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Identifying Suitable Areas for the Resettlement of IDP's due to the Budhi Gandaki Hydroelectric Project in Nepal

by

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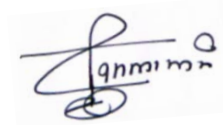
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Science Pledge

By my signature below, I certify that my Thesis/ Research report is entirely the result of my own work. I have cited all sources of information and data I have used in my project report and indicated their origin.



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Abstract:

Large scale hydropower projects featuring dam construction causes massive inundation resulting in displacement of population either economically or both economically and physically. Successful execution of these projects necessitate resettlement plan. One of the major parts of resettlement plan is relocation of the IDPs which requires rigorous method for selection of suitable location involving several criterias.

This research discusses about the relocation plan of BGHEP. A multicriteria approach is implemented through the application of Analytical Hierarchy Process for selection of suitable sites for relocation of the IDPs. Site suitability analysis involves several criteria namely slope, landcover, geology, aspect, etc. The influence of each of these criteria on site selection is determined using AHP. Along with the spatial criteria, the analysis considers policy, legislations, good practise guidelines implemented for site selection in similar hydropower projects.

The analysis indicates that there is sufficient suitable site for relocation of IDPs within each Village Development Committee.

Key word's: Resettlement, IDPs, Multi criteria analysis, Suitability Modelling, AHP

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Chapter 1: Introduction:

This chapter gives the short description about the Budhi Gandaki Hydroelectric Project (BGHEP) and its importance in Nepal for the development issues. The aims and objective of the thesis follow and reflected to the research questions. And also clarification about the scope and limitation of this study.

1.1. Background

Internally Displaced People (IDP) are those who have not crossed an international border but have remained in their home country and are forced to flee their home due to number of reasons (U.N., 1999). Some of the major reasons are armed conflict, mega-development project, and natural disaster. According to Internal Displacement Monitoring Center (IDMC) 38 million people are displaced by conflict as of January 2015 and 22 million people newly displaced by disaster in 2013 among which 19.1% is only from Asia (IDMC, 2015). According to the same report up to 50,000 people are internally displaced due to armed conflict in Nepal, which does not include people displaced by violence in the central Terai. Similarly, monsoon flooding in August 2014 displaced families which account to be around 43,200 families (IDMC, 2015).

Besides conflict and disaster, development project is also another big reason for internal displacement of the people (www.law.georgetown.edu). The data from the WCD shows millions of people have been displaced involuntary in the past few decades. In China roughly 10 million people were displaced in the late 1980s and in India the figure was quite staggering during 2000, about 21 to 33 million were the victims of the large dams. These figures are partial and it did not account for the people living in upstream and downstream which WCD refer as “livelihood displacement” (Bartolome, *et. al.* 2000).

Reservoir type Hydroelectricity Development Project are one of the major causes of displacement of people in context of Nepal. Further, the successful execution of such

development project also depends on the proper resettlement of those internally displaced people due to the project. Thus, for this research case of Budhi Gandaki Hydroelectric Project (BGHEP) has been studied where approximately 42,000 people are internally displaced due to the reservoir of this system. In spite of different approaches of resettlement like hiring relocation lands, building new communities, developing local infrastructure, mitigating geological hazards, compensation and improving internally displaced people's skill (Tang,.*et.al*, 2013), relocation of the displaced people at suitable location closer to the project site has been considered.

In hydropower development, resettlement of people displaced by the reservoir due to the dam is crucial and important matter. Land lost due to the reservoir inundation and the adjustment of land-use policy resulted in land-use changes, and impacted on the human carrying capacity of the land and the land availability for resettlement (Leslie, 2005). Relocation not only includes resettlement and rehabilitation of the physically and economically displaced people but also the relocation of the affected schools and colleges, public and private institutions, temples / shrines and the cremation sites . Local people of the affected area have the social and cultural attachment with the place and thus may be reluctant and resistant to the relocation to new places. Present issue of resistance from the people of Sindhupalchok district who were displaced due to recent devastating earthquake is a good example of the social and cultural attachment with their native place. Thus, different aspects need to be considered during resettlement. The study considers social, environmental, geological stability, terrain, extent of the suitable place (shape and size).

Budhi Gandaki Hydroelectric Project (BGHEP) is a national priority hydroelectric project proposed by the Government of Nepal. The project is a reservoir type project and is going to be developed with installed capacity of 1000/1200MW. The project is expected to cater energy requirements of the major cities and industrial hubs in the Central and Western Development Region of Nepal. Currently, Detailed Project Report

(DPR) of the project is being developed. Being a reservoir type project, the reservoir will submerge settlement areas affecting about 50,000 people. Thus, resettlement of the affected people is inevitable while executing the project.

According to Tang, *et.al*, (2013) “the approaches of resettlement include hiring relocation lands, building new communities, developing local infrastructure, mitigating geological hazards, compensations and improving displaced people’s skills for sustainable development. Similarly ADB (1995) outlines resettlement plan as "scope of land acquisition and resettlement, objectives, policy framework and entitlements, consultation and grievance redress participation, compensation, relocation and income restoration, institutional framework, resettlement budget and financing, implementation schedule and monitoring and evaluation”. However, this research considers resettlement plan as relocation of the displaced people at suitable location closer to the project site. The selection of suitable resettlement site is the most important aspect of proper rehabilitation (Singh,1993).

The successful execution of development projects depends on the resettlement plan for the affected people. There are various mega projects in Nepal that are being delayed due to the lack of suitable resettlement plan. Similarly, resettlement plan is the main issue to be considered in time for the successful execution of BGHEP. In this context, the main issue to be considered is the resettlement and rehabilitation of the physically and economically displaced people and relocation of the affected service centres like schools and colleges, public and private institutions, temples / shrines and the cremation sites.

Since, the BGHEP project is in the phase of developing DPR, it is right time to develop an appropriate resettlement plan. Therefore, this study aims to identify the suitable area near the inundated area such that the affected people can be rehabilitated in the vicinity of the reservoir of the project.

1.2. Rationale

Land acquisition, compensation and resettlement are the crucial issues concerning development projects, which requires appropriate resettlement programme and implementation mechanisms (ADB,1995). Budhi Gandaki Hydroelectric Project is one of the national priority projects of Nepal being developed by Budhi Gandaki Hydroelectric Project Development Committee under Government of Nepal. Since the successful execution of this project relies heavily on the resettlement of the affected people, this study will benefit not only to the local society but also to the nation as a whole.

In present context, Nepal lacks resettlement policy and hence providing compensation and resettlement is a challenging mission. It is expected that the outcome of this study through vigorous research might contribute to the development of national resettlement policy.

Furthermore, there exist several resettlement plans implemented for the IDPs from various projects. But the main concern of the plan remains towards the socio economic prospects and quite a few practices are seen for the spatial assessment. This study will be based on the spatial as well as socio-economic analysis for the development of the resettlement model.

The rationale of developing such plan is that, it will be useful to identify the resettlement sites in the immediate vicinity of the reservoir so that the displaced people get the opportunity to be in the same landscape and maintain the social, economic and cultural linkages.

1.3. Objective

The major objective of the study is to identify the potential sites for resettlement of the IDPs which is the most essential issues to be addressed in resettlement planning within the vicinity of project sites of BGHEP.

Specific objectives of the study are as follows:

- To assess the Socio-economic impacts resulted from the displacement.
- To identify the aspirations of the affected people with regard to rehabilitation.

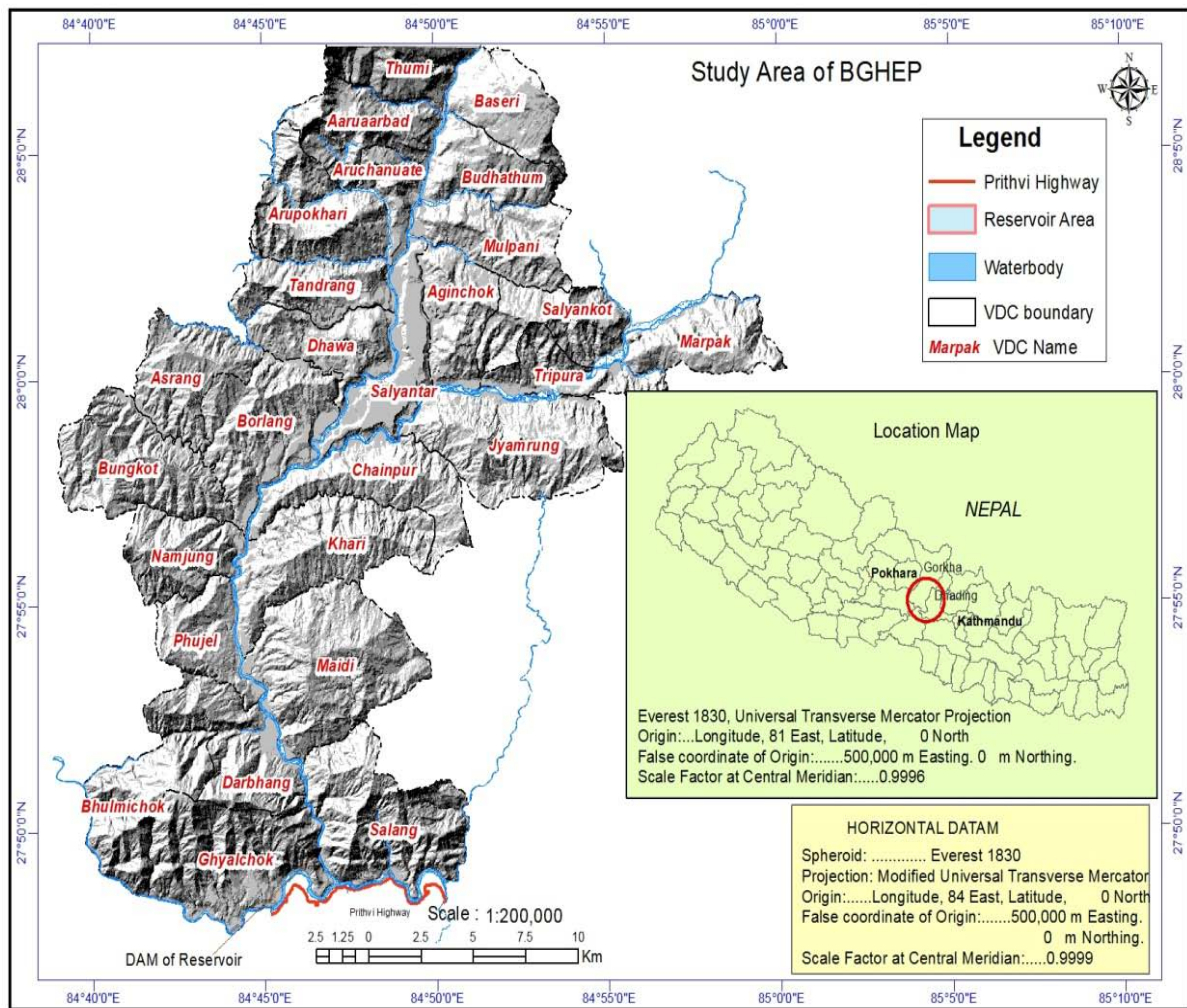
1.4. Research questions

- ✓ What are the spatial criteria for selection of suitable area for resettlement of IDPs?
- ✓ How much cultivation, forestry and other land would be lost due to inundation caused by the dam and what will be the impact of displacement due to resettlement ?
- ✓ What are most suitable places for the resettlement of IDPs from BGHEP inundation of reservoir?

1.5. Study Area

Proposed Budhi Gandaki Hydroelectric Project (BGHEP) is a reservoir based project located about 2 km upstream of Budhi Gandaki–Trishuli confluence on Budhi Gandaki River. When developed with the proposed Full Supply Level (FSL) at 540 masl, the reservoir of the project will require approximately 66 km long linear stripe of land area with total area of 6637 hectares (Table 3) along the valley of Budhi Gandaki in the district of Gorkha and Dhading at the cross-junction of Central and Western Development Region of Nepal.

In this research , 27 VDC from both district Gorkha (14 VDC) and Dhading (13 VDC) are taken as a study area. The VDC are Baseri, Budhathum, Mulpani, Salyantar, Aginchok Salyankot, Marpak, Tripureswor, Jyamrung, Chainpur, Khari, Maldi, and Salang of Dhading District and Thumi (Partial), Aarubang, Aaruchanuate, Aarupokhari, Tandrang, Dhawa, Asrang, Borlang, Bunkot, Namjung, Fujel, Darbhung, Bhumlichok and Ghyalchok, of Gorkha district. The total study area is 579.22 km² including the reservoir area and 513.21 km² excluding the reservoir (Map 1).



Map 1 Location map of the study area.

1.6. Scope and limitation of the Study

1.6.1. Scope

With consideration that every resettlement projects has its unique features, it is very difficult to come up with a generalized model for resettlement. Hence this research work focuses on a particular case where displacement of the people is caused due to development of hydropower project and suitable site selection for the resettlement of the displaced people is crucial for the successful completion of the project. There are possibly infinite number of factors that determines the suitability of relocation for the IDPs. This research work focuses only on a limited set of variables which are

considered to have a significant influence in suitability selection. The most important aspect of proper rehabilitation is the selection of suitable resettlement site, which are investigated within the geographical boundaries of the project affected VDC. Total 27 project affected VDC are considered as the area of study..

1.6.2. Limitation of the study

Since BGHEP is the project with national priority and of national pride which is in a phase of finalizing DPR, resettlement of Affected People (AP) is a crucial matter. There are many factors which need to be considered for developing resettlement plan. Among them one of the factor is selection of suitable sites for relocation and socio economic assessment of the affected area for relocation which is the most important. Resettlement of affected people is very vague subject and need to consider numbers of criteria and factors.

For a successful resettlement plan, various factors such as social, environmental, geological stability, terrain, extent of the suitable place (shape and size), availability of public facilities such as school, hospital, transportation, natural resources (water sources, fire wood etc), public willingness, socio cultural issues and environmental impacts are the major parameters to be considered. However, the study does not deal with availability of public facilities such as school, hospital, transportation, etc since the study area is in rural area and it is assumed that these infrastructures can be developed once the suitable places have been identified which becomes one of the part of resettlement plan also. The thesis only incorporates the suitability analysis on the basis of different criteria and identify the proper relocation sites within the vicinity of the reservoir.

Chapter 2: Resettlement in development projects: A Review

This chapter gives a short literature review about the resettlement and rehabilitation issues, different practices that have been adopted in different development projects. In this chapter, It is discussed about the national and international policies and past experiences on the issues of resettlement of IDPs from their native location.

2.1 Resettlement and issues

According to ADB (1995), resettlement plan is a crucial issue for the successful execution of a project and the plan should consider the socio-economic and environmental impact caused due to construction of project. If the resettlement of population is unavoidable, the strategy should ensure that the people affected by project should generally be at least equal to the existing status after resettlement as they would have been without the project. Resettlement plan is a time-bound action plan with budget, setting out resettlement strategy, objectives, entitlement, actions, responsibilities, monitoring and evaluation (ADB, 1995). Resettlement or relocation is the social process in which people leave their original area of residence and settle in a new area (Woube, 2005). The most essential and basic issue in a resettlement planning is the selection of a most appropriate site where minimum requirements of the people to lead a satisfactory life can be managed (Dagnachew *et.al*, 2014). Thus, critical analysis of site selection is one of the major part of resettlement (Burbridge, *et al*, 1988).

With regards to the scope of this research work, a brief guidelines for the resettlement plan specifically for BGHEP IDPs and other APs can be discussed as below:

1. Assessment of the Affected people(AP)

- a. Enumerate the number of IDPs and economic displaced people.
- b. Categorize the affected people precisely into physically & economically displaced and economically displaced only.

- c. Assess the loss in land, house and other assets with respect to present prize.
- d. Assess the loss of sources of livelihoods
- e. Appraisal of the interest of APs in consideration to the form of resettlement, relocation or compensation options.

2. Site selection for resettlement of IDPs.

The process of land acquisition should be started not only the reservoir area but also to the possible resettlement site.

Asthana (2012) reviews the forced displacement of the affected people from Tehri Dam are in India and found that the project affected people who were resettled in the other locations were also struggling with their new environments and way of life. Furthermore, it concluded that the compensation in the form of money and land is not enough in the event of development projects. Sayatham and Suhardiman (2015) concluded that "while asset substitution generally can improve people's livelihoods, access to land continues to play an important role in the process of livelihood reconstruction and the shaping of livelihood outcomes". Tan, *et.al.* (2013) considered the resettlement of displaced people is one of the most important risks of hydropower project development. The researchers had found that the resettlement of displaced people became a main restriction for the project development. Resettlement problems can influence the attainment of government approvals, disrupt the construction processes, impede the normal operations of completed hydropower projects, and ultimately result in heavy financial losses to the investor. The reasons for creating problems by the displaced people during the project development are;

- i) the compensation is too low to cover the losses of assets acquired for the project development,
- ii) lack of proper coordination between the investor and the government for the resettlement of the displaced people,

- iii) resettlement planning is insufficient due to the short planning period offered by the investor and the technical difficulties in identifying appropriate relocation lands, and
- iv) there are inadequate measures for supporting displaced peoples' sustainable development.

According to Jackson and Sleight (2000) the resettlement issues of Three Gorges Dam in China, the largest hydropower dam of the world, will have adverse social and health impacts on more people than any other ever built. The resettlement plan of the dam could not come out of critics. Furthermore, the researchers also discuss the fact that the resettlement of displaced people from the large projects like Three Gorges Dam needs complex procedures to mitigate adverse effects to the displaced people.

Fujikura R and Nkayama M. (2013) reviewed some ten cases of dams from different 4 countries which compared land-for-land compensation and land-for-cash compensation. The reviewers identified some good practices, which indicate that a land-for-land compensation scheme is a major option for resettled individuals. In case of land-for-cash compensation strategy, the amount of compensation received for livelihood rehabilitation may be completely insufficient for sustaining livelihoods of the displaced people. In some cases, it is found that small landowners and landless farmers suffered many hardships as disparity among resettled individuals became larger.

According to Bartolome, *et.al*, (2000) "there is an inverse relationship between scale of displacement and extent of achieving successful resettlement outcomes even in countries with best policy, institutional capacity and political commitment to do proper resettlement". The paper concludes that a successful resettlement with development is a fundamental commitment and responsibility of the state.

2.2 Resettlement in context of hydropower development in international cases: policies and practices.

Nepal Law Commission has drafted a land acquisition act 2011 with the aim of amending and integrating existing land acts in Nepal related to land acquisition. The draft act addressed some issues identified as gaps associated with international best practices on involuntary resettlement (ADB, 2012). But till date, it is not till concretized as a integrated law. However, Land Acquisition and Resettlement Policy (LARP) is just published from National Planning Commission (NPC).

International agencies such as International Finance Corporation (IFC), Asian Development Bank (ADB) and World Bank (WB) have developed specific safeguard policies concerning involuntary resettlement. The basic elements of the involuntary resettlement policy objectives of the lending agencies are:

- Avoid or minimize involuntary resettlement wherever possible through alternative assessments; and
- Where avoidance is not feasible ensure restoration of the livelihood of the displaced persons at least at par with or better than the pre-project conditions by augmenting sustainable development programs as an integral part of the project.

According to International Finance Corporation physical and economic displacement of the people may occur due to the project-related land acquisition and/or restrictions on land use (IFC, 2012). Therefore, land-based compensation should be offered to affected people if their livelihoods are totally based on land and the proposed land take is significant enough to render a land holding economically unviable (IFC, 2012). If it is not possible to offer land for replacement, the client is to provide opportunities that enable sellers of land to restore their livelihoods and standards of living to levels equivalent to, or better than, those maintained at the time of sale (IFC, 2012).

The involuntary resettlement covers physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas.

According to ADB (1995) the key involuntary resettlement policy principles and strategy includes:

- meaningful consultation with the affected persons with special attention to vulnerable persons including host communities on i) options and rights related to resettlement ii) choices of resettlement alternatives, and iii) measures of integration with host communities by providing participation opportunities during planning and implementation of resettlement programs;
- Non- title to land is not a bar to resettlement assistance and compensation rights;
- preference to equal quality land-based resettlement for displaced persons whose livelihoods are land-based;
- Replacement cost based resettlement for displaced persons whose livelihood is land based may be applicable where it could be demonstrated that adequate land is not available ;
- Disclose Land Acquisition and Resettlement Action Plan (LARP) and resettlement and rehabilitation entitlements to the displaced person including documentation of consultation at freely accessible public institutions in language understandable to the displaced persons prior to resettlement implementation;
- provide compensation at full replacement cost for losses of assets prior to land and property acquisition;

- provide full resettlement entitlements and rehabilitation assistance to the displaced persons prior to the land and property acquisition;
- implement the LARP under close supervision throughout project implementation;
- monitor and assess resettlement outcomes against the baseline conditions; and
- disclose monitoring reports regularly.

2.3 National Policies and practices in context of hydropower development in Nepal.

The Government of Nepal drafted the policy on land acquisition, resettlement and rehabilitation for the infrastructure project development only in 2015. Prior to this, land acquisition were not explicitly guided by any single policy but formed a part of several acts such as Land Acquisition Act, 2034 (1977), Land (Survey and measurement) Act, 2021 (1964), Land Revenue Act, 2034 (1977) and Guthi Corporation Act, 2033 (1976). These legislations stipulate legal procedures for acquisition of the private/community lands, however, do not address measures to rehabilitate the affected people in accordance with their vulnerability (economic, social, educational, ethnic etc). Except for the Guthi land (religious trust land) preferred mode of compensation to the lost land and property as per these legislative measures is cash based. Affected peoples are notified with regard to land and property acquisition but are not generally consulted prior on the matters related to fixation of compensation prices which is purely dominated by bureaucratic officers. However, appeal against the compensation prices could be registered to higher bureaucratic level and to the appellate court for final decisions.

The National Policy on Land Acquisition, Compensation and Resettlement in Development Projects in Nepal was prepared in September 2006 by the NPC with assistance from ADB. The Policy was approved by a ministerial level working

committee and the NPC but has yet to be approved by cabinet. The Policy has the following guiding principles (GoN, 2015a):

- Appropriate and adequate compensation for the loss of assets or income is a fundamental right of all Project Affected Peoples. Physically displaced person must be relocated with basic amenities such as school, health posts and other facilities.
- All affected persons should be assisted to restore at least their pre-project income and livelihood sources.
- The absence of legal title to land should not be a bar for compensation, resettlement and rehabilitation assistance.
- Vulnerable groups such as Ethnic group, indigenous and lower cast people (Janajati/Adivasi, Dalits), landless, women, especially women-headed households, poverty groups and senior citizens are entitled to special benefit and assistance packages in addition to compensation and resettlement.”

One of the entitlements for people affected by development projects is: cash compensation at full market value (equivalent to replacement value) for all acquired land if the provision of replacement land is not feasible; with the stipulation that a person who becomes a marginal landholder as a result of land acquisition should be provided with replacement land of equivalent productivity or value.

The scale of displacement varies from project to project according to the size and topography of the project. In Nepal, there is no any such a huge amount of IDPs due to the project as that of BGHEP. Therefore BGHEP Developing Committee will face the problem of finding solution for the IDPs before the execution of the project. Hydropower projects in Nepal are predominantly run-of-river types which induce far less resettlement and rehabilitation issues in comparison to reservoir based projects. Kulekhani hydropower project (1977-82) is the only reservoir based project which induced displacement of people at a larger scale. 3000 individuals were displaced from

450 households (Benerjee, 2005), which is still very less in comparison to the displacement that will cause due to BGHEP. The IDPs were provided with option of land-for-land and cash as compensation. Predominantly the IDPs opted for cash because of scaling up of price of land but in a long run the cash compensation resulted to IDPs being poorer..

2.4 Spatial issues in resettlement due to dam

A review of resettlements caused by hydropower developments is done to garner insight into the prospective spatial issues that could arise in resettlement. Different issues of hydropower dam were studied.

2.4.1. Three Gorges Dam, China

The Three Gorges Dam project, the largest hydropower-station in the world was officially launched in Dec 14, 1994. By the completion of the project in 2009, more than 1.2 million population was resettled. The reservoir covers an area of 1000 km² (Emily Levine, 2005). The resettlement program was initiated in 1995. The policy on resettlement focused on opening up land and moving the displaced to higher ground within the home counties assuming 60% of rural resettlers to continue with the agriculture (Shawn, S., et al, 2002). The opening up of land caused deforestation which exacerbated flooding in the Yangtze river. This realization led to the policy shift emphasizing on distant resettlement over local resettlement. The regulations were amended to prohibit opening of new land on slopes greater than 25 degrees and also incentives were provided to return the land to natural forest (International River, 2012, Jackson & Sleigh, 2000 , Steil & Yuefang 2002).

2.4.2. Tehri Dam, India

The Tehri dam, multipurpose rock fill dam of height 260.5 meter from ground level is one of the highest dam in the world. It was designed finally in 1972. The construction work started from 1978, but it was delayed for a long time due to the social,

environmental and resettlement issues. From 2006, it was operated with 1000MW of energy.

The major achievement of this project is that it is one of the successfully implemented project in the issue of involuntary resettlement (Adhikari, 2009). Due to this project, more than 85000 people were affected from 12547 family. The project prepared well planned resettlement plan dividing urban and rural site for IDPs due to dam, by the establishment of New Tehri Town at the height of 1600 m from msl. About 5300 families were resettled in New Tehri town near the reservoir providing all modern facilities and became a best example of involuntary resettlement. 4194 hectares of forest land were used (Adhikari, 2009) for the construction of dam and resettlement for the IDPs.

2.4.3. Son La Dam, Vietnam

Started in 2005, the Son La Hydropower Project which comprised Son La Dam was completed in 2012. 91,100 people from 246 villages were displaced due to the inundation. Though a "land for land" policy was applied for compensation with the aim of providing 1 hectare of farmland for each displaced family, lack of adequate arable land resulted in diversion from the policy and thus cash compensation was provided. The assessment of the host along with resettlers community after the resettlement indicates dwindling of the income of both the community (Bui, *et. al.*, 2013).

2.4.4. Itaipu Dam, Brazil

This is the world's 2nd highest electricity generating hydropower dam with the height of 196 meters situated near the border of Brazil and Paraguay built from 1975 to 1991 on the Parana River. Due to the dam, more than 50,000 people from 10000 families were displaced from the inundated area and relocated them near the dam site. The total inundation area due to this dam is 1,350 km² (520 sq mi) (Natalie, *et al*, 2007).

Forest and environment management was initiated after the project was launched to maintain the equilibrium of the ecosystem. The program includes reforestation and preservation of the area and supporting effort to save the forest and species to preserve the biodiversity. As a result of the effort, it was successfully able to preserve and protect approximately 105,000 hectare of lands and 11.5 millions of plant species (<http://www1.american.edu/ted/itaipu.htm>).

Chapter 3: Methodology

This chapter primarily emphasizes the methodology prescribed for the suitability analysis of the land for resettlement of the IDPs. This chapter also briefly discusses the qualitative and quantitative features of data and procedures of analysis.

3.1 Required resources

Being a research, oriented towards spatial analysis, this research uses an integrated methodology to process the spatial as well as non-spatial data which is based upon literature review of experiences of resettlement and relocation in several hydropower projects.

3.1.1 Data

For this study, some geospatial and socio-economic data retrieved from direct field survey and collection of some attribute data from different organization such as Survey Department, Central Bureau of Statistics, Department of Mine and Geology (DMG) and BGHEP. Data used for the study includes:

- ✚ 9 sheets of topographical Map (2884_16 on scale of 1:50000 and, 2884-15D, 2784_03B, 2784_03D, 2784_04A, 2784_04B, 2784_04C, 2784_03D, 2784_08A with the scale of 1:25000)
- ✚ Ortho photo of inundation area with spatial resolution of 1 meter,
- ✚ Geological data with information of formation level and
- ✚ Population data and other socio-economic data of study area .

The ortho-photo is used for the assessment of the land lost due to the reservoir, spatial features and assets.

Primary data

- Socio-economic data directly from field visit.
- Recent population data from household survey

Secondary data

- Ortho-photo of reservoir area with dam from BGHEP
- Existing topographical data with contour and land cover of study area from survey Department.
- Socio economic data from Central Bureau of Statistic (CBS) of Nepal
- Geological map from Department of Mine and geology of Nepal

3.1.2 Software

- ArcGIS 10.2
- Erdas Imagine 2011
- Microsoft office packages
- Adobe Acrobat

The detailed work flow diagram of Multi Criteria Analysis for suitability of resettlement sites is given below in Figure 1

Work flow diagram for Multi Criteria Analysis for suitability of resettlement sites.

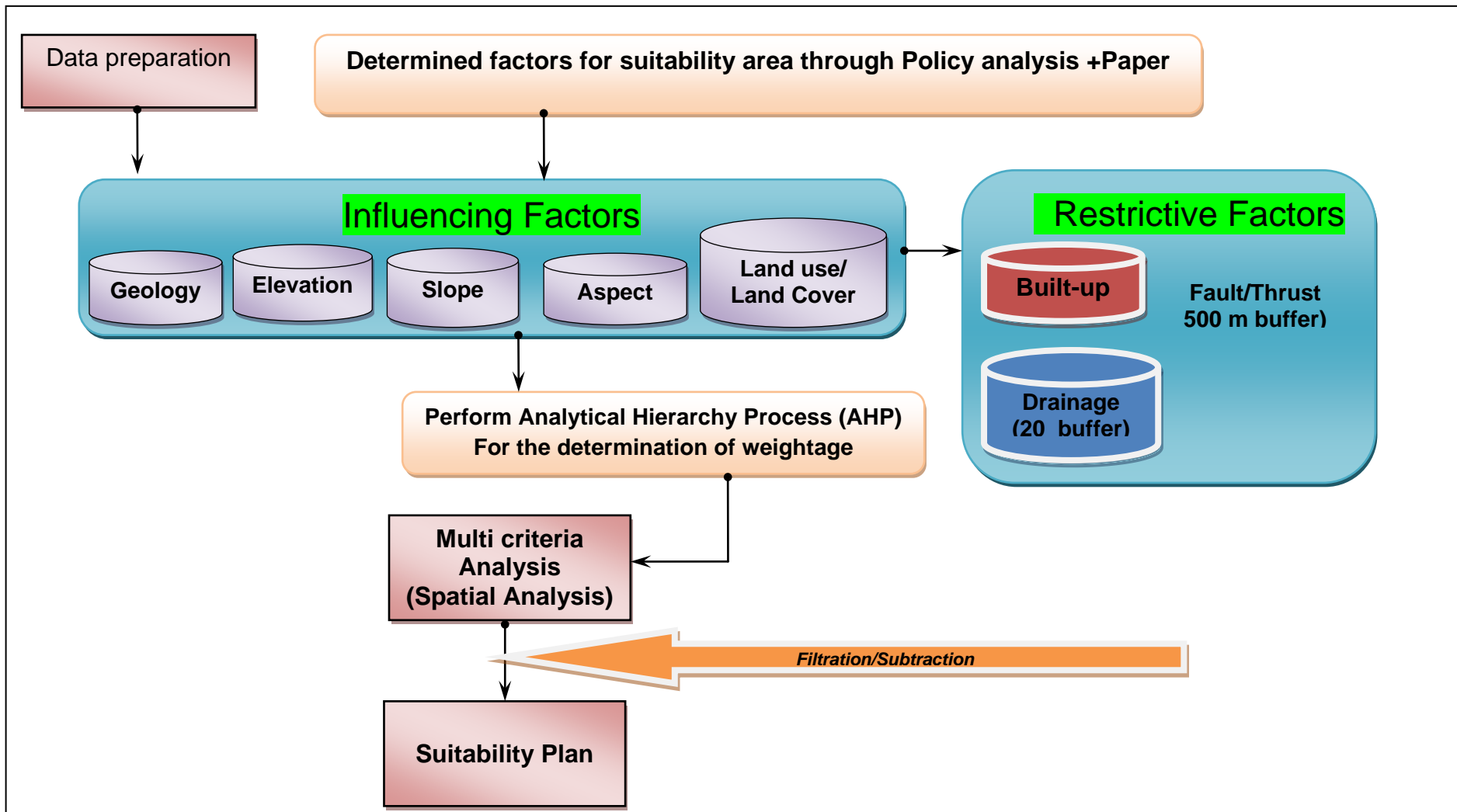


Figure 1: Flow chat for the Suitability plan for IDPs.

3.2 Discourse on criteria for resettlement site selection.

Several criteria, some spatial and non spatial component play important role in site selection for resettlement. While some of these criteria may be universal, there are also site specific criteria which are based upon culture, source of livelihood and the interest of the IDPs. An effort is made to summarize the criteria based upon literature review of papers, interviews and study of national and international policies regarding resettlement.

1. Emphasis on land-for-land based compensation as per the policy of IFC .
2. Resettlement area should be in the vicinity of the native location of the IDPs.
3. The resettled area must be well facilitated than the native location of the IDPs.

It is predisposed by the IDPs that the resettled area would be well facilitated than the native location of the IDPs. Public support towards the project can only be ensured when this condition is met. This research considers that the resettled area would have basic amenities and hence is not considered as parameter for site selection.

3.3 Procedure

The most essential and basic issue in a resettlement planning is the selection of a most appropriate site that offers best of the features required for people to lead a reasonably satisfactory life (Dagnachew, *et.al*, 2014). So, the successful resettlement fundamentally depend upon the appropriate selection of resettlement area, which is decisive to livelihood revival. Resettlement area cannot be decided by emphasizing and taking single parameter. Thus, multiple factors are considered for suitability and modeling them in GIS. For the successful resettlement program, Remote Sensing, GIS and Multi Criteria Analysis should be performed to arrive at most suitable resettlement site (Jenson, 2000). The MCA is performed here for the suitability analysis of resettlement sites, which execute composite evaluation criteria. In this study, five spatial subjective criteria were employed which were taken into consideration for resettlement site selection. Some of restrictive factors such as existing settlement

area, hazardous area and buffer of drainage, thrust and fault are carry off from the result of subjective criteria and the final resettlement site are proposed for the relocation for IDPs.

There are many MCA tools suggested by different expert through their scientific study. But in this research, Analytical Hierarchy Process (AHP) tool is employed for allocating the weightage of each influencing parameter. Influencing parameters are the factors which are considered for the analysis in AHP. Expert knowledge is used for the calculation of weightage of each parameters and their subclasses which is discussed in next chapter.

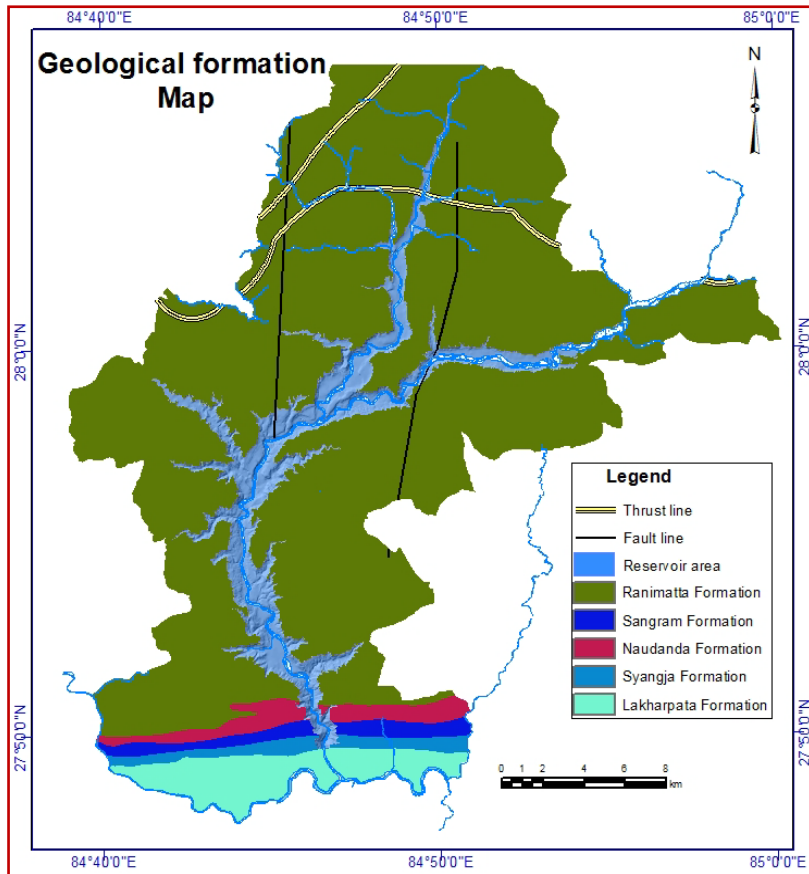
The restricted factor such as existing settlement area, hazardous area fault line, thrust line, and drainage are not analyzed as part of AHP. The following factors were taken under consideration for MCA.

3.3.1. Geology

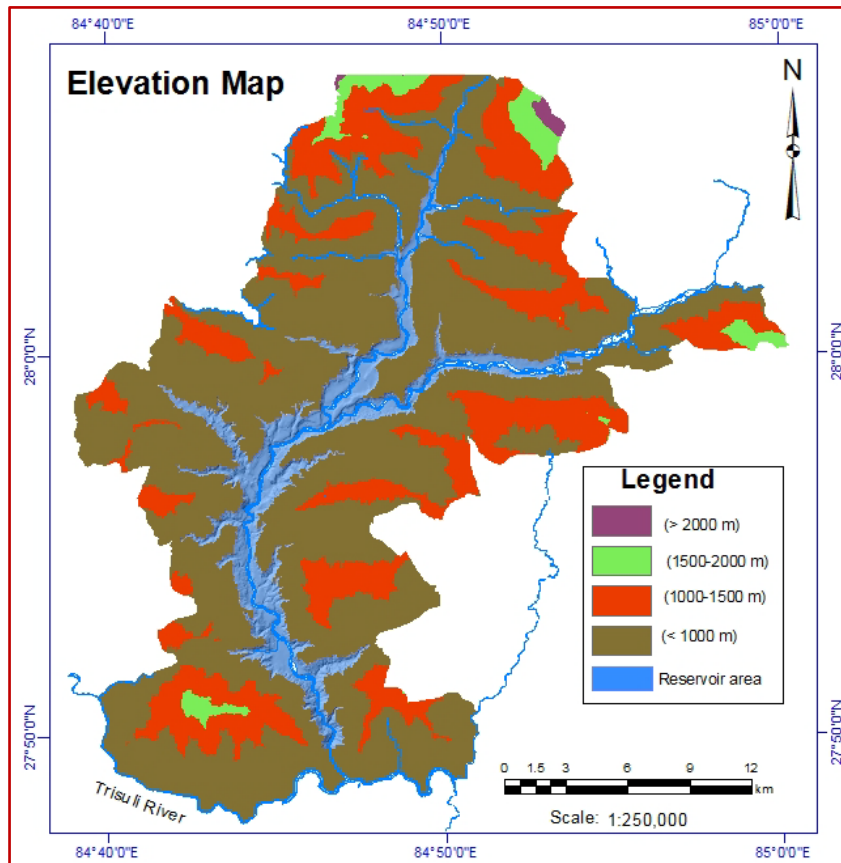
Siince Nepal is highly vulnerable to earth quake and other natural disaster as the Indian plate and Eurasian plate is continuously slipping one over other, analysis of lithology of the area is most important part as well (Stöcklin, 1980, Gupta, R. and Joshi, B.,1990). The Budhi Gandaki hydropower reservoir and its surrounding area lies mainly on Main Boundary Thrust (MBT). People should not be settled where there exist fault and thrust because these area are prone to natural disasters like earthquake. Thus, these kinds of area are excluded in the selection of resettlement sites. The distribution of geology within the study area is shown in Map 2.

3.3.2. Elevation

Elevation in the study area varies from 260 meter to 2390 meter from mean sea level. This links with the livelihood of the displaced people. In high altitude it may be difficult to find suitable land for agriculture which is necessary to support the displaced people with their livelihood. Thus, area with high altitude is given less weight and plane area is given high weight. The elevation map is shown in Map 3 below.



Map 2 geological map of study area.

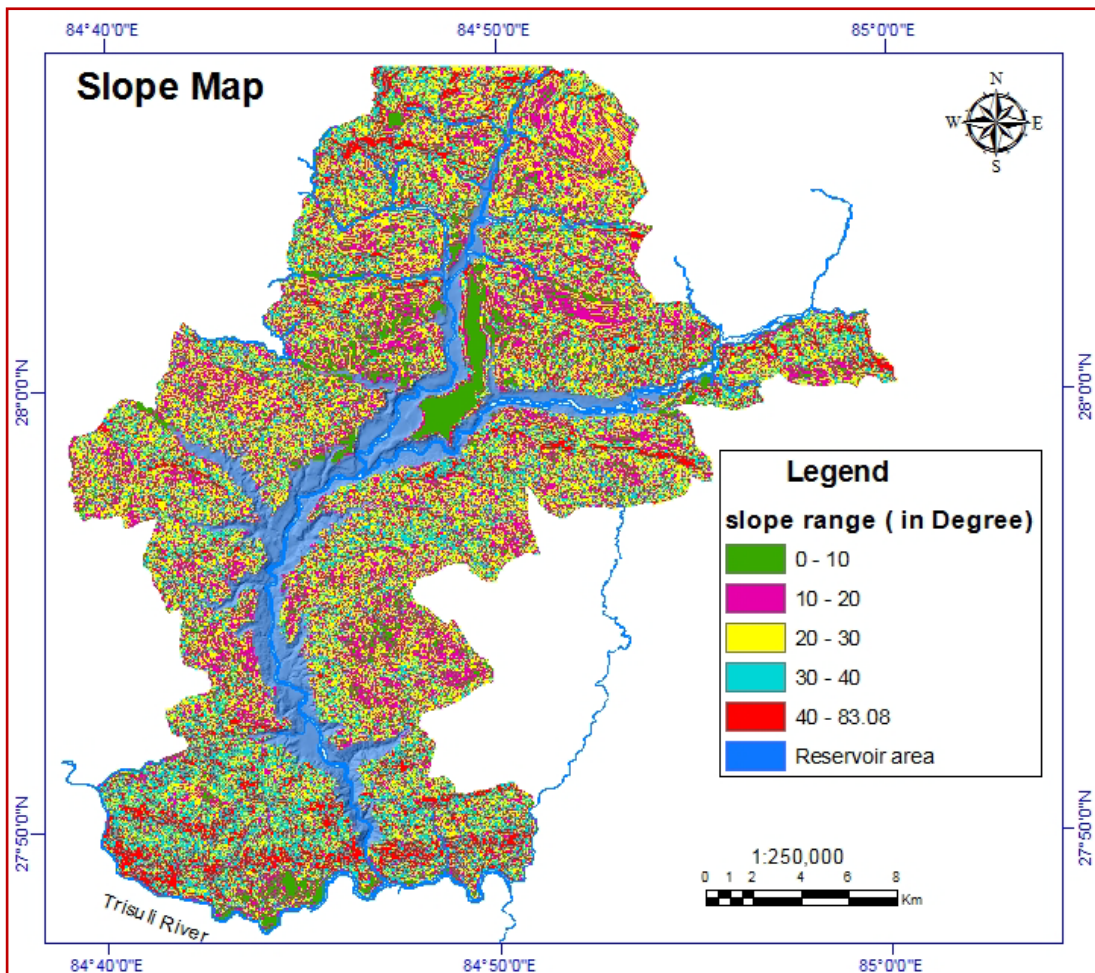


Map 3 Elevation map

3.3.3. Slope

Slope is one of the important factor for determining the pattern in resettlement area for basic living conditions. Flat area is recommend for the construction of infrastructure. Area with steep slope may result in high probability of geological hazards. After the big earth quake in Nepal on April 25,2015 The Government of Nepal declared that the area higher than 30 degree slope is not acceptable for the housing purpose without taking prior permission from department of mine and geology (GON, 2015b). In this research the area more than 30 degree slope is selected as not suitable area for settlement and given the weight 0.

The slope distribution of the study area is given in Map 4 below.

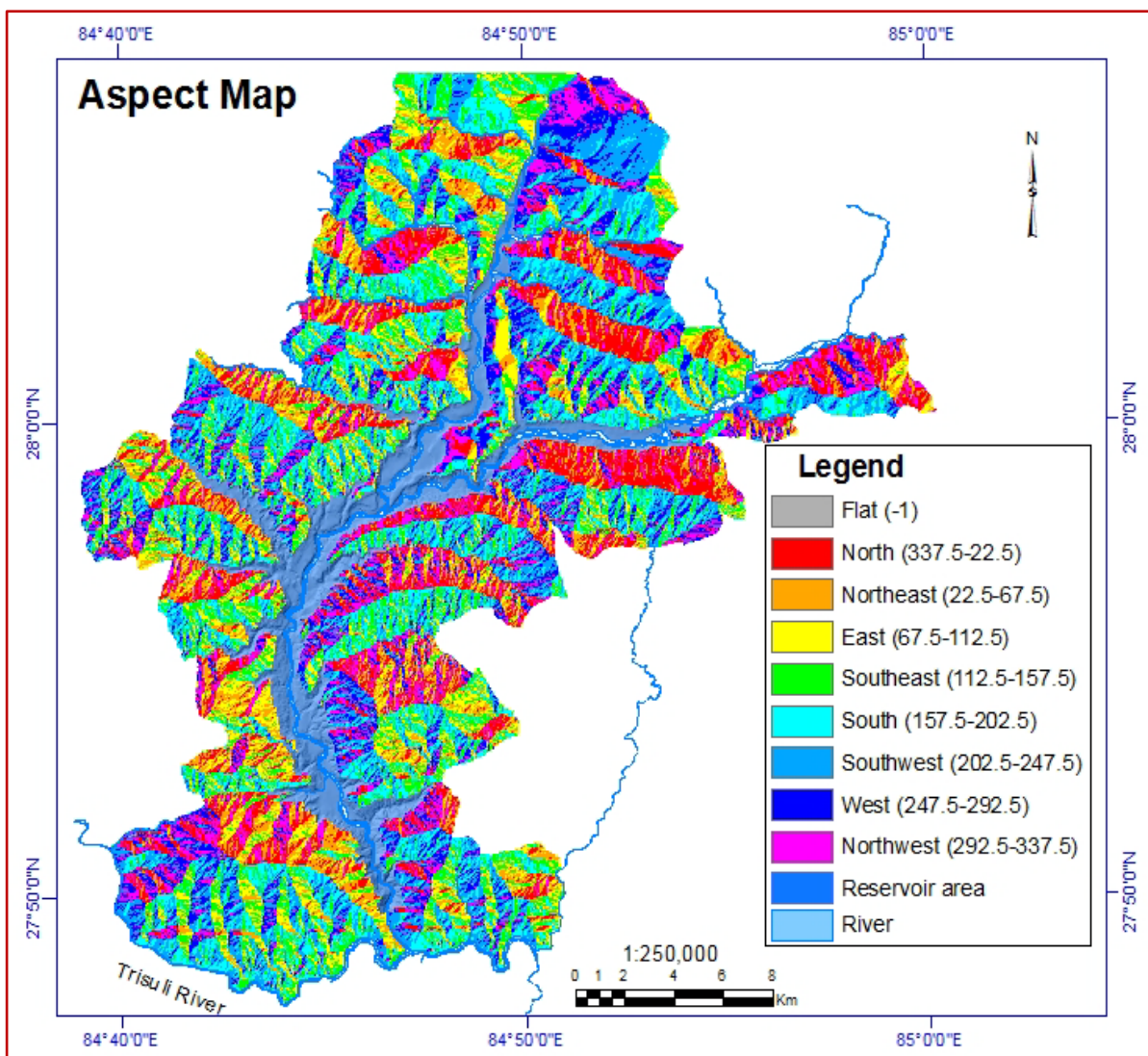


Map 4 Slope map of the study area

3.3.4. Aspect

Aspect means the direction of land pattern in hilly area. If we consider about the construction of building, it is better to face the building either in East or in South direction because of the sun light. Since sun rise from east and sets in the west, most of day time, there is sufficient amount of light in East and South direction. In North faced land, there is very poor light and always cold. Hence, the South and East aspect are given high weight and North and West aspect are given less weight.

The Aspect map of the study area is given in Map 5 below.

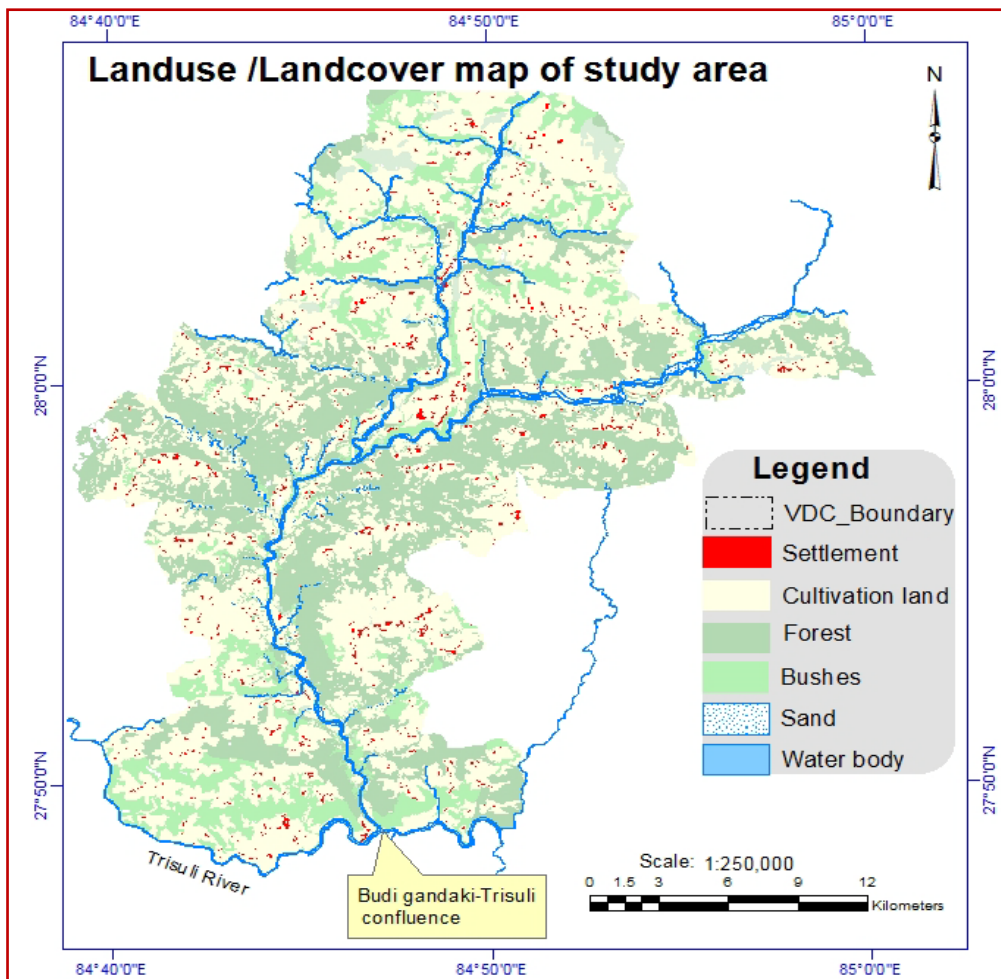


Map 5 Aspect map of the study area.

3.3.5. Land Cover/ Land use

Availability of abundant land resources suitable for residential development and cropping are the living security for migrants (Sheng *et al.* 2009). Thus, in every type of spatial analysis for resettlement, assessment of land use/ land cover is the basic criteria of assessment. In resettlement planning, there exist a principle that land resources of the new resettlement area should have better conditions over areas that the migrants move out from (Yimin *et al.* 2011). Built-up, water body, sand deposits and wetland are not suitable and cannot be recommended for settlement (Ibrahim *et al.* 2015). Moreover hazardous area also cannot be recommended for the resettlement purpose. Thus, built-up, water body, drainage, sand deposits and wetland are considered as outliers in selection of suitable resettlement site.

The distribution of Land use/land cover map is given below in Map 6.



Map 6 Land use/ Land cover map of the study area

3.4 Multi criteria Analysis (MCA)

Multi Criteria Analysis (MCA) reduces complex problems with different criteria into finest ranking of best options from which appropriate options can be selected (Yassine and Adel, 2011). It is the technique where multiple conflicting decisive factor are essential to be evaluated in decision making.

MCA mainly include 2 essential parts, they are factor criteria and constraint criteria. Every criteria is expressed as a map layer. Factor maps are represented as a spatial allocation to show the prospect criteria and the quality of achieving a goal. Constraint maps are limitations or restrictions which prohibit certain elements to be taken into account while conducting the analysis (Malczewski, 1999). There are two major methods in GIS based MCA, i.e. weighted summation procedure and overlay options (Yassine & Adel, 2011). In this study, weighted summation procedure was performed in Arc GIS using raster calculator tool .

For the weighted summations procedures, the weighted linear combination of factor criteria is calculated as below:

$$S = \sum W_a C_a \dots\dots\dots(i)$$

where S = Suitability to the objective being considered,

W_a = Weight of factor a (the sum of all weights of factors is equal to

1)

C_a = Criteria score of factor a.

3.5 Analytical Hierarchy Process (AHP)

AHP is one of the multi criteria decision making process which was developed by Prof. Thomas L. Satty in 1980. It is one of the widely used tool for GIS based multi criteria decision making due to its flexibility (Jankowski, 1995). In the context of this research, there are several factors which influence the decision of site suitability. These factors neither have equal weightage nor are proportionate (Umrikar B.N., 2013). These

factors can be classified in ordinal scale. The AHP methodology derives ratio scale out of these factors using paired comparisons (**Table 1**).

Table 1:Satty's Scale for pairwise comparison.

Intensity of Importance	Qualitative Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective
3	Moderate importance	Experience and judgements slightly favour one activity over another
5	Strong importance	Experience and judgement strongly favour one activity over another
7	Very strong or demonstrated importance	An activity is favoured very strongly over another and dominance is demonstrated in practice
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order of affirmation
2,4,6,8	Intermediate value	

Source: (Satty,1990)

The input value is obtained from subjective opinion such as satisfaction feelings and preference of experts using pair wise comparison scale. Each factor is paired with another factor and a comparison is made on a scale of 1 to 9. Using the value from each pair wise comparison, a pairwise comparison matrix is obtained. If M is the structure of the pair wise comparison matrix then,

$$M = [m_{pq}]_{n \times n}, \dots\dots\dots(ii)$$

where m_{pq} is the pairwise comparison rating for factor p and factor q. The matrix M is reciprocal matrix which means $m_{qp} = m_{pq}^{-1}$. All the diagonal elements of this matrix is 1. A normalized comparison matrix is obtained by dividing each element of the matrix by the sum of its column. The average of each row of the normalized matrix give the priority vector of each factor (eigenvector) .

The ratio scales are derived from the principal Eigen vectors which is the actual weight of that entities, and the consistency index is derived from the principal Eigen value (Satty T.L,2008). In this research, the expert knowledge from different discipline were

used by preparing a firm of AHP scale (Annexes 1). From the pair wise comparison, the reciprocal matrix were performed and then normalized it by the sum of each column. Then Principle Eigen value was derived, which is the actual weight of each factor. For the consistency check , the system also calculate the ratio to indicate any inconsistency that may have been happening in pair wise comparison

$$CI := \frac{\lambda_{max} - n}{n - 1} \dots \dots \dots (iii),$$

where CI is the consistency index, λ is the principal Eigen value and n is the number of factor.

Similarly, for the consistency check, following relation was used.

$$\text{Consistency Ratio (CR)} = \text{Consistency index (CI) / random consistency index (RCI)} \dots (iv)$$

Where RCI is content depending upon the value n as shown in Table 2 .

Table 2: Random Consistency Index (RCI) for $n= 1,2,3,\dots,10$ (Satty,1990)

N	RCI	n	RCI	N	RCI
1	0	4	0.9	7	1.32
2	0	5	1.12	8	1.41
3	0.58	6	1.24	9	1.45

Source: (Satty, 1990)

It was supposed that if the consistency index (CI) is greater than 10% then the weighted result indicates existence of inconsistencies between pair wise comparison with one- another. Thus, weightage value cannot be accepted until the value of CI is less than 10% (Alanbari, *et al.* 2014).

Chapter 4: Process and Result

This chapter describe the overall procedure for finding the results in accordance to the methodologies described in chapter 3. It also emphasizes on the spatial and socio-economic analysis of the project area along with the suitability map with short discussion.

4.1. Spatial assessment of inundation area

4.1.1. Land Use/Land cover under Reservoir Acquisition Area.

The BGHEP reservoir Full Supply Level (FSL) is 540m from MSL. Additional 5m is added to this FSL level to minimize the risks of potential flood and reservoir rim failure. Inclusive of this risk buffer, land required for the reservoir is estimated to be 6637 ha (Table 3). The land cover assessment of the inundated area was performed based upon image analysis. The land use/land cover assessment was performed using supervised classification in Erdas Image software. Table 3 shows the Result of land cover of inundated area classified according to VDCs.

Table 3:Reservoir Effects on Land from Ortho image Analysis (Area in Hectare)

S.N	VDCs Name	Area (ha)	Barr en	Bush	Clif f	Fore st	Gra ss	Low land	Orch ard	Ro ck	San d	Settle ment	Up land	Water body
1	Aaruarbang	34.66	0	0	0.01	0.72	2.2	19.46	0	0	5.76	0.42	0.08	6.01
2	Aruchanuot	132.7	0.19	7.1	0	4.61	15.40	53.12	8.13	0	16.97	10.78	1.71	14.59
3	Arupokhari	23.64	0	1.73	0	3.9	0.83	11.92	0	0	3.61	0	0.91	0.73
4	Asrang	73.44	0	0.64	0	23.25	0.74	31.69	0	0	1.25	0	13.83	2.04
5	Bhulmichok	0.82	0	0.02	0	0.09	0.07	0.51	0	0	0	0	0	0.13
6	Borlang	818.99	0	116.51	0.38	203.67	13.95	261.06	6	0.03	31.87	2.72	164.45	18.36
7	Bungkot	239.64	0.26	6.24	0	105.3	3.2	90.74	0	0	3.64	0	23.11	7.09
8	Darbang	472.38	0	54.71	0.24	118.54	31.27	143.1	0	0	14.41	3.08	83.56	23.49
9	Dhawa	285.89	0.01	17.51	0.22	109.65	10.20	115.97	0	0	14.48	0.87	5.39	11.51
10	Fujel	493.93	0.08	27.05	0.68	145.75	6.95	150.54	0.66	0	15.57	0	125.42	21.27
11	Ghyalchok	100.14	0	31.5	0.2	30.92	6.8	5.51	0	0	2.38	0	18.27	4.56
12	Namjung	286.65	0.3	9.52	0.22	139.69	3.54	44.73	4.15	0	10.06	0	65.21	9.23
13	Tandrang	90.15	0	7.25	0	12.55	8.79	39.86	0	0	9.09	0	5.57	7.05
14	Thumi	12.17	0	0.05	0.05	0	0.07	2.79	0	0	4.02	0.44	0	4.75
15	Aginchok	157.45	0	0.61	0	33.45	0.06	71.11	0	0	30.53	0	12.66	9.03
16	Baseri	7.89	0	0.27	0	0.15	0.22	0.61	0	0	3.45	0	0	3.2
17	Budhathum	67.55	0	4.21	0	3.36	7.93	19.39	0	0	7.48	0	13.5	11.69

18	Chainpur	508.28	0	37.39	0.02	133.2	10.07	136.32	0	0	32.44	0	118.02	40.82
19	Jyamrung	304.84	0	3.62	0	63.84	1.87	109.10	0	0	76.14	0.27	23.23	26.68
20	Khari	461.03	0	26.59	0.18	126.2	17.66	179.12	0	0	10.73	1.9	76.95	21.71
21	Maidi	505.8	0	44.09	0	209.71	10.56	147.77	0	0	22.06	2.54	46.48	22.61
22	Marpak	11.03	0	0.53	0	0.14	0	0	0	0	9.42	0	0	0.95
23	Mulpani	80.04	0	0.98	0.1	4.21	3	56.04	0	0	6.19	0.48	4.63	4.42
24	Salang	284.16	0	59.56	0.04	109.24	15.81	39.47	0	0	13.58	0	31.18	15.29
25	Salyankot	60.9	2.02	2.08	0.43	2.42	1.35	2.82	0	0	40.15	0	0.81	8.81
26	Salyantar	823.64	0	158.88	0.35	111.56	47.81	97.5	0	0	75.36	3.88	261.99	66.3
27	Tripureshwo	301.5	0	3.14	0.95	8.81	1.71	162.10	0	0	77.57	2.82	27.77	16.54
Grand Total		6639.3	2.87	621.8	4.1	1704.9	222.2	1992.5	18.94	0.03	538.2	30.21	1124.7	378.88

Note: Upland is the slope terrace cultivation area and Lowland mean the plane cultivation area.

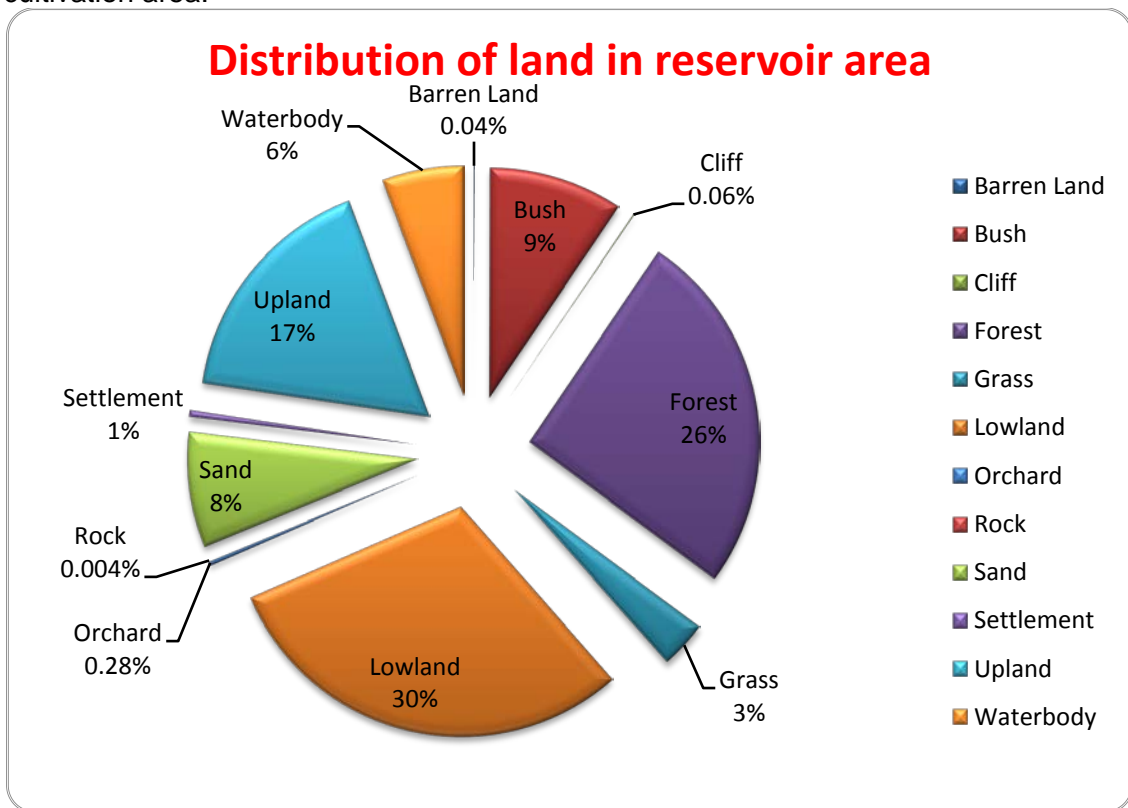
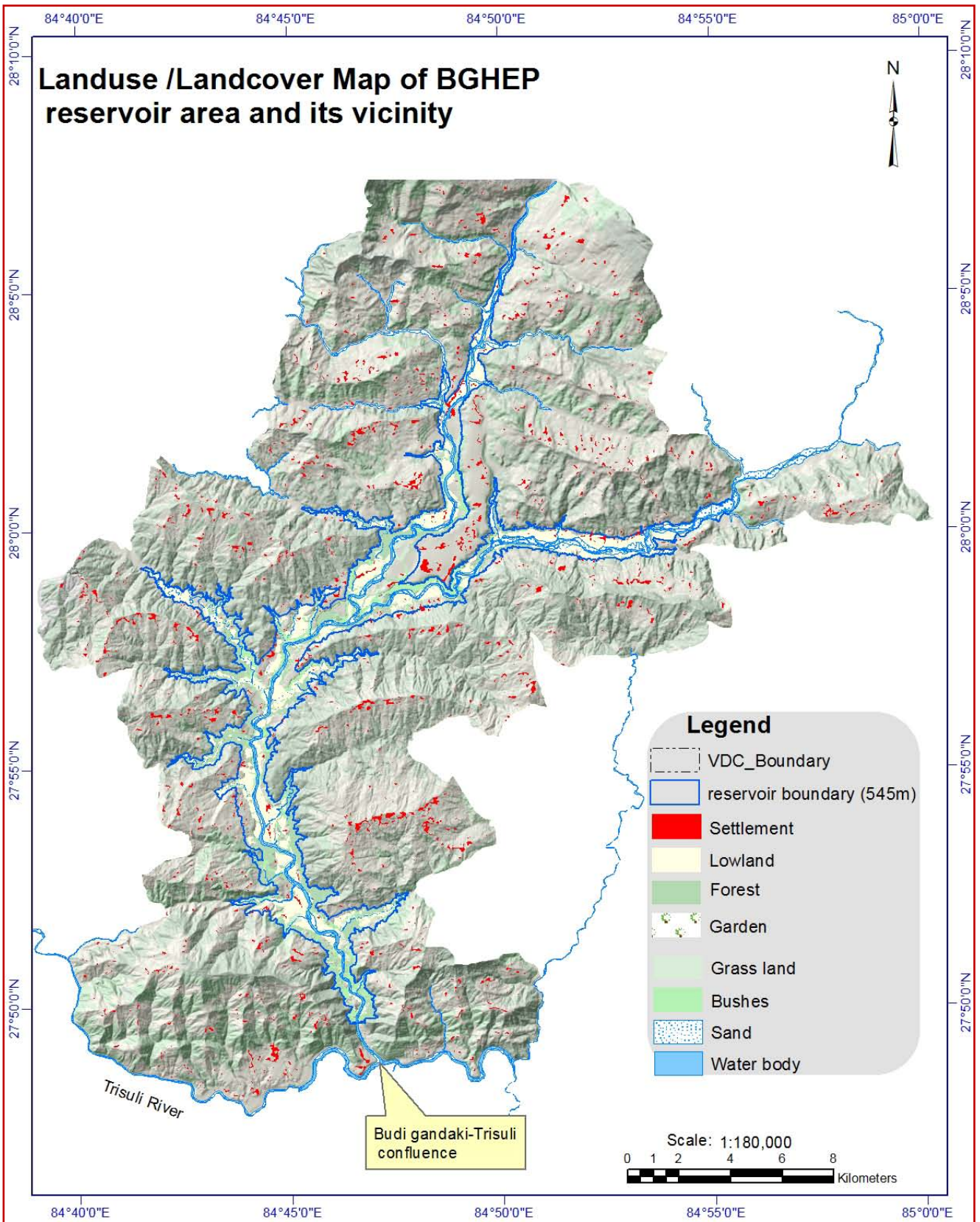


Figure 2: diagram showing the inundated land use/land cover due to reservoir.

From the image analysis of the inundation area, the pie diagram was plotted (Figure 2). Majority of the lowland and forest area has been inundated which causes the direct impact on overall agricultural production and biodiversity respectively.

The Land use/ Land cover map of the inundation area was prepared . Below Map 7 is the land use land cover map of reservoir area along with PVDC.



Map 7 Land use / land cover map of reservoir area with its vicinity.

4.1.2. Displacement of Infrastructures

Reservoir inundation also displaces a number of educational, other service institutions, temples/shrines, cremation sites and access facilities particularly motorable roads, suspension bridges and motorable bridges, which are not only used by the physically displaced persons but also by the upland residents of the region. Below Table 4 summarizes the preliminary assessment of displaced infrastructures on account of reservoir inundation. The Map of all these displaced infrastructure is given in Map 10. A separate map is prepared showing Temples and Shrines given in Map 11 below.

Table 4: Infrastructures fall in reservoir.

Displaced Infrastructure	Nos(Length)
Public Educational Institutions (School)	23
Other service infrastructures (health posts, police post, post office, community halls etc)	64
Temples and Shrines	59
Motorable Road (km)	131.95
Motorable Bridge	6
Suspension Bridges	30
Cremation Sites	44

(Source: Field Survey with BGHEP team with researcher and Orthophoto Analysis - July, 2015).

Below Table 5 is the name of Public Schools and Colleges in Gorkha and Dhading district falling in the Reservoir Area of BGHEP. The map is given below in Map 8.

Table 5: Name of public school and college of reservoir area.

SN	Name of the School (Gorkha District)	Location/ VDC	No of structure	No of students	No of Teachers
1	Dahale Primary School	Asarang	1	21	4
2	Shree Ghatbesi Primary School	Borlang	3	63	4
3	Shree Chakradevi Primary School	Darbang	2	40	3
4	Basanta Primary School	Ghyalchok	3	8	3
5	Gandaki Lower S School	Dhawa	4	143	9
6	Bhimodaya Higher Secondary School	Aaruchanaute	12	787	24
7	Shree Patandevi Higher S School	Borlang	8	320	18

8	Shree Ratneswar Higher S School	Darbang	12	625	19
9	Bhimodaya Multiple College	Aaruchanaute	1	160	11
Name of the School (Dhading district)					
10	Tripura Sundari Primary School	Aginchok,	2	12	4
11	Shree Aadarsha Primary School	Maidi	3	32	2
12.	Shree Budhigandaki Primary School	Maidi	3	32	2
13	Shree Shivalaya Primary School	Mulpani	1	21	3
14	Khadgadevi Primary School	Salang	3	35	2
15	Jyamire Chaur Primary School	Salyantar	4	80	5
16	Shree Aankhu Primary School	Tripureshwar	2	30	3
17	Shree Janabhawana Lower Secondary School	Jyamrung	8	150	10
18	Shree Pipaltar Lower Secondary School	Maidi	5	256	10
19	Shree Janajyoti Lower Secondary School	Tripureshwar	5	160	9
20	Chundevi Higher Secondary School	Salyantar	7	400	15
21	Netrawati Community College	Tripureshwar	4	250	10
22	Aachane Higher Secondary School	Tripureshwar	12	900	25
23	Shree Baladevi Secondary School	Khari	6	365	15

(Source: District Education Office, Gorkha and Dhading district and Field Survey June-July, 2015)

4.2. Socio Economic Analysis

4.2.1. Affected population and household

Resettlement program has to be planned in detail and must be based on accurate information and careful consideration of the likely impacts of displacement (IDB,1999). In Budhi Gandaki Hydropower project, basically two types of displacement can be observed.

- **Physical and Economic Displacement.** are those people/household who will lose their native residential location and their cropping land.
- **Economic Displacement.** are those people/household who will only lose their some agricultural land but not their house.

From the analysis of cadastral map of inundation area overlaying with orthophoto, it was found that total 3147.47 ha (Table 3) of agricultural land will be inundated due to

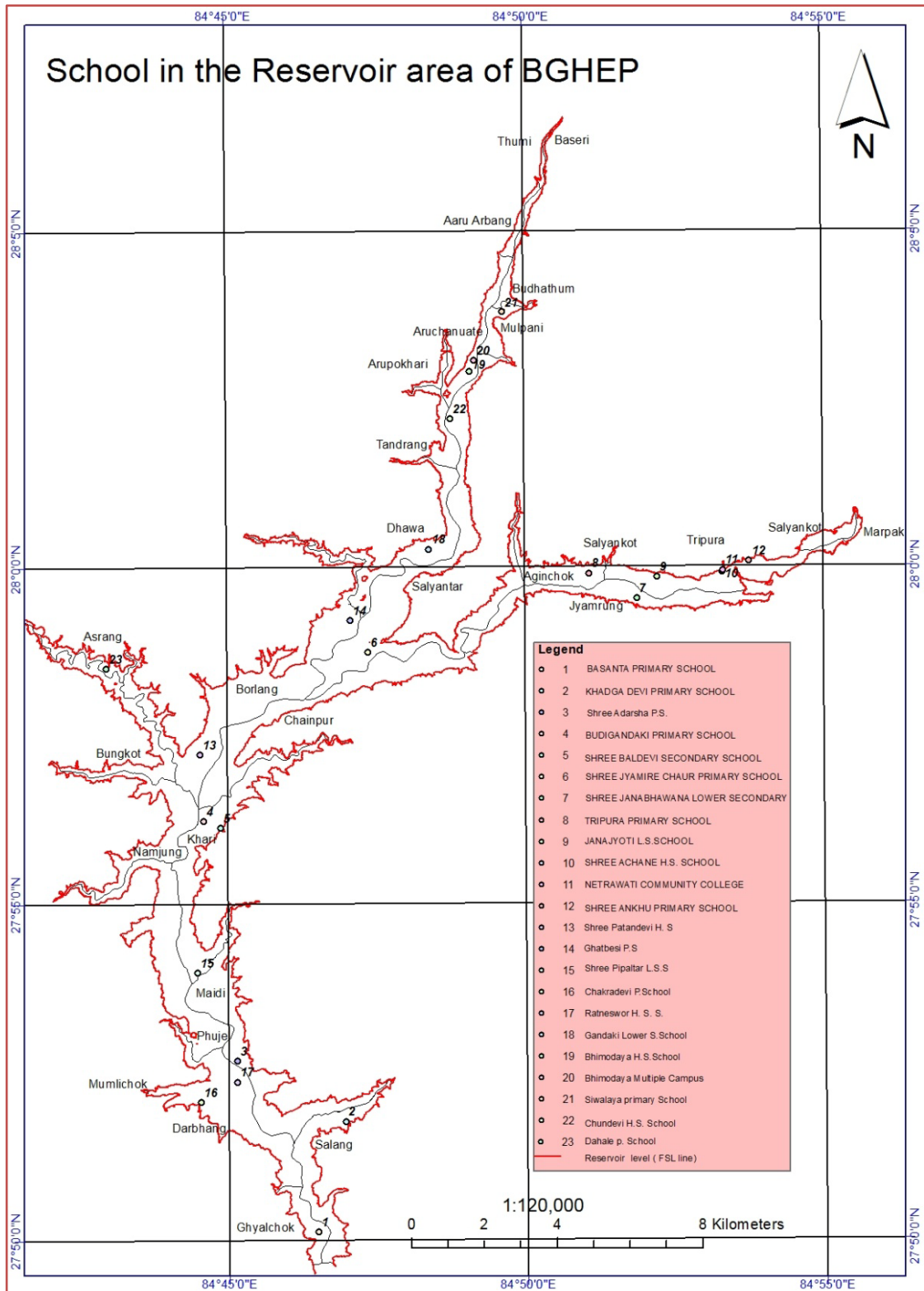
construction of dam. Among them, it was assumed that more than 30 % of cultivated land have not legal document but cultivated by the people.

Following Map 9 Shows the result of preliminary assessment of affected and displaced household number and affected population (HH). The detailed of data is shown on the Table 6 .

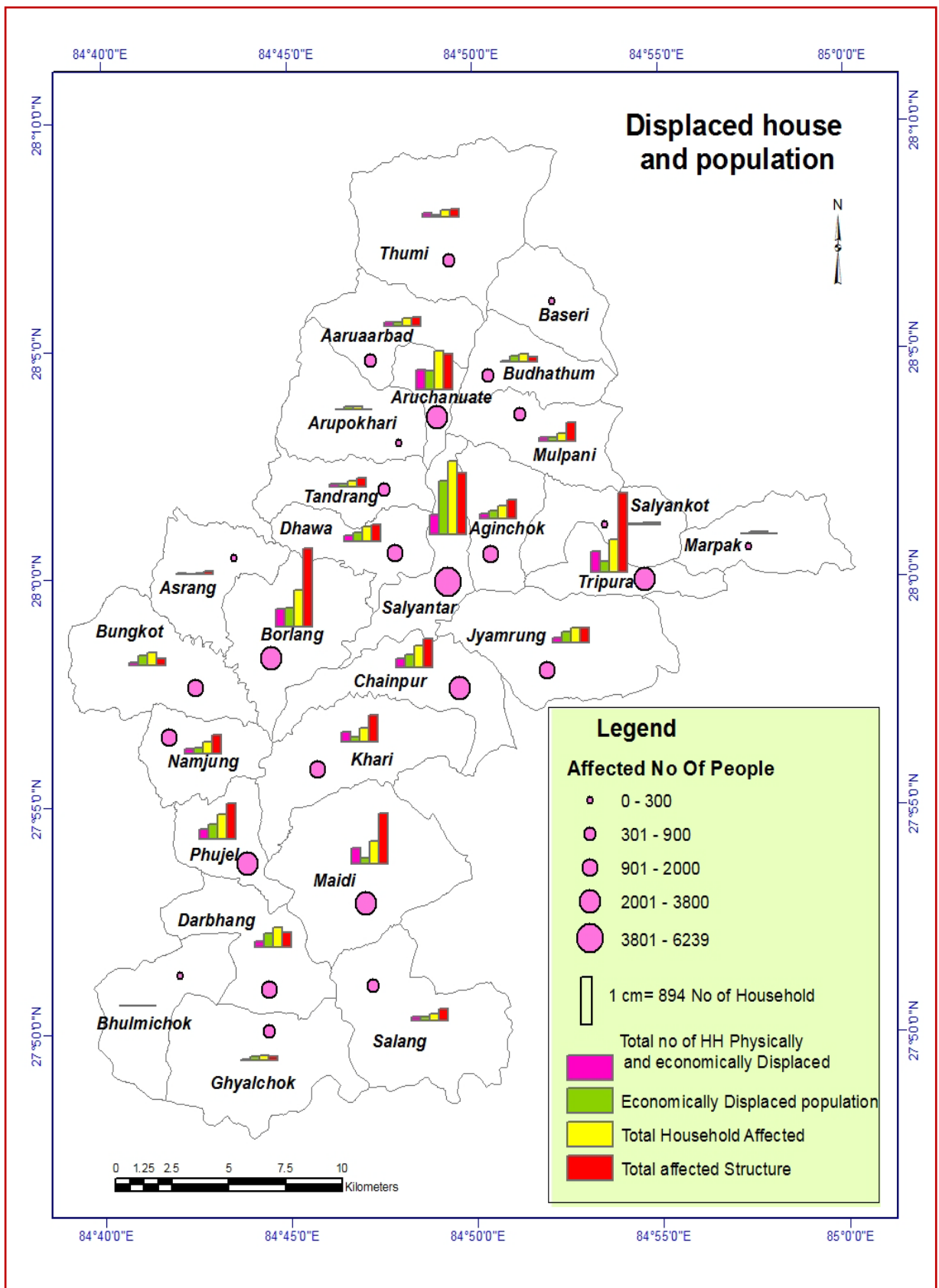
Table 6 Affected population and displaced household.

SN	Distri ct	VDC	Total No of HHs Physically and economical ly displaced	HHs Economic ally displaced	Total HHs affecte d	Total Populatio n affected	Averag e HH size	Total Structur es affected
1	Gork ha	Aruarbang	69	79	148	752	5.08	170
2		Aruchanaute	372	361	735	3309	4.50	682
3		Arupokhari	0	49	49	175	3.57	0
4		Asrang	23	17	30	175	5.83	68
5		Bhumlichock	2	10	12	97	8.08	6
6		Borlang	344	363	708	3785	5.35	1510
7		Bungkot	52	191	243	1532	6.30	127
8		Darbung	111	266	377	2083	5.53	278
9		Dhawa	117	167	284	1317	4.64	330
10		Fujel	199	280	479	2407	5.03	690
11		Ghyalchock	24	73	97	579	5.97	78
12		Namajung	108	118	228	1329	5.83	379
13		Tandrang	48	49	97	546	5.63	158
14		Thumi	80	55	136	623	4.58	162
15	Dhad ing	Agnichok	94	149	243	1604	6.60	366
16		Baseri	0	0	0	0	0.00	0
17		Budhathum	26	117	143	868	6.07	86
18		Chainpur	168	251	420	2332	5.55	548
19		Jyamrung	88	197	285	1777	6.24	276
20		Khari	190	89	279	1423	5.10	525
21		Maidi	318	130	449	2530	5.63	981
22		Marpak	4	38	42	289	6.88	8
23		Mulpani	77	73	152	871	5.73	360
24		Salang	64	67	131	885	6.76	215
25		Salyankot	11	11	22	145	6.59	34
26		Salyantar	377	1019	1398	6239	4.46	1172
27		Tripureshwor	408	216	626	3444	5.50	1524
Grand Total			3374	4435	7813	41116	5.26	10733

(Source: Census Socio-economic Survey from BGHEP with researcher, 2015, June-July).

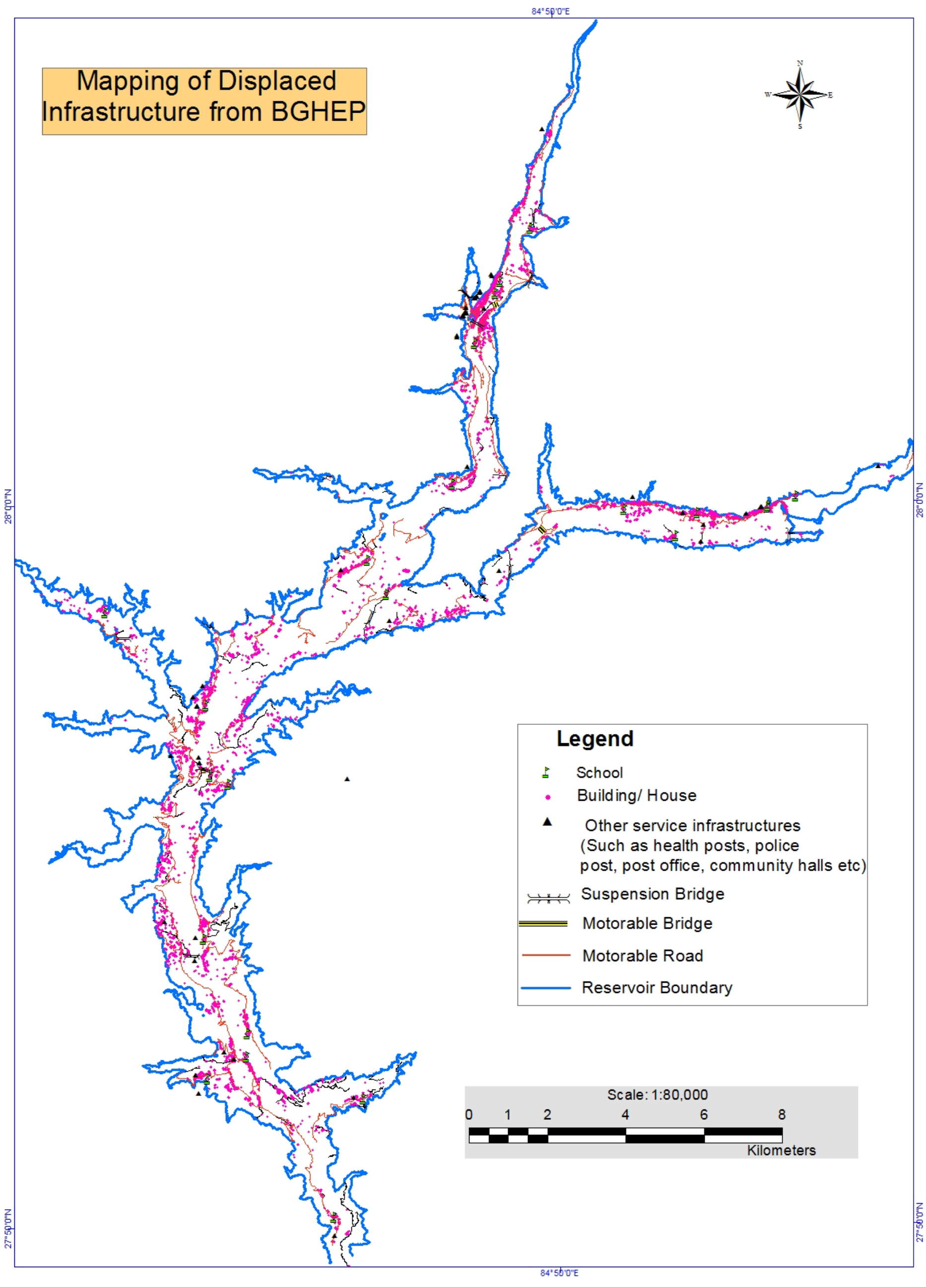


Map 8 public school and college falls in the reservoir.

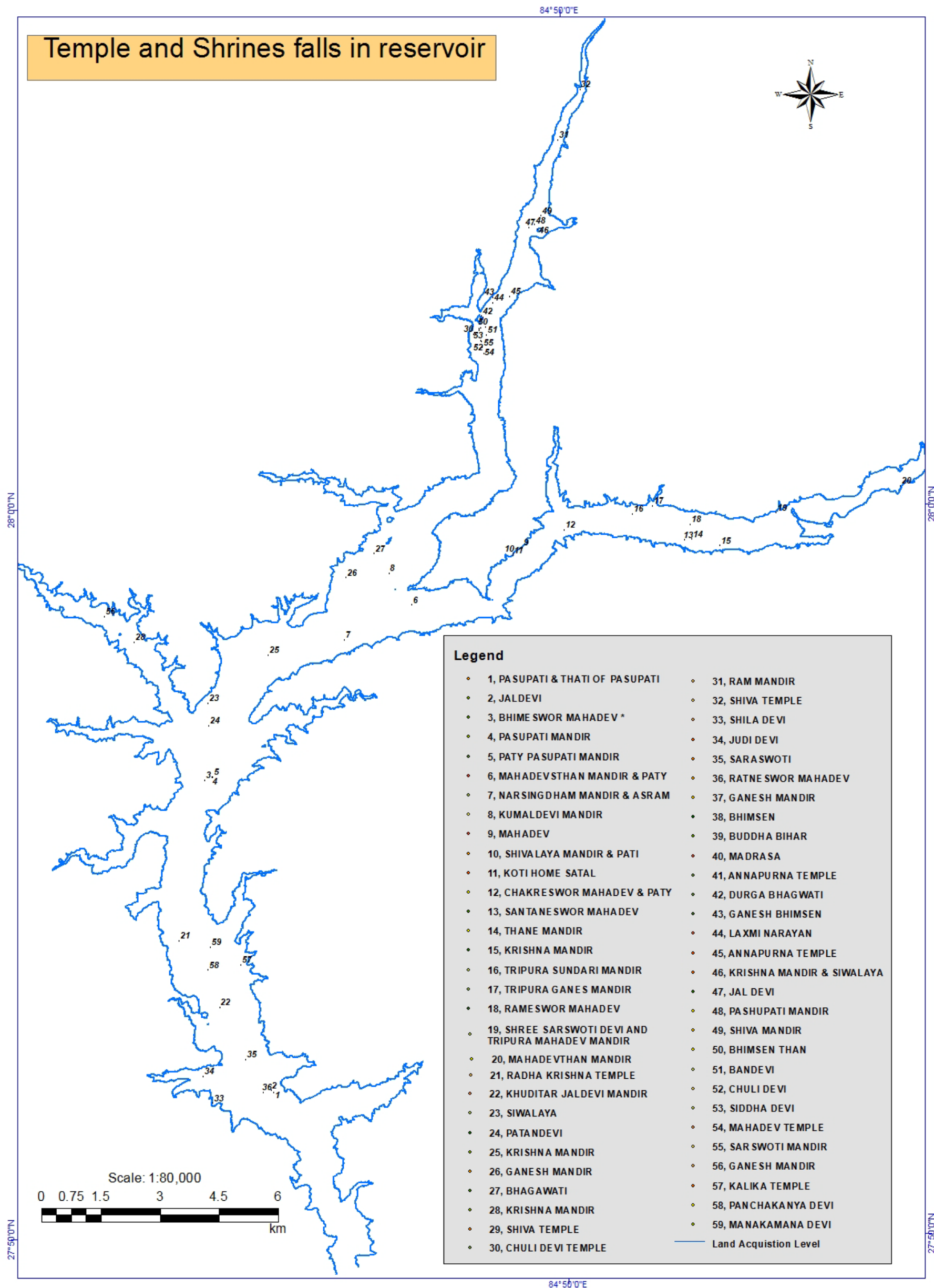


Map 9 Preliminary assessment of Displaced HH and population in PVDC.

Mapping of Displaced Infrastructure from BGHEP



Map 10 Displaced infrastructure from the reservoir of BGHEP.



Map 11 Temple and Shrines falls in reservoir.

4.2.2. Aspiration of Affected people with regard to rehabilitation

Local community involvement is mandatory for a successful resettlement plan (IDB, 1999). Participation ensures communication and creates a platform to reflect the needs and aspirations of the affected people. Furthermore, it also creates a sense of belongingness in the community to take a more active role in economic development as well as operation and maintenance of local infrastructures.

In addition to the resettlement policy, regulations, guidelines and practices, aspirations of the IDPs is equally important and should be given high priority. An assessment of the aspirations of the IDPs was done through group discussion and subsequent documentation of the aspirations of the IDPs was performed. Consultation was done with 37 groups in 13 locations of the project area. 1677 people from 27 affected VDCs participated in the consultation. 21% of the participants were women. It is to be noted that the participants were social leaders and representatives of local political parties and hence ensure that they represents the aspirations of general public.

Once the public discussion was done, the participants were provided with a well structured form for priority ranking of the resettlement choices. The form had provision for five resettlement and rehabilitation choices along with space for additional choices. The choices were well explained before the participants were provided with the opportunity for ranking the choices. The five choices of resettlement and rehabilitation are mentioned below:

- **Land for Land and house for house option (Option 1):** This option does not foresee cash compensation for the land and house except supporting rehabilitation measures for livelihood restoration. Equal or better quality land and housing is provided for resettlement and rehabilitation;
- **Developed Land Parcel for Housing (Option 2):** This option foresee development of resettlement village with all support facilities such as motorable road connection, piped water, electricity, telecommunication, educational institution, health institution,

community hall etc within the village. The land plot is provided in such developed village for housing, while compensation to the lost property and land is provided at the replacement cost to the affected households. The households will build their house within the plot. Besides, the affected are provided with rehabilitation assistance for livelihood restoration.

- **Developed Land Parcel for Housing with a Market Area (Option 3):** This option is similar to the option 2, but such developed village will have a developed market area for people to initiate their own shops.
- **Developed Land Parcel for Housing with an Industrial Area (Option 4):** This option is similar to Option 2, with provision of land areas for industrial development. The industrialists are invited to develop industries where the affected people are provisioned for industrial employment.
- **Cash Compensation only and resettlement and rehabilitation by themselves (Option 5):** This option provides cash compensation to lost land and property at replacement cost with additional rehabilitation measure cost. The affected people will manage themselves for resettlement and rehabilitation.
- **Any other option of the people Choice (Option 6):** People could propose their own options other than the Option 1 to 5.

For each of the above options, the participants could make choice for:

- Local Area (within the project VDC or districts), or
- Outside Area (Out of the Project VDCs and Districts)

The results of the consultation process is presented in the Table 7 below:

Table 7: Priority Ranking of Stakeholders on Resettlement Options.

SN	Resettlement Options	Priority Ranking (1= High Priority, 5= Least Priority)					
		1	2	3	4	5	Total
1	Land for land	8.1	13.5	13.5	24.3	40.5	100.0
2	Settlement Plot with all basic facilities	11.1	11.1	36.1	30.6	11.1	100.0

3	Settlement Plot with all basic facilities and market	8.3	38.9	27.8	11.1	13.9	100.0
4	Settlement Plot with all basic facilities and industrial area	50.0	19.4	13.9	13.9	2.8	100.0
5	Compensation only, resettlement by own	21.6	18.9	18.9	10.8	29.7	100.0

(Source: Census Socio-economic Survey from BGHEP with researcher , 2015, June-July).

- Settlement Plot with all basic facilities with a developed industrial area (**Option 4**) : 50% with **1st priority**
- Settlement Plot with all basic facilities with a developed market area (**Option 3**): 38.9% with **2nd priority**.
- Settlement Plot with all basic facilities (**Option 2**) : 36.1 with **3rd priority**
- Compensation only, resettlement by own (**Option 5**): 29.7% with **4th priority**
- Land for land (**Option 1**) : 40.5% with **5th priority**

Resettlement with establishment of basic facilities is the priority 1 choice for a majority of the participants. If all three types of options related to settlement is taken into account, i.e Settlement Plot with all basic facilities, Settlement Plot with all basic facilities and markets and Settlement Plot with all basic facilities and industrial area; the number of displaced persons prioritizing as number 1 choice for the well facilitated resettlement reaches almost 70%. The number of stakeholders, prioritizing as 1st choice for the “compensation only, resettlement by own” is estimated to be 21.6%. Similarly, 1st priority for land for land and house for house is given by only 8.1%.

A close scrutiny of the above results reflects following message:

- Only economically displaced persons prefer option 5
- Physically and economically displaced persons who are women headed and economically and socially deprived prefer option 1

- Physically and or economically displaced persons who are on the main stream of social, economic and political life prefer option 2, 3 and 4 with higher percentile for option 4.

While 64% of the affected people preferred to be resettled within their VDC/District, a considerable segment of affected people 36% were ready to be resettled outside their vicinity (Table 8).

Table 8: Choice of Relocation/Resettlement

S N	Resettlement Options	Choice of Resettlement Place		
		Locally	Outside	Total
1	Land for land	64.9	35.1	100.0
2	Settlement Plot with all basic facilities	66.7	33.3	100.0
3	Settlement Plot with all basic facilities and market	63.9	36.1	100.0
4	Settlement Plot with all basic facilities and industrial area	63.9	36.1	100.0
5	Compensation only, resettlement by own	62.2	37.8	100.0
	Overall	64.3	35.7	100.0

(Source: Census Socio-economic Survey from BGHEP with researcher , 2015,june-july).

4.2.3. Ecological Context

From the ecological perspective, Budhi Gandaki Project Village Development Committees (PVDCs) in general and Budhi Gandaki PFP (project foot print) in particular, represent modified and degraded natural environments due to high level of human activities. Though the forest covers nearly 41.36% of the PVDCs land use, the quality of forest is poor to fair and mostly in regeneration stage, indicating revival of the forests in the last 30 years or so after the handing over of the forest to the local CFUGs. Most of the forest cover land use is located in the steep sections of terrain and is fragmented owing to the expansion of cultivated land and settlements in slopes less than 20 degree . The cultivation covers nearly 57.78% of the land cover; rest is occupied by riverine area, grass land and barren cliffs (Tractebel Engineering & Jade Consult, 2014). The PVDCs are rich in plant diversity with a limited number of

conservation species. The status of the forest cover surrounded by cultivated land and settlements, has restricted terrestrial wildlife habitats. Terrestrial wildlife, which are opportunistic and resilient with human habitation are observed in the PVDCs, while those which are non-resilient, sensitive to human activities are very rare. A majority of the mammalian wildlife reported and observed is of conservation significance and listed under IUCN Red Book and CITES Appendices, but their population is very thin (Tractebel Engineering & Jade Consult, 2014)..

The Budhi Gandaki PFP areas are very much similar to PVDCs in terms of land use and ecological characteristics. Nearly 35.40% of the land cover is forest, while agricultural and settlements occupy about 50.45%. Because of the BGHEP, PFP location at the valley bottom, the riverine area coverage is about 14.03%. In terms of plant diversity and terrestrial wildlife, the BGHEP PFP is not different than the PVDCs. The plant diversity and terrestrial wildlife diversity observed in the PFP are also common in the PVDCs beyond the PFP geographic limits. Of ecological significance in the BGHEP PFP is the aquatic habitats, particularly riverine fishery comprising of migratory fish; a few of them are even listed in the IUCN Red Book and CITES Appendices.

4.2.4. Social and Cultural Context

Though the BGHEP shows low population density 110 persons/km², the PVDCs population density is nearly 100 percent higher (203.32 persons/km²), which is also higher than the national average (180 persons/km²). BGHEP PFP shows population density of 258 persons/km², which is even higher than the PVDCs population density. This reflects the social implications of the BGHEP development in terms of physical/economical and economical displacement of the people. The issue is even grave when one considers the source of livelihood of the residing population. Most of the affected population livelihood is land based and relies traditionally on subsistent agriculture and animal husbandry. BGHEP displaces 3374 households physically and

economically and additional 4435 households economically. The population within the BGHEP PFP comprises a mix of caste/ethnicity groups, which could be broadly categorized into three major social groups such as Brahmins/Chettri/Thakuri/Sanyasi (BCTS), Dalits and Adivashi/Janajati (A/J) consisting of 51.15%, 6.33% and 42.52 % of population respectively. These caste/ethnicity social groups are mixed culturally, while a few casts such as, Baram, Darai and Kumal under A/J social groups still maintain their traditional lands and cultural identity.

The project is likely to impact over 11000 built property of the households. Likewise, 23 educational institutions consisting of 124 built structures; 59 shrines comprising 88 built structures; 44 cremation sites; and 64 institutions with 65 built structures will be inundated (Table 4) by the BGHEP reservoir. In addition nearly 131.95 km length of motorable roads, 6 numbers of motorable bridge, 30 numbers of suspension bridges will be impacted directly by the project reservoir. Similarly, water supply systems, irrigation systems, electricity distribution systems will also be affected by the project. All of the above personal and community assets and built properties need relocation and re-establishment outside the PFP in the new relocation sites.

4.3. Suitability analysis for relocation

The study area for suitability analysis was limited to the 27 VDC which shared the inundated area. It is very important to calculate the weightage of particular spatial factor in site selection process. The AHP tool was used for the weightage calculation.

4.3.1. Social justification for selecting the resettlement area closer to Project.

The 27 VDCs partially inundated by the reservoir are the project VDCs (PVDCs) impacted by the project as per the Environment protection Regulation (EPR) of Nepal. Relocating people displaced by the project outside these VDCs enlarges the geographical scope of the project vis a vis project cost. Further, this also dislocated socio cultural and kith and kin relationship. Hence to minimize the geographical and

economical scope of the project, relocation sites should have to be looked within the geographical boundaries of the PVDCs as far as possible.

During the socio-economic survey more than 64% of the people (Table 8) who participated in the survey showed the willingness to live within vicinity of the reservoir, so in order to resettle the people, it is important to consider the common interest of IDPs. Studies have shown that those projects in which public interest are addressed have been successfully completed in time but in those projects where decisions are made against affected people's voices have faced several socio-political problems and therefore could not complete in time (AUILR, 2001).

4.3.2. Pair wise comparison and weightage calculation using AHP tool.



Figure 3: Standard priority scale of AHP for pair wise comparison.

As described in previous chapter, AHP is used to determine the weightage of the factors. All the factors were compared in pairs on a priority scale (Figure 3) as suggested in AHP methodology. The priority scale were provided to several experts. As per the priority suggested by the experts (Annex 1), reciprocal matrix was computed as shown in the Table 9.

Table 9: Reciprocal Matrix for pair wise comparison

Reciprocal Matrix					
	Slope	Elevation	Aspect	Geology	Land Cover
Slope	1.000	5	3	7	1
Elevation	0.200	1	0.2	0.333333	0.2
Aspect	0.333	5	1	1	0.33333333
Geology	0.143	3	1	1	0.33333333
Land Cover	1.000	5	3	3	1
Sum	2.676	19	8.2	12.33333	2.86666667

Normalized relative weight matrix was calculated by dividing the sum of column to each cell of the reciprocal matrix. It is to be noted that the sum of column of normalized pairwise comparison matrix should be always equals to one (Table 10) .

Normalized Principle Eigen vector (Table 10) was computed which is the average of the normalized relative weight of each factors. It is the average of elements of individual row. The normalized principle eigenvector is the weightage of the particular criteria.

Table 10: Normalized pairwise comparison Matrix.

Normalized Relative Weight (Normalized pairwise comparison Matrix)						Normalized principal Eigen Vector
	Slope	Elevation	Aspect	Geology	Land Cover	
Slope	0.374	0.263	0.366	0.568	0.349	0.384
Elevation	0.075	0.053	0.024	0.027	0.070	0.050
Aspect	0.125	0.263	0.122	0.081	0.116	0.141
Geology	0.053	0.158	0.122	0.081	0.116	0.106
Land Cover	0.374	0.263	0.366	0.243	0.349	0.319
Sum	1.000	1.000	1.000	1.000	1.000	1.000

The one to one pairwise comparison scale of suitability criteria of 10 experts from different discipline such as GIS expert, urban planner, geologist, resettlement planner, were carried out for the weightage. According to the expert evaluation in pair wise comparison scale, slope factor was considered as the dominant influence due to the maximum hilly topography covered in vicinity of the reservoir (Table 10).

AHP has the provision for consistency check through the computation of consistency ratio (CR). The ratio of Consistency Index (CI) and Random Consistency Index (RCI) is the Consistency ratio (CR). The pairwise comparison is assumed consistent if the CR is less than 10%.

To determine the CI, we need to compute principle Eigen Value from the above table as: Principle Eigen Value (λ),

$$\lambda = \Sigma[\text{sum of column of reciprocal matrix} \times \text{principle Eigen vector}]$$

$$= 5.354$$

$$\text{Consistency Index (CI)} = [(\lambda - n) / (n - 1)] = [(5.354 - 5) / (5 - 1)] = 0.089$$

The value of random consistency index (RCI) is given in the Table 2. Which is constant .

Finally CR is calculated as, $CR = \{ \text{Consistency index (CI)} / \text{Random consistency index} \}$
 $= \{ 0.089 / 1.12 \} = 0.079$, which is less than 0.1. Since, Consistency Ratio is less than 0.1, the pairwise comparison is consistent.

From the pair wise comparison and computation of principal Eigen vector, it can be observed that the influences governed by slope, land cover, aspect, geological formation and elevation are 38.4%, 31.9%, 14.1%, 10.6%, and 5 % respectively (see in Table 10) .

4.3.3. Suitability Index and rating map of each sub-criteria

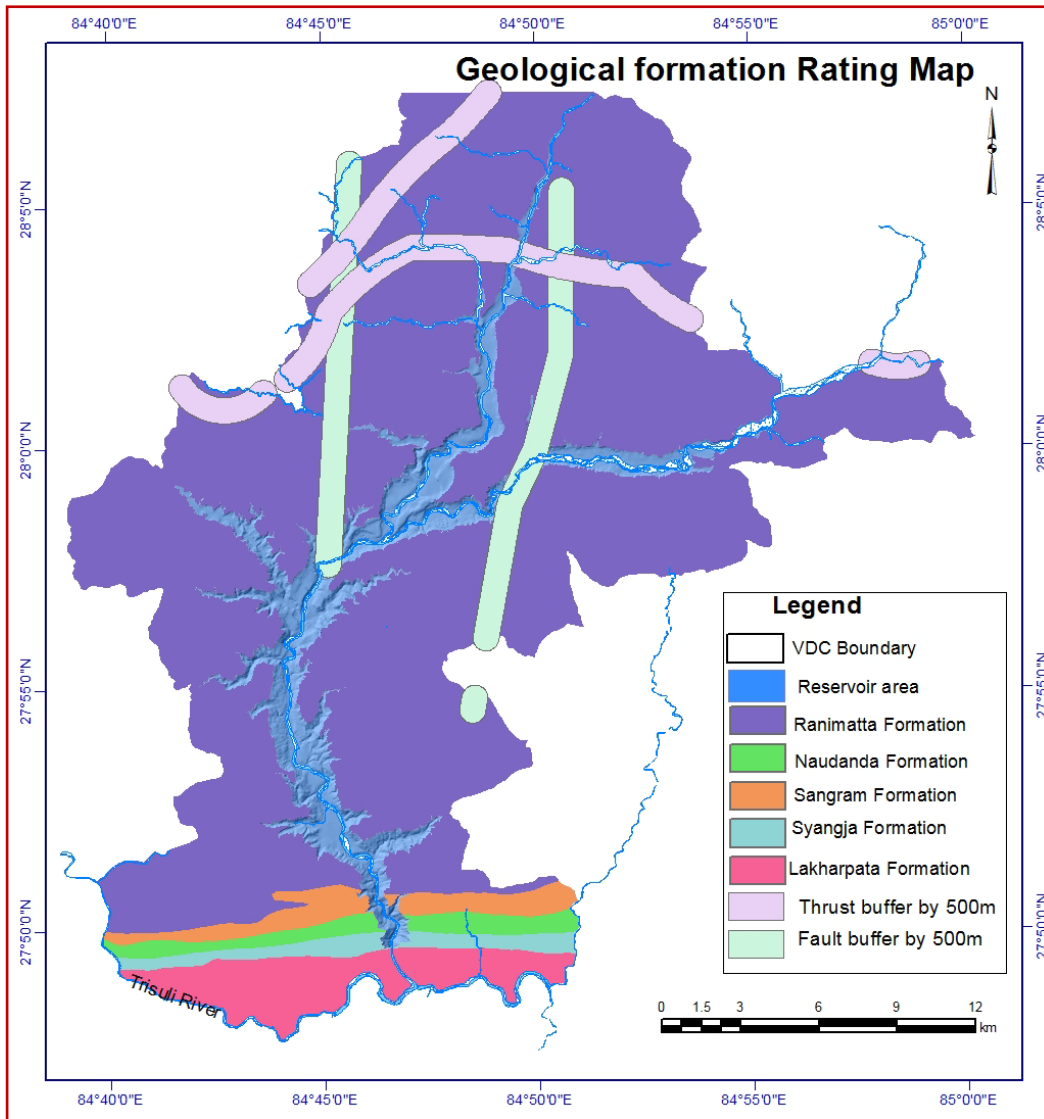
Weightage was also provided to the sub-criteria on a scale of 0-9 based upon expert knowledge; 0 being assigned to completely unsuitable sub-criteria while 9 being assigned to extremely suitable sub-criteria.

4.3.3.1. Geological Formation (Lithological Analysis).

Table 11 Geological formation with weightage value with lithological information.

Geological Formation	Value	Suitability	Description of lithology
Lakharpata Formation	7	High suitable	Grey shales with intercalation of limestones and quartzite
Naudanda Formation	6.5	Suitable	White massive quartzite's and shales
Ranimatta Formation	9	Extremely suitable	Phyllites, Quartzites, Meta sandstone and Conglomerate beds
Sangram Formation	6	Suitable	Green shales, limestone and quartzite
Syangja Formation	5	Moderately suitable	White pale orange pinkish or purplish calcareous quartzite's and quartzitic limestone's intercalated with dark grey purple and green shales strongly reply marked quartzite at the base

Sources: The description of lithology as per the formation level is carried out from Stöcklin, J. 1980



Map 12 Geological Formation rating map.

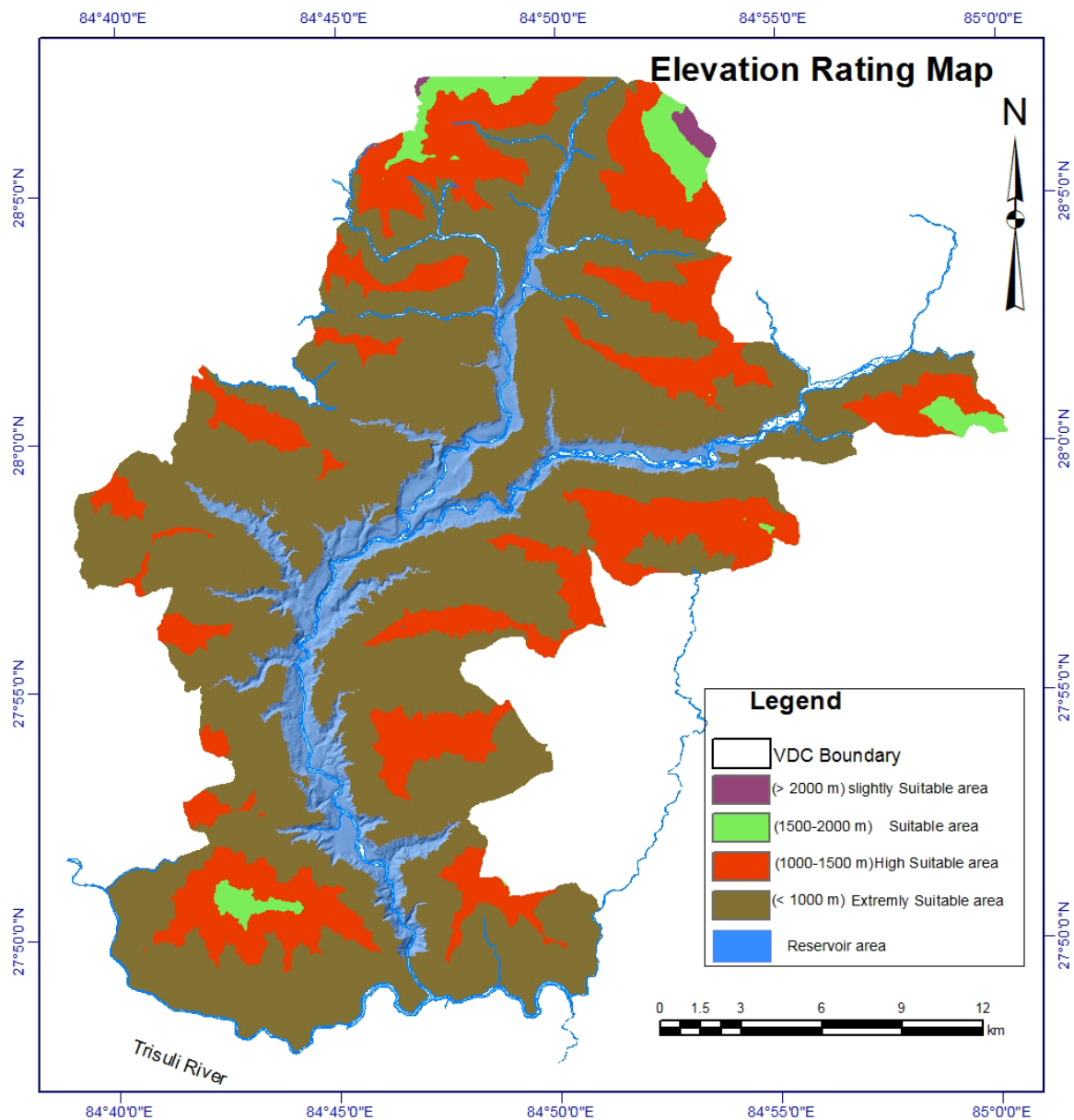
4.3.3.2. Elevation

The elevation criteria is also sub-classified into four sub-criteria (Table 15). The area encompassed by each sub-criteria according to elevation range is presented in Table 15 below:

Table 12: Ranking value of elevation

Elevation range	Value	Occupied Area (Sq.Km.)
< 1000 m	9	369.82
1000-1500	8	127.73
1500-2000	6	14.03
2000-2500	5	1.56

The Elevation rating map is given in the Map 13.



Map 13 Elevation rating Map.

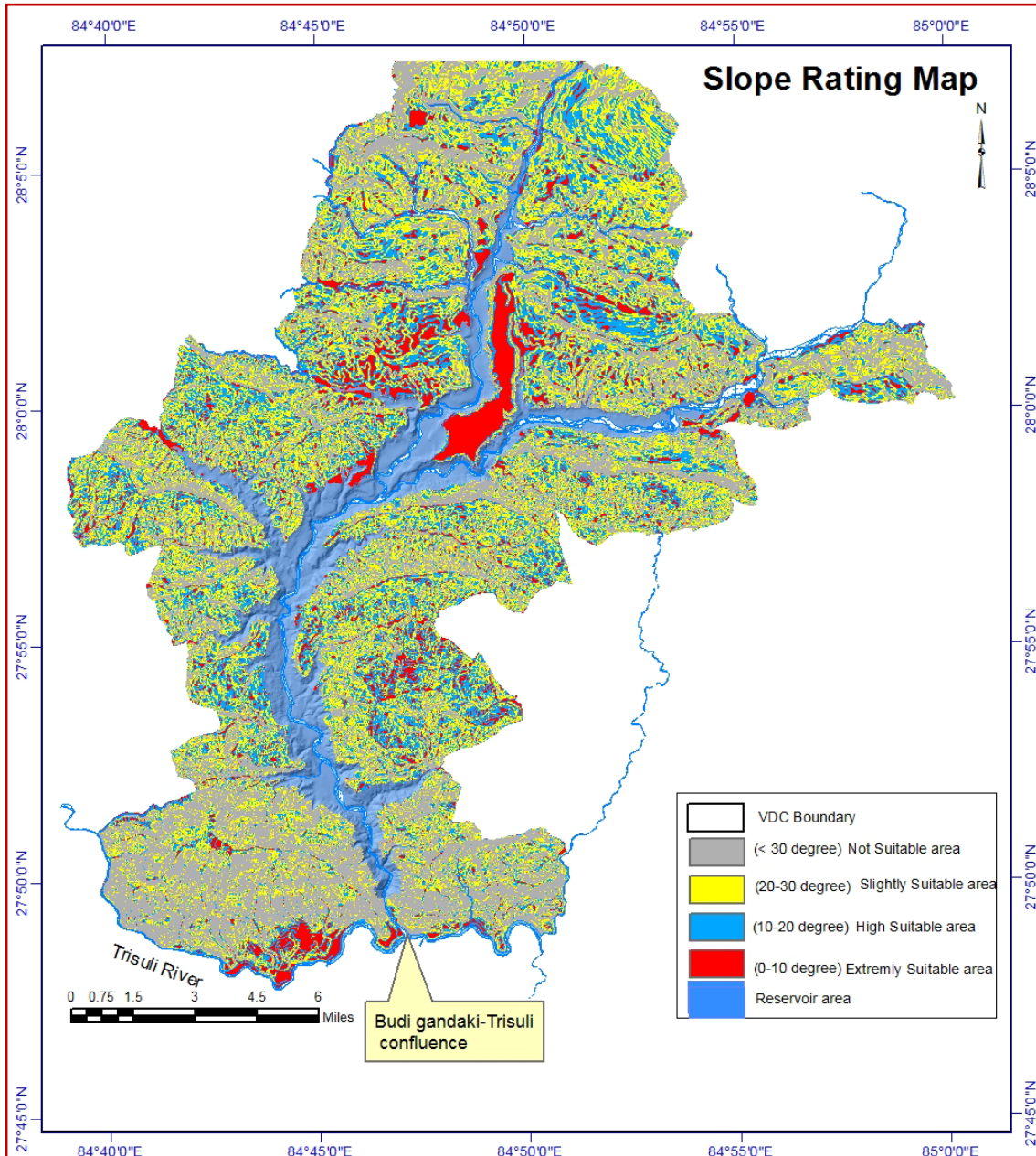
4.3.3.3. Slope:

Slope criteria is further classified into four sub-criteria. These sub-criteria is based upon literature review, government legislations and past resettlement experiences. The weightage of the sub-criteria along with the area of land that falls under each sub-criteria is presented in Table 13.

Table 13: Sub classification of the slope and weightage.

Slope	Area (Sq. Km.)	Value	Degree of Suitability
< 10 ⁰	175.8218	9	Extreme Suitable
10-20	163.9498	7	High suitable
20-30	123.5332	5	slightly Suitable
>30	49.8446	0	Not Suitable

The Slope Rating map of the study area is given in the below Map 14.



Map 14 Rating map of Slope.

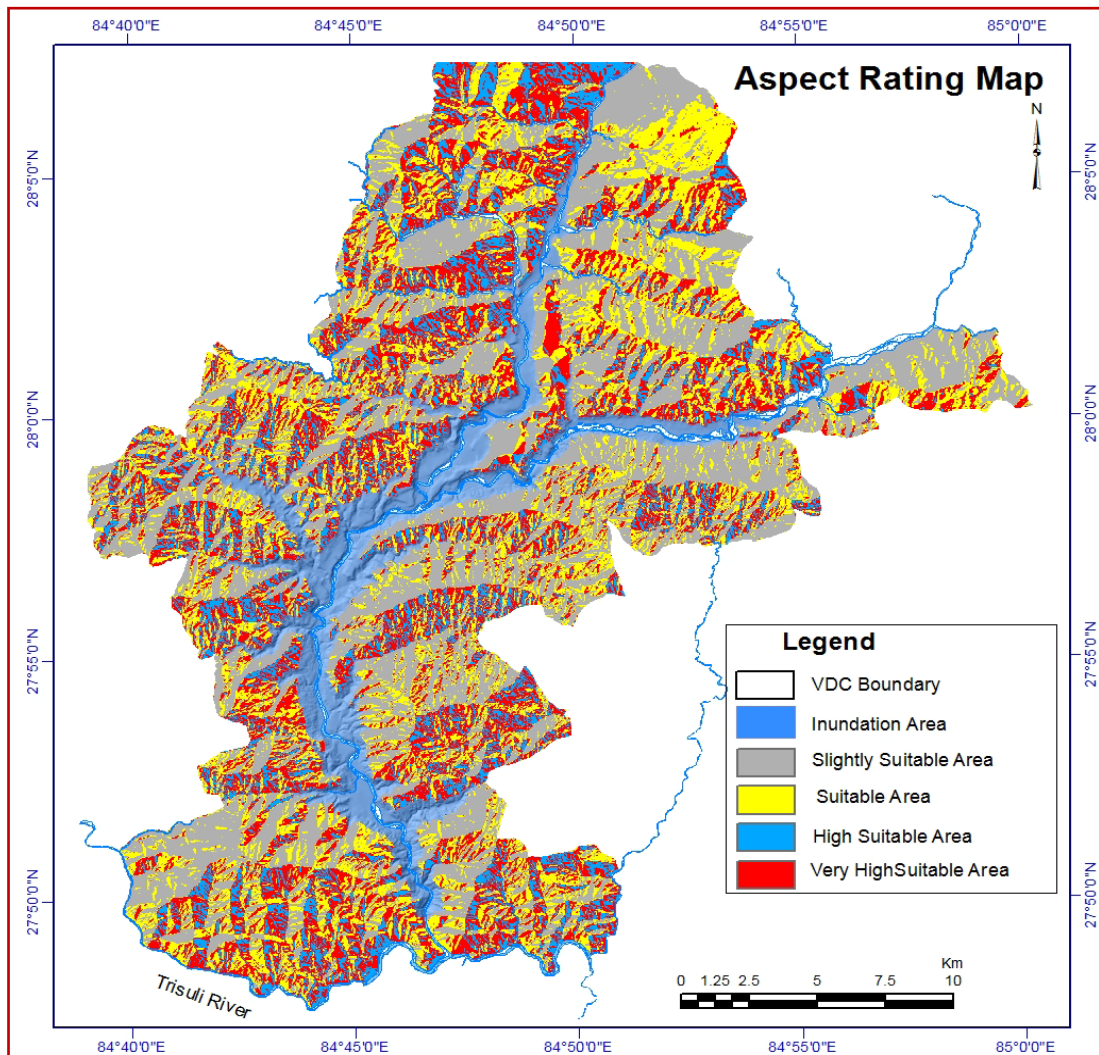
4.3.3.4. Aspect:

Aspect was divided into 9 sub-criteria and each sub-criteria was provided with weightage. The weightage provided to each sub-criteria is presented in Table 16.

Table 14: Grading value for Aspect.

Aspect	Value	Suitability
North	5	Slightly suitable
North-east	6	Moderately suitable
East	8	Highly suitable
South-East	7	High suitable
South	8.5	Highly suitable
South-West	6	Moderately suitable
West	5	Slightly suitable
North-West	5.5	Slightly suitable
Flat	9	Extremely suitable

The Aspect rating map was prepared (Map 15) on the basis of given grading value.



Map 15 Aspect rating Map.

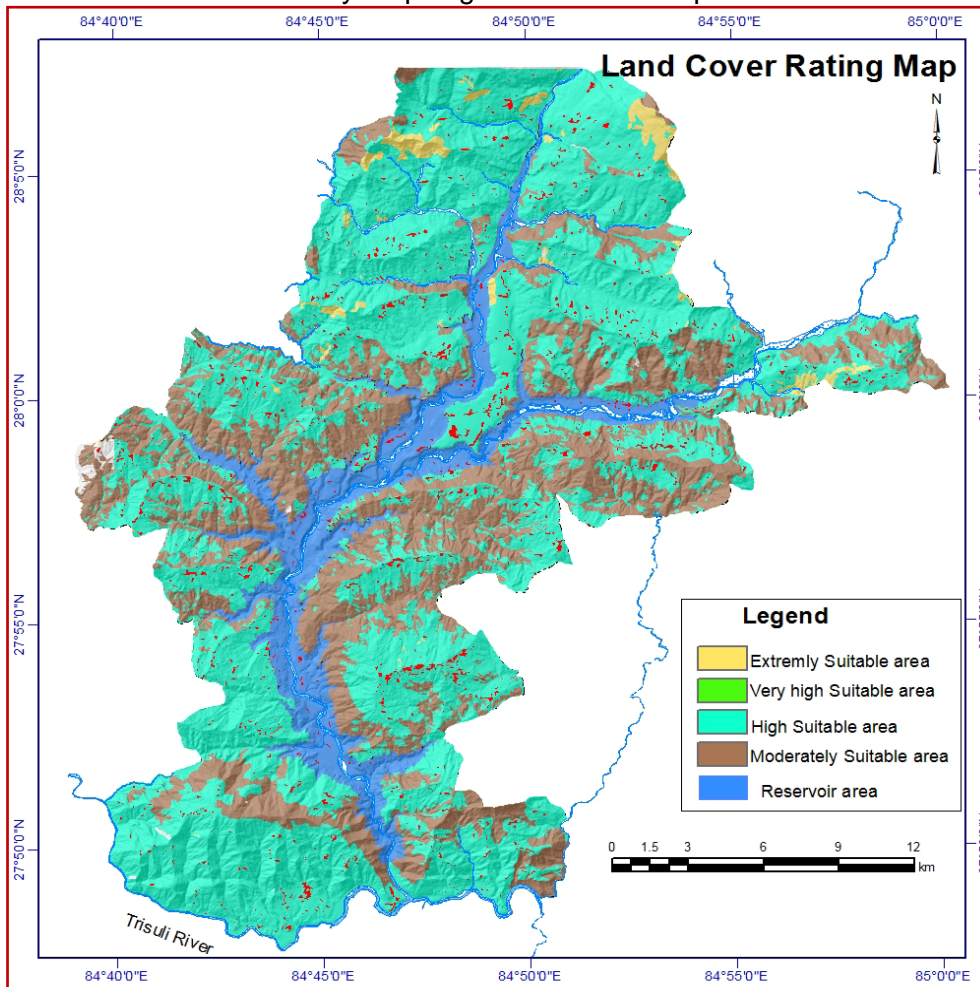
4.3.3.5. Land Cover:

The land cover is further classified into 7 sub-criteria. As similar to the case of slope, a weightage is provided to different sub-criteria of land cover. Table 14 shows the weightage given to each sub-criteria along with the area covered by that particular land cover.

Table 15: Rating for land cover and result of suitability area for each rating.

Land cover	Area(km ²)	Rating	Degree of Suitability
Agriculture	273.8	7	High suitable
Forest	156.95	5	Slightly suitable
Grassland	8.80	9	Extremely suitable
Shrubland	66.18	7	High suitable
Bare area	0.12	8	Highly Suitable
Water body	4.83	0	Not suitable
Cliff		0	Not suitable

The land cover suitability map is given below in Map 16.

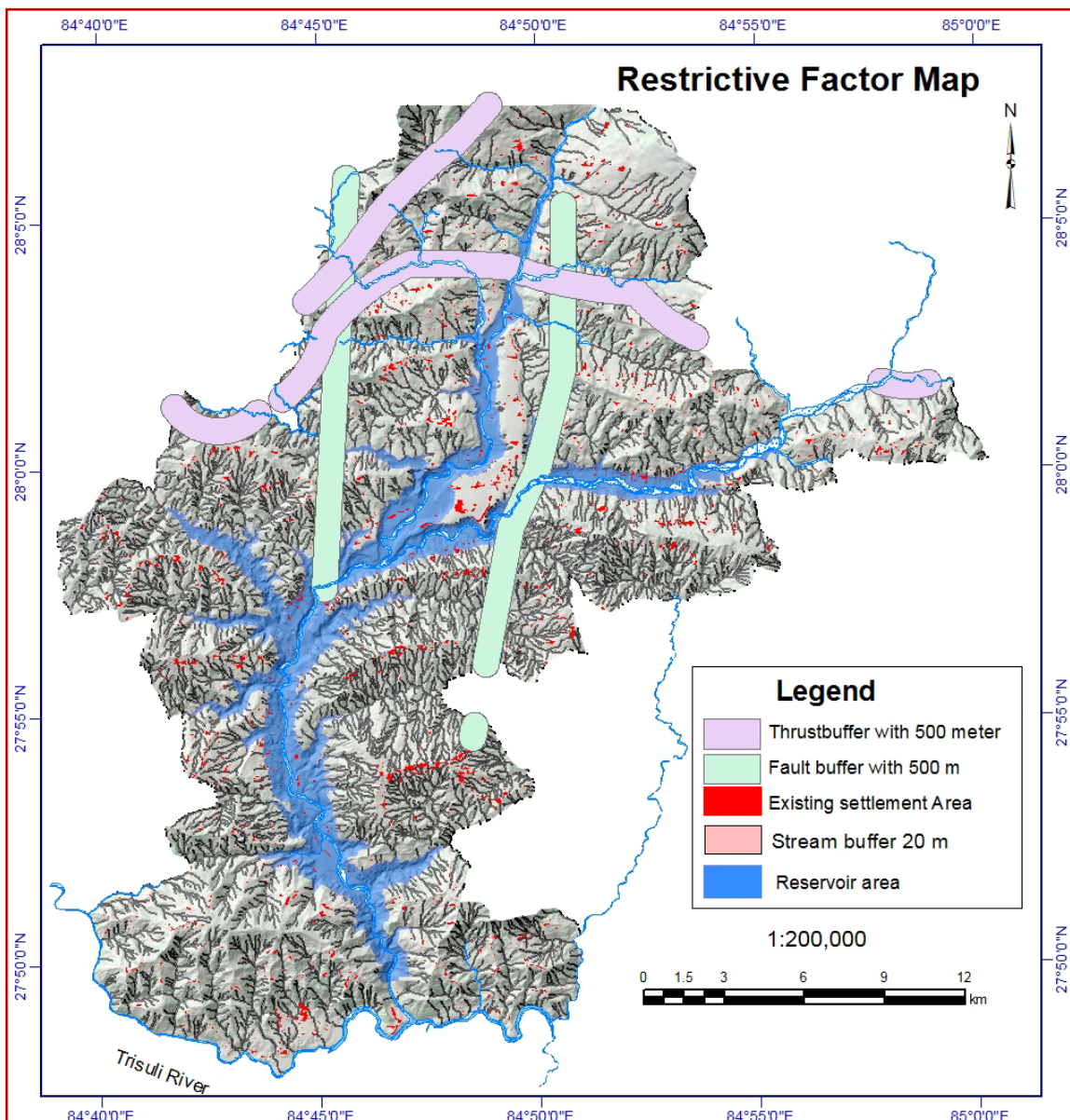


Map 16 The land cover rating map.

Criteria which are totally unsuitable for resettlement purposes are considered as restrictive factors. The restrictive factors are decided based on literature reviews and expert opinions. Following criteria are considered as restrictive factors:

- a) 500 meter buffer of thrust and fault line
- b) 20 meter buffer of drainage and 40 meter buffer of river.
- c) Preexisting settlement area

Map 17 shows the area that is restricted for resettlement purposes.



Map 17 Restricted factor map.

4.3.4. Suitability Map for resettlement of IDPs.

The suitability map was prepared (Map 18) using Arc GIS software. The procedure of preparation of map is elaborated in the GIS model as show in Figure 4. Essentially the tool used was Raster Calculator in which the weightage were provided based upon the results of AHP for criteria and weightage based upon expert opinion for the sub-criteria. Once the suitability map was prepared, the restricted area was subtracted.

$$\text{Site Suitability} = \Sigma[\text{Parameter rating maps } (C_n) \times \text{Weight } (W_n)] - \text{Restrictive Factor.}$$

In the suitability map each pixel is assigned suitability index which are in decimal form. The values of suitability index is converted to integer for computational purposes. The raster was converted to vector in the form of polygons. 54326 polygons were found as suitable. However, polygons having an area of less than 0.5 ha were omitted as these were considered too small for relocation planning. After this filtration, 5553 polygons with area 158.66 km² were identified as suitable for resettlement planning. Among them the area of the polygon with grid value 5 was considered as moderately suitable and found 118.48 km² (23% of overall study area). The area of the polygon with grid value 6 was considered as suitable and found 28.66 km² (6% of overall study area) and the area with grid value 7 was considered highly suitable whose area was found to be 11.53 km² (2% of overall study area). Remaining 69% of the study area (Figure 6) was not found suitable for new resettlement having the grid value less than 5. The classification of suitability index was done as shown in Table 17 based upon the grid value.

Table 16 Classification of suitability index for resettlement site selection

Grid Value	suitability index	Grid Value	suitability index
<5	Not Suitable	5	Moderately Suitable
6	Suitable	7	Highly Suitable
8	Strongly suitable	9	Extremely suitable

The diagram of the model is presented below (Figure 4).

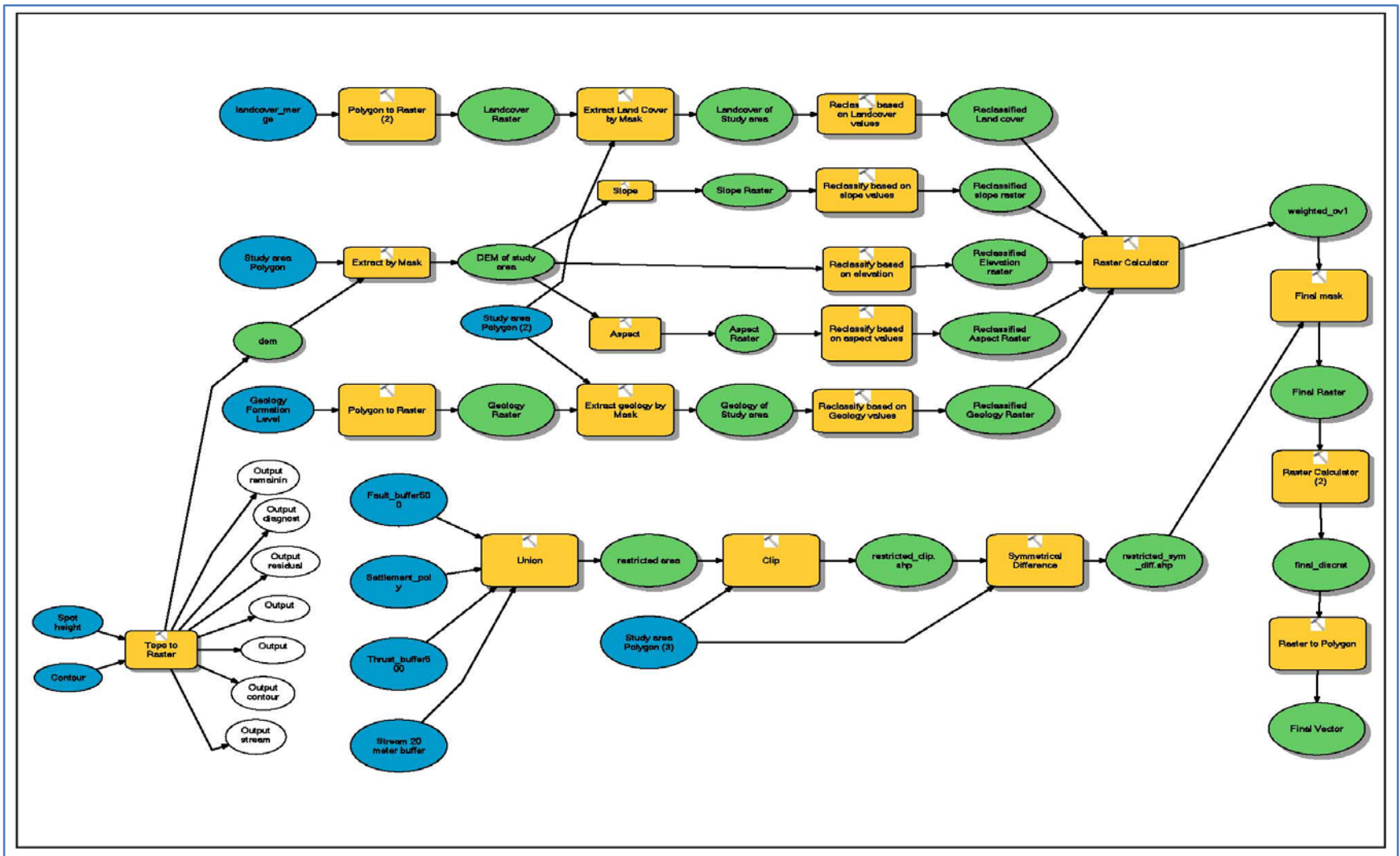
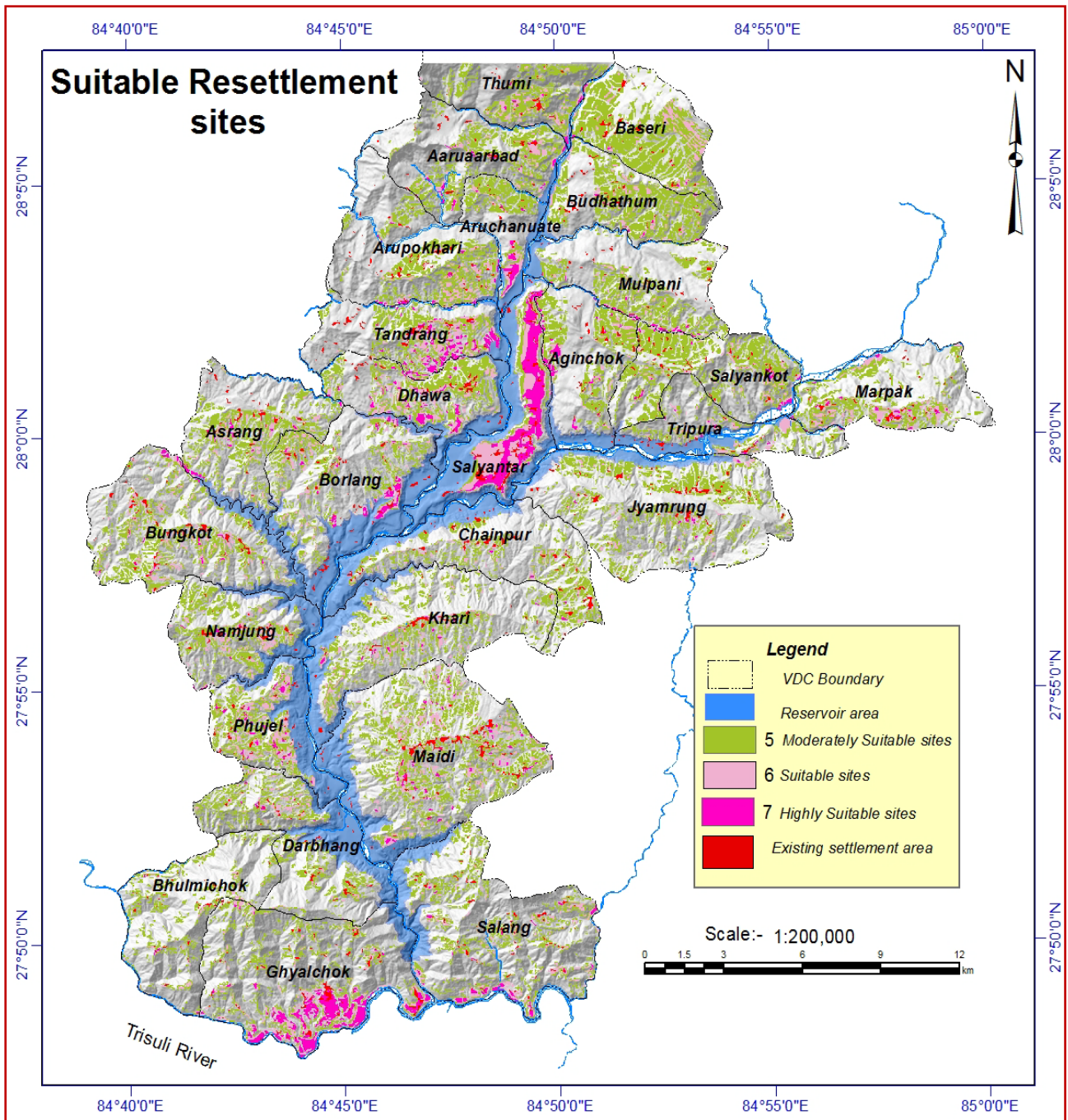


Figure 4: Geographical modeling using Arc GIS Model

.A suitability map was prepared (Map 18) using raster calculator tool of Arc GIS. The raster map was converted to vector layer resulting in several polygons. Polygons having grid values less than 5 were considered unsuitable and the polygons with grid value greater or equal to five are considered as suitable relocation sites.



Map 18 Final suitable resettlement sites.

A suitability area is exported in to kml file and visually inspected by overlaying over Google Earth images. Images below show some of the snapshots from the overlay (Figure 5)

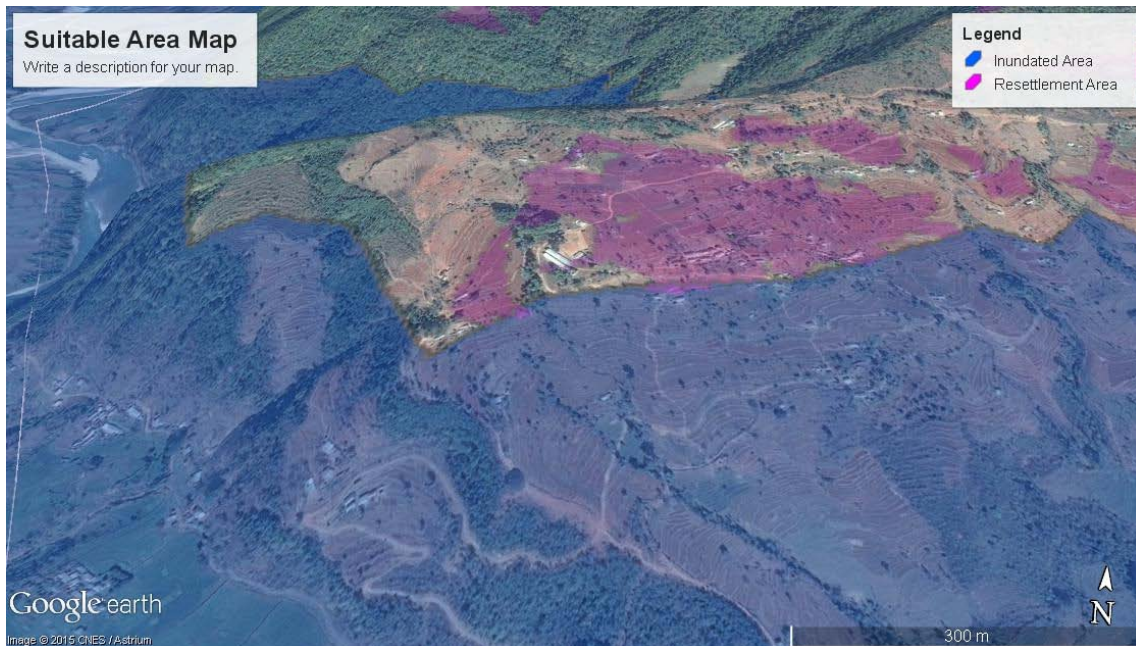
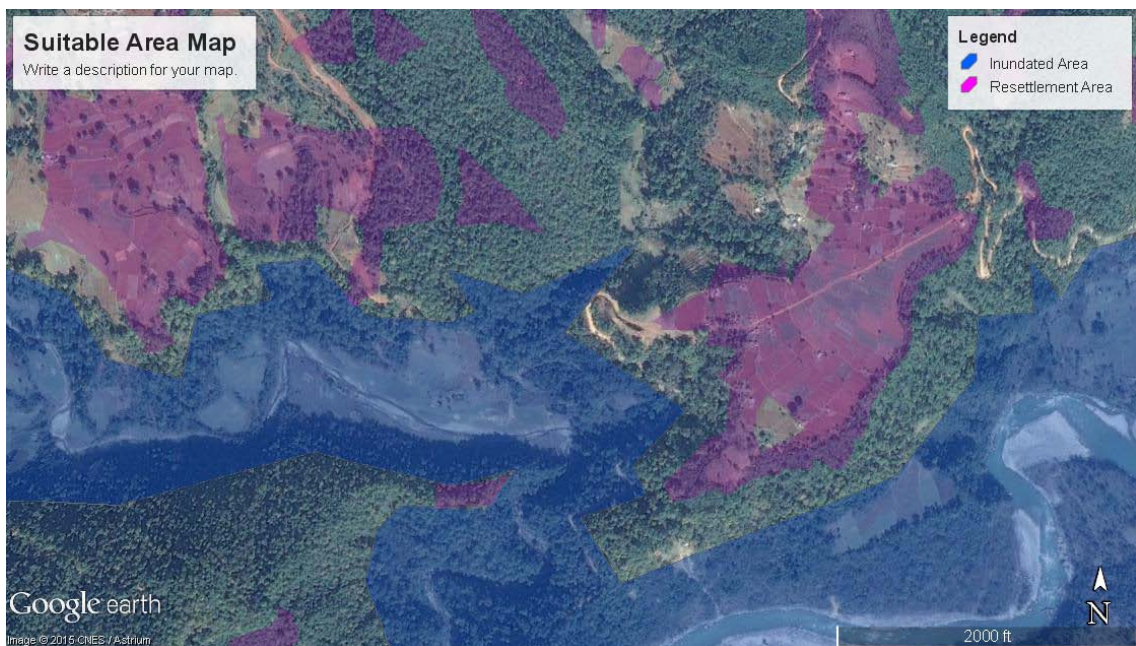


Figure 5: Showing the relocation sites on the Google earth.



Based upon the suitability map, among the total area, 2% (11.53 km²) area was found to be highly suitable, 6% (28.66 km².) was found to be suitable area while 23% (118.48 km²) area was found to be moderately suitable (Figure 6)

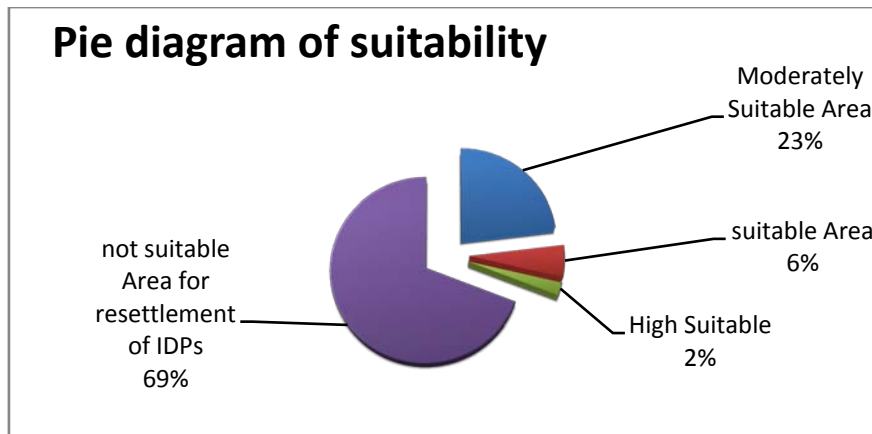


Figure 6: Pie chart of total study area with the result of suitability value.

4.3.5. VDC wise comparative analysis of suitability area versus inundated area.

Table 18 depicts the availability of suitability area along with the area to be resettled. The area to be resettled means total sum of agricultural and settlement area which will be inundated (31.47 km²). In aggregate, the sum of area of high suitable and suitable land is more than the area to be resettled. If we consider VDC wise approach for resettlement, 20 VDCs have enough area in high suitable and suitable category for resettlement. Only 7 out of 27 VDCs have deficit land in high suitable and suitable category (Figure 7) . However, even these 7 VDCs have enough land including all category (Table 18) for resettlement.

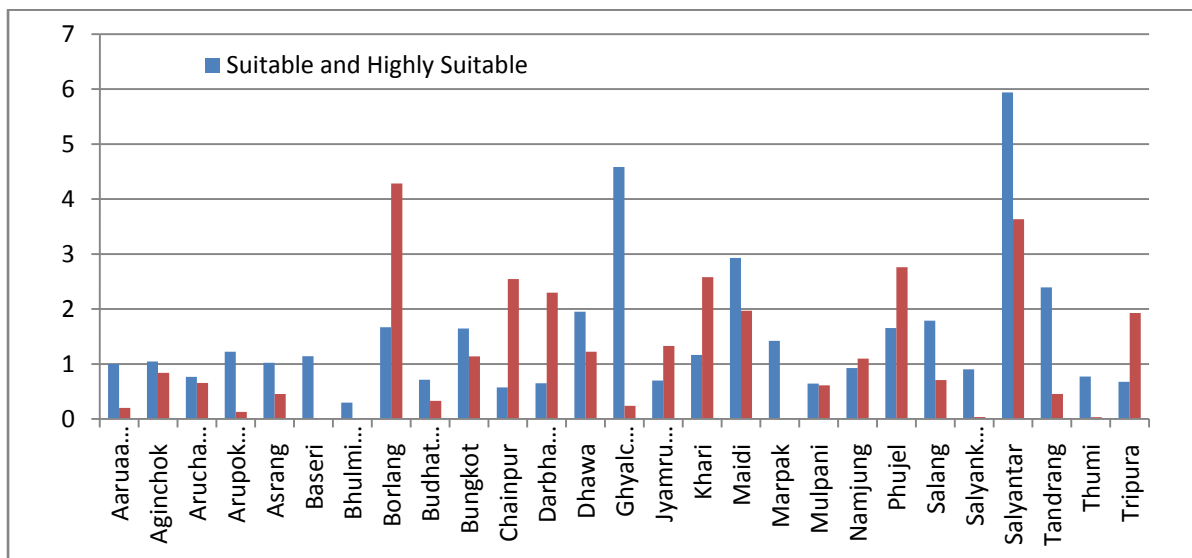


Figure 7: A comparison histogram showing the total suitable land of Suitable and highly suitable area with the minimum area to be resettlement (Cultivation and settlement land).

Table 17: Suitability as per the classification with total agricultural and settlement area fall in reservoir.

<i>VDC name</i>	<i>Moderate Suitable</i>	<i>suitable</i>	<i>High Suitable</i>	<i>Total In sq.km.</i>	<i>Total agri+ settle land fall in reservoir(sq.km.)</i>
Aaruaarbad	4.117	0.785	0.215	5.12	0.200
Aginchok	3.649	0.638	0.406	4.69	0.838
Aruchanuate	1.960	0.464	0.303	2.73	0.656
Arupokhari	4.418	1.038	0.185	5.64	0.128
Asrang	4.267	0.801	0.220	5.29	0.455
Baseri	7.727	1.093	0.048	8.87	0.006
Bhulmichok	2.985	0.276	0.022	3.28	0.005
Borlang	4.015	1.195	0.474	5.68	4.282
Budhathum	6.046	0.650	0.065	6.76	0.329
Bungkot	5.509	1.465	0.181	7.16	1.139
Chainpur	4.075	0.533	0.041	4.65	2.544
Darbhang	4.137	0.600	0.050	4.79	2.297
Dhawa	4.024	1.413	0.537	5.97	1.222
Ghyalchok	4.174	2.100	2.484	8.76	0.238
Jyamrung	6.949	0.627	0.070	7.65	1.327
Khari	5.121	1.064	0.100	6.29	2.580
Maidi	9.450	2.499	0.431	12.38	1.968
Marpak	3.789	1.257	0.166	5.21	0.000
Mulpani	4.211	0.444	0.200	4.85	0.612
Namjung	3.640	0.865	0.062	4.57	1.099
Phujel	3.316	1.388	0.267	4.97	2.759
Salang	5.297	1.403	0.385	7.08	0.707
Salyankot	6.052	0.713	0.191	6.96	0.036
Salyantar	1.260	2.642	3.298	7.20	3.634
Tandrang	3.069	1.429	0.965	5.46	0.454
Thumi	3.279	0.680	0.093	4.05	0.032
Tripureshowr	1.947	0.600	0.075	2.62	1.928
Total	118.483	28.660	11.533	158.68	31.474

4.4. Land use change after resettlement

After construction of dam of BGHEP of height 245 meter, 66.39 km² (see in Table 3) of land will be changed into lake including cultivation and settlement land which will induce extensive impact on ecosystem and the surrounding environment. Further, for the resettlement purpose also, other land area is required which will further bring land use/land

cover changes since total area of 32 km² (Table 18) needs to be relocated if land for land compensation policy is adopted. Table 19 shows the present land cover sites where the IDPs' can be resettled. This shows that if, only moderately suitable, suitable and highly suitable area are considered for the relocation, agricultural land, bush, forest and grassland will also change to the settlement area after relocation. However comparing the inundated cultivated and settlement area (31.47 km²) and the suitable sites for the relocation which is 158.66 km², it is seen that moderately suitable area can be excluded in order to compensate the inundated cultivate and settlement area. This thus, helps in conserving forest and agricultural land in spite of the suitability for the relocation since total area of suitable and high suitable site for relocation is 40.19 km² (See in below Table 19) .

Table 18: Suitability result fall under the existing LULC.

Land cover	GRIDCODE	Suitability	Area
Agri Area	5	moderately suitable	92.524261
Agri Area	6	Suitable	24.105864
Agri Area	7	Highly suitable	10.994354
Bush	5	moderately suitable	11.687885
Bush	6	Suitable	1.0221
Bush	7	Highly suitable	0.422188
FOREST	5	moderately suitable	12.432045
FOREST	6	Suitable	2.422633
FOREST	7	Highly suitable	0.012
Grass land	5	moderately suitable	1.82755
Grass land	6	Suitable	1.098252
Grass land	7	Highly suitable	0.098245
Total			158.66667

From above Table 19 Including all the category of sites , we can say that there is sufficient site for relocation of IDPs even leaving the area of moderately suitable area.

Chapter 5: Conclusion And Recommendation

This chapter conclude the results and gives the recommendation for better improvement of the proposed resettlement sites for the successful resettlement plan.

5.1. Conclusion

Resettlement plan is a sensitive and meticulous procedure guided by several policies, procedures and legislations. Resettlement plans in mega hydropower projects with dams result in internal displacement of people. Unless properly managed, this may hinder successful operation of the project. In the long term, it may fail to ensure security of livelihoods of the displaced people.

From a spatial perspective, relocation of IDPs is a key factor of resettlement plan. This research is directed towards determining the suitable area for relocation involving multi criteria decision making through Analytical Hierarchical Procedure.

Using the AHP tool for multi criteria decision making, the influence of several criteria were determined. It was determined that slope governs 38.4% influences, land cover governs 31.9%, aspect governs 14.1%, geological formation governs 10.6%, and elevation influences 5 %.

It was found that the hydropower project causes inundation of 6637 hectare of land area along with physical and economical displacement of 3374 households including prosperous urban settlements such as Aarughat bazaar. It was found that an area of 158.66 km² (31%) of study area excluding the reservoir were identified as more or less suitable for resettlement planning. Among them 23% of overall study area (118.48 km²) was found moderately suitable, 6% of overall study area (28.66 km²) was found as the suitable and 2% of overall study area (11.53 km²) was found as highly suitable for relocation of IDPs from the BGHEP. It is concluded that there is enough land area around the reservoir for relocation (replacement) of agricultural and settlement areas which will be inundated after construction of dam.

In this research, AHP has been adopted to find the suitable sites for the relocation of the displaced people due to the dam prepared for the hydropower. However, this technology can be also adopted to the any sort of people displaced due to other reasons like natural disaster.

5.2. Recommendation

- Resettlement of affected people is one of the most crucial issue need to be addressed in every development project. However, this need to be supported by strong policy which can be implementable. Nepal has already formulate Land Acquisition and Resettlement Policy. Still, this policy have many issues and aspects missing to be addressed. Further, social intact of the IDP must be incorporated while resettling them. If any development project fail to address this issues, then there may exist problem in successful execution of the project.
- Fast (2013) states that dam-related resettlement practices have failed to restore resettlers' livelihoods in Nepal the reasons for which include over-reliance on cash compensation. But this is not the case. The issue is only the lack of national resettlement policy to address the issue of IDP strongly. Further, the research has only analyzed the suitable site for the relocation. However, plan for establishment of other infrastructures like school, road, bridge, water supply, electricity also need to be made which is out of the scope of this research.
- Clear and strong policy need to be prepared and implemented strictly. Land Acquisition and Resettlement Policy has been prepared recently. Still this documents have many rooms for revision. Basic issues like acquisition of land for relocation of affected households are also not clearly discussed in this document. This and other number of issues that has already been identified, need to be revised and thus implemented accordingly.

- The IDPs should be always resettled within their native VDC boundary as far as possible. Further, compensation rates should be calculated in consultation with the representatives of the affected populations to ensure that the rates are fair and adequate.

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Annex-1: Expert Pairwise comparison relative Scale (AHP)







Please rank the following pair wise comparison of 5 factors based on their relative significance of their influence on Suitability Analysis for Resettlement of IDPs from reservoir on its vicinity area.

Name: _____ **Designation:** _____

Organization: _____ **Expertise Field** _____

Intensity of Importance	Qualitative Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective
2	Weak	
3	Moderate importance	Experience and judgements slightly favour one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgement strongly favour one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favoured very strongly over another and dominance is demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order of affirmation

Slope	<table style="width: 100%; text-align: center;"> <tr> <td>Extreme favors</td> <td>Very Strong favors</td> <td>Strongly favors</td> <td>Slightly favors</td> <td>Equal</td> <td>Slightly favors</td> <td>Strongly favors</td> <td>Very Strong favors</td> <td>Extreme favors</td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td>9</td> <td>7</td> <td>5</td> <td>3</td> <td>1</td> <td>3</td> <td>5</td> <td>7</td> <td>9</td> </tr> </table>	Extreme favors	Very Strong favors	Strongly favors	Slightly favors	Equal	Slightly favors	Strongly favors	Very Strong favors	Extreme favors										9	7	5	3	1	3	5	7	9	Elevation
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