.स. सुनसरी)
वडा नं./ठाउँ : ६, दिङ्गुरादी मिति : २०७४/०९/१९ समय :

उपस्थिती

क्र.सं.	नाम थर	पद/पेशा	ठेगाना/संस्था	सम्पर्क नं	हस्ताक्षर
१.	केदार प्रेमाल		दि-सु-४	९७०२६०६९०	
२.	राजु "				राजु प्रेमाल
३.	आशुम "		दि-सु-६		
४.	दिङ्गुरादी "				दिङ्गुरादी
५.	प्रदिप "		दि-सु-४		
६.	नवल "		दि-सु-४	९७०२६०६९०	
७.	विमलराज "				विमलराज
८.	दिङ्गुरादी "	कृषि	मिपलराज		दिङ्गुरादी
९.	शेषराज दिङ्गुरादी	"	"		शेषराज
१०.	पुनम पौडेल		ने वि.प्रा.		
११.	नगेन्द्र सुब्बा	तोकरी	ने वि.प्रा.		
१२.					
१३.					
१४.					

रायसुझाव :

- आशुमराज प्रेमाल प्रस्तावित पीपलको चित्र सुझावमा
विकास निर्माणको कार्यमा सहभागी

Issues/Demands received from Consultation meetings (translated in English):

1. Since there is the scarcity of drinking water in the settlement, the project should provide support for deep boring.
2. People are positive towards project if the project will give appropriate compensation to the affected families.