

Government of Nepal  
Ministry of Urban Development  
Department of Urban Development and Building Construction  
Babarmahal, Kathmandu

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Initial Environmental Examination (IEE)  
*of*  
Rehabilitation, Extension and Development of Water  
Supply Works at Dharan Municipality

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*Submitted to:*  
Ministry of Urban Development  
Singhdurbar, Kathmandu

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*Submitted by:*  
Integrated Urban Development project (IUDP)  
Project Implementation Unit (PIU)  
Dharan Municipality, Dharan, Sunsari

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## ACRONYMS:

ADB	Asian Development Bank
amsl	above mean sea level
DDC	District Development Committee
DSC	Design and Supervision Consultant
DUDBC	Department of Urban Development & Building Construction
DWEC	District Wages Evaluation Committee
DWSS	Department of Water Supply and Sewerage
DWSMB	Dharan Water Supply Management Board
EIA	Environmental Impact Assessment
EMAP	Environmental Management Action Plan
EMP	Environmental Management Plan
EPA	Environmental Protection Act
EPR	Environmental Protection Rules
ES	Environmental Specialist of DS
GoN	Government of Nepal
GRM	Grievance Redress Mechanism
HH	Household
IEE	Initial Environmental Examination
lpcd	litres per capita per day
MoUD	Ministry of Urban Development
MPPW	Ministry of Physical Planning and Works
NDWQS	National Drinking Water Quality Standard
NEA	Nepal Electricity Authority
NTFP	Non Timber Forests Product
NWSC	Nepal Water Supply Corporation
OHS	Occupational Health & Safety
PAF	Project Affected Family
PMO	Project Management Office
REA	Rapid Environmental Assessment
RP	Resettlement Plan
SPAF	Severely Project Affected Family
TDF	Town Development Fund
TSP	Total Suspended Particles
VDC	Village Development Committee
WUSC	Water User and Sanitation Committee

**प्रस्तावक**  
आयोजना कार्यान्वयन ईकाई, धरान  
एकिकृत शहरी विकास आयोजना  
शहरी विकास मन्त्रालय  
नेपाल सरकार

**प्रस्तावकको ठेगाना**  
धरान उप-महानगरपालिकाको कार्यालय, धरान, सुनसरी  
कोशी अञ्चल, नेपाल  
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## कार्यकारी सारांश

### पृष्ठभूमि

यस परियोजनाको प्रस्तावक शहरी विकास मन्त्रालय अन्तर्गत एकिकृत शहरी विकास आयोजना, आयोजना कार्यान्वयन ईकाई, धरान हो। नेपाल सरकार तथा एशियाली विकास बैंकको आर्थिक सहयोगमा संचालित यस परियोजनाको उद्देश्य हाल धरानमा विद्यमान खानेपानी सेवा सुविधाको विस्तार तथा भरपर्दो एवं सुलभ गर्नु हो। यस आयोजनाबाट धरान उ.म.न.पा. का १ देखि १९ वडा का जनताहरु लाभान्वित हुनेछन्।

### प्रारम्भिक वातावरणीय परिक्षणको उद्देश्य, नेपाल सरकारको ऐन, नियम र एशियाली विकास बैंकको नीति

यस प्रारम्भिक वातावरणीय परिक्षणको मूल उद्देश्य वातावरणमा नकारात्मक असर नपरोस भन्नको लागि गर्नु हो। साथै ती असरहरुलाई न्यून गर्नु एवं साथै ती असरहरु लाई निर्मुल वा ऐनको स्विकार्य सिमामा ल्याउनको लागि सुभाविदनु हो।

नेपाल राष्ट्रको प्रचलित कानून, नियम तथा एशियाली विकास बैंकको नीति अनुसार कुनै पनि विकासको योजना तथा निर्णय निर्माण प्रक्रियामा वातावरणीय असरहरुको ध्यान पुऱ्याउनु पर्नेहुन्छ।

नेपाल सरकारको कानुनी प्रक्रियाअनुसार यो प्रस्तावित परियोजनाले वातावरण संरक्षण नियमावली, २०५४ को पालना गर्नुपर्ने हुन्छ। प्रस्तावित प्रारम्भिक वातावरणीय परिक्षणले वातावरणीय संरक्षण नियमावलीको तालिका १ अन्तर्गत नियम ३ र अनुसुची ७ को पालना गर्दछ। त्यस्तै गरि एशियाली विकास बैंकको सुरक्षण नीति कथन (जून २००९) अनुसार यो परियोजना श्रेणी B मा पर्दछ र एशियाली विकास बैंकको निर्देशिका अनुसार समेत यो प्रारम्भिक वातावरणीय परिक्षण गरिएको छ।

### परियोजनाका मुख्य अंशहरु

यस परियोजनाले खानेपानी श्रोतको लागि हाल संचालनमा आइरहेको सतह श्रोतहरु खर्दु खोला र सर्दु खोला र नपुग पानीको लागि भूमिगत जलश्रोत प्रयोगमा ल्याउने लक्ष्य राखेको छ। यस आयोजनाले प्रस्तावित गरेका अधिकांश क्षेत्रहरुमा हाल खानेपानी सेवा सुविधाहरु संचालनमा रहेका छन्। सकेसम्म विद्यमान खानेपानी संरचनाहरुलाई नै प्रयोग गर्न जोड गरिएको छ। तसर्थ यस आयोजना नितान्त नयाँ आयोजना नभई खानेपानी सेवा सुविधाको लागि पुनर्स्थापना तथा विस्तार आयोजना मात्र हो। विद्यमान संरचना, भौगोलिक अवस्था तथा मानव बस्तिहरुको आधारमा ५ वितरण उप-प्रणालीहरु प्रस्ताव गरिएको छ। ती हुन् १) फुस्रे २) विजयपुर ३) सुम्निमा ४) रेलवे ५) पिण्डेश्वर। पिण्डेश्वर तथा रेलवे उप-प्रणालीहरु नयाँ निर्माण गरिनुपर्ने, यी बाहेक अन्य उप-प्रणालीहरु मर्मत संभार एवं पुनर्स्थापन गरिनुपर्दछ। यस आयोजनामा पानी सुद्धिकरण एवं जीवाणुरहित गर्ने सुविधा, वितरण ट्याङ्किहरु एवं घर सम्म पाइपलाइनको सुविधा एवं मिटर राख्ने कार्य समेत यस आयोजनाले व्यहोर्ने प्रस्ताव राखिएको छ।

### विद्यमान स्थिती

हाल उप-महानगरपालिकामा नेपाल खानेपानी संस्थान लगायत अन्य ६ वटा स्थानीय समुदायद्वारा संचालित खानेपानी कार्यक्रमहरु संचालनमा रहेका छन्। ८१ प्रतिशत घरधुरीहरुमा खानेपानीको सुविधा उपलब्ध भएको पाइन्छ। सामुदायिक खानेपानी समितिहरुद्वारा संचालित खानेपानीका श्रोतहरु तेति भरपर्दो देखिएका छैनन्। सुख्खा मौसममा सुक्ने गरेको पाइएको छ। अर्को प्रमुख वितरणकर्ता नेपाल खानेपानी संस्थान रहेको छ। यसले नगरको उत्तरमा अवस्थित सर्दु खोला र खर्दु खोला र नगरको दक्षिणमा चारकोसे भाडी जंगलमा रहेको ३ वटा डिप टयुववेल (भूमिगत जलश्रोत) बाट पानी वितरण गर्दै आएको छ। वर्षातको समयमा दैनिक १ देखि २ घण्टा तथा सुख्खा मौसममा १ दिन बिराई पानी वितरण गरिएको पाइन्छ।

आयोजना क्षेत्रको सामाजिक आर्थिक अवस्था मध्यम रहेको पाइएको छ । अधिकांश घरधुरी (३५%) को प्रमुख आयश्रोत वैदेशिक रोजगारी रहेको छ । अन्य घरधुरीका आम्दानीका श्रोतहरूमा व्यापार व्यवसाय, सरकारी तथा अन्य सेवामा रोजगार इत्यादी रहेका छन् । जनजातिहरू प्रमुख रूपमा रहेका यस क्षेत्रमा समुदायहरू आपसमा मिलेर बसेको देखिन्छ । प्रसिद्ध वी. पी. कोइराला स्वास्थ्य विज्ञान प्रतिष्ठान यस उ.म.न.पा. नै रहेको छ ।

### **निर्माण स्थलको भू-उपयोग बोट**

परियोजनाको मुख्य संरचनाहरू, श्रोतहरूमा सतह जलश्रोत र भूमिगत जलश्रोत, खानेपानीको पाइपलाइन, खानेपानीको ट्याङ्क, प्रशोधन केन्द्रहरू छन् । खानेपानीको ट्याङ्क, पम्प हाउस, जेनेरेटर घर निर्माण गरिने स्थलमा करिब १९८ रुखहरू काट्न पर्ने देखिन्छ । त्यस बापत ४९५० नयाँ रुखहरू रोप्नको लागि परियोजनामा रकम छुट्याइएको छ । उक्त स्थलमा परियोजनाको कार्यान्वयन पछि कुनै उल्लेखनीय भू-उपयोगमा परिवर्तन हुने देखिन्दैन ।

### **वातावरणीय प्रभाव, नकारात्मक प्रभाव न्यूनिकरण उपायहरू र अनुगमन**

कुनै खासै महत्वपूर्ण नकारात्मक वातावरणीय प्रभाव देखिदैन र संभावित नकारात्मक प्रभावहरू पनि स्थानिय र सजिलै सँग निराकरण गर्न सकिने स्तरको देखिन्छ । खानेपानी वितरण प्रणालीका मुख्य वातावरणीय मुद्दा निर्माणसंग सम्बन्धित क्रियाकलाप जस्तै इन्टेक निर्माण, डिप बोरिङ्ग कार्य, प्रशोधन इकाई निर्माण र पाइप लाइन बिछ्याउदा सडकको सतह खुकुलो हुदा हुने भूक्षय जस्ता छन् । तिनको नकारात्मक प्रभाव न्यूनिकरण गर्न सावधानी उपायहरू जस्तै: खनिएका खाल्टाहरू राम्ररी पुर्ने र कम भन्दा कम बोट विरुवाहरू (भाडी) काट्ने प्रकारका छन् ।

परियोजनाको मुख्य संरचना स्थानको छनोट, स्थानीय जनताहरूको सल्लाह एवं प्राविधिक दृष्टिकोणले उपयुक्त स्थानमा गरिएको छ र त्यसको लागि कुनै पनि संरचना र जन समुदायलाई विस्थापित वा पुर्नस्थापना गर्न नपर्ने देखिन्छ । प्रशोधन इकाई, भण्डारण टैंक र पानी सुद्धिकरण निर्माण गर्नको लागि आवश्यक पर्ने जग्गा उपयुक्त मुल्यमा खरिद भइसकेको छ । यी सबै कुराहरूलाई ध्यानमा राख्दा, प्रस्तावित परियोजनाबाट सो क्षेत्रका जैविक, भौतिक, आर्थिक, सांस्कृतिक तथा सामाजिक वातावरणमा कुनै गहन प्रभावको सम्भावना निकै कम देखिन्छ ।

नकारात्मक प्रभाव न्यूनिकरणको कार्यन्वयन राम्रो संग भएको वा नभएको जाँच गर्न अनुगमन गर्नु जरुरी छ । त्यसैले निर्माण र संचालन अवधिमा हुने क्रियाकलापहरूलाई समेटेर एउटा बिशुद्ध अनुगमन कार्यक्रम तयार पारिएको छ । परियोजना शुरु गर्नु अगाडि, परियोजना व्यवस्थापन कार्यलयले नकारात्मक प्रभाव न्यूनिकरण उपायहरूको कार्यन्वयन गर्नकालागि बिशुद्ध कार्य योजना र वातावरणीय योजना अनुसारको अनुगमन योजना बनाइने छ जसलाई निर्माण र संचालन कार्यको ठेक्का संगै संलग्न गरिने छ ।

### **निष्कर्ष तथा सुभावहरू**

यस परियोजनाको प्रकृति, परियोजना श्रोतको वातावरण एवम् आर्थिक सामाजिक अवस्था र स्थलगत निरिक्षण एवम् सरोकारवाला संगको सरसल्लाहलाई मध्यनजर राख्दा यस परियोजना बाट त्यस श्रोतमा न्यून नकारात्मक वातावरणीय असर पर्नेछ । संभावित प्रभावहरू धेरै जसो स्थानिय प्रकारका छन् र सुभाइएका उपयुक्त न्यूनिकरण उपाय र नियमित अनुगमन गरिएमा यी प्रभावहरूलाई सजिलै एवम् कमखर्चमा न्यूनिकरण गर्न सकिने छ । यस परियोजना बाट स्थानिय बासिन्दाहरूले चौविसै घन्टा सुरक्षित खानेपानी पाउने छन् र सरसफाईको अवस्थामा सुधार हुनेछ जसले गर्दा धरान उ.म.न.पा. वडा नं १ देखि १९ का बासिन्दाहरूको जीवन स्तरमा सुधार आउने छ । यस परियोजनालाई उचीत तरिकाबाट कार्यान्वयन गरिएमा, स्थानिय बासिन्दाहरूको स्वास्थ्य र वातावरणमा महत्वपूर्ण सुधार हुने देखिन्छ । त्यसैले प्रारम्भिक वातावरणीय परिक्षणनै पुग्ने देखिन्छ ।

# EXECUTIVE SUMMARY

## Background

The Integrated Urban Development Project, Project Implementation Unit (PIU) Dharan, Sunsari of Department of Urban Development and Building Construction (DUDBC) is the proponent of the current project. The Project intends to implement improvement of existing water supply services in Dharan Municipality under Asian Development Bank (ADB) finance. The proposed project will facilitate the wards of 1-19 wards of Dharan Sub metropolitan City, Sunsari District.

## Purpose of IEE, GoN acts and rules, ADB policy

The purpose of this Initial Environmental Examination (IEE) is to examine the environmental implication of proposed project and its activities to ensure that it will not damage the environment and to provide measures to remove or reduce those impacts into acceptable limits.

Law of Nepal and ADB policy both require that the environmental implications of individual developments are taken into account in the planning and decision making process and that action is taken to reduce the impacts to acceptable levels. This is done through environmental assessment process, which has become an integral part of lending operations and project development and implementation worldwide.

The statutory requirement of the Government of Nepal, that has to be adhered to for the proposed project, is the Environmental Protection Act, 1996 and Environmental Protection Regulation, 1997 (and amendments 2007). The present IEE study fulfils the requirements pertaining to Rule 3, Annex G of Schedule 1 of EPA, 1997 (including amendments). Similarly, as per ADB Safeguard Policy Statement (SPS) 2009, the project is classified Environment Category B and IEE is required as per the checklist suggested by ADB.

## Components of the project

Dharan water supply project has been conceptualized as a piped water supply system considering conjunctive use of surface source from Khardukhola and Sardukhola streams and ground water source. Moreover major part of the proposed project is under operation, emphasis has been given to use existing facilities as far as possible. Major portion of the area has to be rehabilitated and other areas have to be covered. Thus this project is a rehabilitation and extension of water supply project. Based on the existing facilities, natural terrain and settlement patterns five distribution subsystems are proposed namely i) Phusre, ii) Bijaypur, iii) Sumnima, iv) Railway and v) Pindeswor. Area to be served by Pindeswor and Railway are to be newly constructed where as other subsystems are of rehabilitation nature. The system also consists of treatment and disinfection facilities, ground reservoirs, rehabilitation of existing intakes. Source protection works, plantation and revegetation works are proposed in the project.

## Baseline information

The Municipality has a number of piped water supply system including community managed systems serving 81% of the population. The distribution hour is 1-2 hours a day in wet season and most of the times in alternate days in dry season. The sources presently used by community water supply systems are quite unreliable and get dry in dry season and are quite unreliable. The major system is operated by Nepal Water Supply Corporation (NWSC). Sardu khola and Khardu khola are the surface sources in the north and at present using ground water sources extracting water from 3 tube wells situated in the Charkoshe Jhadi (southern boundary of the Municipality).

The socio-economic condition of the area is moderate. Majority of the people (35%) depend on foreign employment i.e. remittance is the major sources of income. Other sources of income includes business, government and other services. The community has good ethnic diversity. Though Janajati are in majority people from various ethnic groups living together. The southern part of the project area is covered by forest and the area has five community forests. Famous BP Koirala Institute of Health Sciences is situated in Dharan.

## Landuse pattern of Construction Sites

Major activities of the project is to construct intakes, deep boring, drinking water pipe laying, construction of reservoirs and treatment units. 198 trees to be cut where reservoir are to be constructed ( viz near Panchakanya

Temple and near deep boring area where sumpwell is to be constructed). 4950 plantation works will be carried out. No other remarkable change in landuse will be there by the implementation of the project.

### **Environmental impacts, mitigation and monitoring**

No remarkable significant adverse environmental impacts have been predicted and the anticipated negative impacts are of local in nature and low in magnitude. The main environmental concern for water supply system is related to construction activities such as drilling of boreholes for tube well installations and laying distribution networks along the roads. This may cause uneven settlement in the part of the street surfaces due to excavation of trenches which could lead to soil erosion. The mitigation measures are precautionary types such as proper back filling of the excavated trenches and avoiding cutting of vegetation. The locations of major structures have been acquired in consultation with the municipal local bodies and no households or community have been displaced or resettled. Therefore there are very less possibilities of adverse impacts on the biological and socio economical environment of the project area.

Monitoring is necessary to check the implementation of mitigation measures and a detailed monitoring schedule has been designed specifying the regular and periodic monitoring activities during the project construction and operation phase. Before the operation of the project, PIU Dharan will develop detailed work plan for implementing mitigation measures and monitoring plans based on Environmental Management Plan which will be incorporated into the construction and operation contracts.

### **Conclusion and Recommendation**

Considering the nature of the project; environmental and socio-economic situation of the area and based on the detailed field survey and consultation with the relevant stakeholders, it can be concluded that the proposed project will have only minor negative impacts on the area. The impacts are mostly local in nature and can be easily and mitigated in low cost with suitable mitigation measures and regular monitoring schedules. Implementation of the project will benefit the local people with safe and sufficient supply of drinking water and improved sanitary situation thereby raising the quality of life the people in Dharan . If the project is properly implemented and environmental issues are duly considered, there will be a significant improvement in the health of the environment and people. Hence, IEE is sufficient and proposed project is suitable for implementation.



# 1. NAME AND ADDRESS OF INDIVIDUAL OR INSTITUTION PREPARING THE REPORT

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## 1.1 Name of the Proposal

Rehabilitation, Extension and Development of Water Supply Works at Dharan Municipality

## 1.2 Name and Address of the Proponent

The proponent responsible for preparing this report is the Integrated Urban Development Project (IUDP), Project Implementation Unit (PIU), Dharan Municipality, Dharan. Ministry of Urban Development (MoUD), Government of Nepal (GoN) is the Executing Agency.

### Name of the Proponent:

Project Implementation Unit (PIU)  
Integrated Urban Development Project (IUDP), Dharan  
Ministry of Urban Development, Government of Nepal

### Address of the Proponent:

Dharan Municipality Office, Dharan, Sunsari district, Kosi zone, Nepal  
Phone: 025-520407 Fax: 025-521991  
URL: [www.dharan.gov.np](http://www.dharan.gov.np)  
e-mail: [info@dharan.gov.np](mailto:info@dharan.gov.np)

## 1.3 Name and Address of the Consultant preparing IEE report

Building Design Authority  
Kamaladi-31, Kathmandu, Nepal  
Phone: 01-4248200, 4247939 Fax: 977-01-4223536  
URL: [www.bda.com.np](http://www.bda.com.np)  
e-mail: [bdapvtltd@gmail.com](mailto:bdapvtltd@gmail.com)

## 2. SUMMARY OF THE PROPOSAL

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### 2.1 Objectives of the Proposal

The main objectives of the proposal is to improve health and hygiene of the people of Dharan Municipality ( Wards 1-19) by rehabilitating , extending and developing potable water.

### 2.2 Objectives and Scope of the IEE

IEE is a tool for incorporating environmental concerns at the project level and is carried out as a part of the detailed study. The objectives are:

- provide information about the general environmental settings of the project area as baseline data;
- provide information on potential impacts of the project and the characteristic of the impacts, magnitude, distribution, affected groups and duration
- provide information on potential mitigation measures to minimise the impact including mitigation costs
- assess the best alternative project with most benefits and least costs in terms of financial, social and environmental aspects
- provide basic information for formulating management and monitoring plans

The present IEE has been conducted for the water supply and sanitation subproject proposed for Dharan Municipality, Sunsari District. It discusses the environmental impacts and mitigation measures relating to the location, design, construction and operation and management of the scheme.

The scope of the study is to study and prepare IEE report as per the format indicated by EPR 2053 BS (1997AD) together with the instructions provided by the project management office. The task during the preparation of this report included description of the project with reference to the physical, biological and social environment, and identification of potential impacts, mitigation measures and monitoring plan and related topics. However, the study does not limit itself only here, but has strived to completeness and objectiveness. As the proposed sub-project is classified as environment Category B project as per the ADB's Safeguard Policy Statement (SPS) 2009, an Initial Environmental Examination (IEE) has to be carried out.

However, after the enforcement of GoN's Environmental Protection Acts 1997 and Environmental Protection Regulation (EPR) 1997 (including amendments 1999), all projects under consideration are required to fulfil either IEE or EIA applications. The screening criterion for the application of IEE or EIA is clearly mentioned in the schedule 1 and schedule 2 of EPR. The points of the schedules determine whether the project should undergo IEE or EIA.

The current studies have been conducted as per the TOR approved by MoUD. The environmental issues identified by the TOR have been looked into in detail by this study and EMP and has been designed to address these issues.

The impacts of providing infrastructure in the areas have been assessed and the Initial Environmental Examination (IEE) Reports and Environmental Monitoring Plans produced. Studies were conducted according to ADBs Safeguard Policy Statement 2009 and GoNs Environmental Protection Rules (1997) and amendments.

This IEE fulfils the policy requirements of both the ADB and the GoN

#### **ADB's Safeguard Policy Statement 2009**

As per ADB's Safeguard Policy Statement 2009, projects are screened for their expected environmental impacts and are assigned to one of the following categories:

**Category A:** A proposed project is classified as category A if it is likely to have significant adverse environment impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works, for which an environmental impact assessment (EIA) is required.

**Category B:** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category- A projects. These impacts are site-specific, few if any of them are

irreversible, and in most cases mitigation measures can be designed more readily than for category- A projects. In such cases, an initial environmental examination is required.

Category C: A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

Category FI: A proposed project is classified as category FI if it involves investment of ADB funds to or through FI (Financial Intermediaries).

The Bank has classified this sub project as of Category B and accordingly an IEE has been conducted.

ADB's Safeguard Policy Statement 2009 is to consider environmental issues in all aspects of the Bank's operations. ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, financial intermediation loans and private sector investment operations.

### 2.3 Rationality of Conducting IEE

As per the TOR, it is stated that the project needs to be studied from the environmental point of view as per EPA 1997 and EPR 1997 (*Amendments 1999 and 2007*). Major part of the proposed project is under operation, emphasis has been given to use existing facilities as far as possible. Major portion of the area has to be rehabilitated and other areas have to be covered. Thus this project is a rehabilitation and extension of water supply project. Based on the existing facilities, natural terrain and settlement patterns five distribution subsystems are proposed namely i) Phusre, ii) Bijaypur, iii) Sumnima, iv) Railway and v) Pindeswor. Area to be served by Pindeswor and Railway are to be newly constructed where as other subsystems are of rehabilitation nature.

It is expected that on implementation of the project the users of the area will be able to avail adequate amount of safe drinking water. The project needs to go through IEE process as stipulated in EPR 1997(*Amendments 1999 and 2007*). The proposed project shall be using surface water and ground water sources. The Project does not involve construction of any tunnels; relocation of people or households, there is no need to settle any households above the gravity source, and construction of river training works (more than 1 km) is not required. The project shall benefit more than ten thousand persons in the area with higher and better water services.

As the proposed project falls within the definitions provided in the EPR 1997(*Amendments 1999 and 2007*) Annex 1 (G) for drinking water projects; only an IEE is required. The regulation stated in Annex 1 (H) shall only be applicable, if the proposal does not fall under categories (A) through (H) of Annex 3.

Table 1 compares the status of the project point by point against the conditions defined by Environment Protection Act 1997 and Environment Protection Regulation 1997 (and its amendments 2007) for which a drinking water would require IEE or EIA.

**Table 1: Criteria for Requirement of IEE and/or EIA for Drinking Water Supply Projects as per Annex 1 and Schedule 1-G and Annex 3 Schedule 1-H of EPR, 1997 Amendment 2007 Compared with the Situation of the Project**

S.N	Condition described in the Act and Regulations	IEE Required as per the Regulation Annex 1 G	EIA Required as per the Regulation Annex 3 H	Conditions in this Project
1	River Control (training)	Up to 1 kilometer	Over 1 kilometer	NA
2	Channeling Water from one Watershed to Another	Applicable	Applicable	NA
3	Rain Water Collection and Use of Spewing Wetland	Up to 200 hectares	More than 200 hectares	NA
4	Supply of Water in Dry Season from Surface Water Source with a safe yield of	Up to 1 cusec and utilizing up to 50 % of the available quantity	More than 1 cusec and utilizing the total available quantity	(1 cusec = 28.34 lps) Two surface sources will be used namely Sardu and Khardu and proposed to tap 24.3 lps from each source in

S.N	Condition described in the Act and Regulations	IEE Required as per the Regulation Annex 1 G	EIA Required as per the Regulation Annex 3 H	Conditions in this Project
				Dry Season. (These two sources are being used for water supply since last 48 years)
5	Ground Water Recharge	Up to 50 % of total aquifer	More than 50 % of aquifer	NA
6	Water Treatment	10- 25 litre per sec		Within limit (25 lps)
7	Construction of Tunnel for Channeling Drinking Water	Not more than one kilometer	more than one kilometer	Tunnel construction not required ( NA)
8	Water Resource Development which Displaces People (Permanent Residents)	25 to 100 people	Over 100 people	Not done
9	Settlement of People Upstream of Water Source	Settlement of up to 500 people	Settlement of above 500 people	Not done
10	Supply of water to a population of	2,000 to 20,000	Over 20,000	Rehabilitation schemes cover 71,839 population and New schemes covers 48,535
11	Connection of New Source to Supply Water to existing water supply system for a population of	10, 000 - 100, 000	More than 100, 000	No new source is connected (existing intakes will be rehabilitated ) Rehabilitation schemes cover 71,839 population and New schemes covers 48,535
12	Extraction of water from point and non-point sources or underground water sources (over mining of biologically or Chemically polluted point and non point sources)	NA	Applicable	No non-point and point sources of pollution in the vicinity of the water source
13	Operation of water supply project included in a multipurpose project utilizing a source of 25 liter per sec water. (Construction of Multiple Purpose Reservoir Required)	Not operated	Operated	This is not a multipurpose project and is solely for water supply

#### 2.4 Impacts on Land Use

Major activities of the project is to construction of intakes, deep boring, drinking water pipe laying, construction of reservoirs and treatment units. Some trees to be cut where reservoir are to be constructed ( viz near Panchakanya Temple and near deep boring area where sumpwell is to be constructed). Besides plantation works will be carried out. No other remarkable change in landuse will be there by the application of the project.

#### 2.5 Adverse Impacts on Environment, Human Life and Population Pressure

The likely adverse impact due to the activities and subsequent activities in terms of physical, biological, socio-economic and cultural aspects were identified, predicted and evaluated. Based on these, appropriate mitigation measures are recommended.

**i. Physical Environment**

Erosion and land surface disturbances, Impairment to the existing facilities viz disturbance in water supply, telecom lines; air and noise pollution , generation of solid waste are the adverse effect that are like to come up. But these are minor and can be mitigated with low cost.

**ii. Biological Environment**

198 numbers of trees are to be cut for the construction of reservoir boaring, generator house and pump house near Panchakanya Temple, Langhali and Sardu .

No other adverse impact is noted.

**2.6 Damage to be suffered by Local goods and Objects**

No other remarkable damage is noted than the cutting of tree as mentioned above.

### 3. DESCRIPTION OF THE PROPOSAL

#### 3.1 Types of Proposal and Project Description

The Dharan Town Water Supply Project has been conceptualized as a piped water supply system based on existing gravity systems and pumping of water from surface sources for additional water to cater the demand with ground reservoirs for distribution. The system has been formulated for a reliable continuous 24 hours drinking water supply in adequate quantity and quality to the consumers of the service area at the desired service level. The schematic system layout of the project components is given in Figure 1 for easy conceptualization. The figure also demonstrates the rehabilitation and new extension portions.

**Table 2: Salient Features of the project**

Sl. No.	Items	Description
1	Name of the Project	Integrated Urban Development Project (IUDP)
2	Implementing Agency	Project Implementation Unit, Dharan Municipality, Dharan, Sunsari
3	Type	Surface and Ground water pumping systems
3	Location Area	
	Region	Eastern Development Region
	Zone	Koshi
	District	Sunsari
	VDC/Municipality	Dharan Municipality
	Wards	1-19
4	Available Facilities	
	Roads/ Highway	Koshi Highway ,
	Airport	Biratnagar
	Existing Water Supply System	Surface source Sardu & Kharu Khola, Additional water from ground water, operated by NWSC Other 5 community managed schemes are also in operations
	Electricity	Available
	Communication	Available
	Health Services	Available
	Banking Facilities	Available
5	Source Characteristics	
	Source Location	Surface Source North of Dharan, Ground water : South of Dharan
	Tapped yield (lps)	Wet season : 17.49 MLD from gravity 2.23 MLD from ground water <hr/> 19.72 MLD  Dry season : 4.5 MLD from Surface Sources 15.22 MLD from ground water
	Tube wells	To be renovated : 3 # existing Test tubewells : 1+1=2 Proposed new :5#
6	Treatment Facilities	
	Flocculator & Sedimentation Tank	Existing Flocculators : capacity each with 6 MLD in Sardu & Kharu (total 12 MLD) to be used  Existing Sedimentation: capacity each with 6 MLD in Sardu & Kharu (total 12 MLD) to be used  Additional units of 4.2 MLD are proposed

Sl. No.	Items	Description																					
	Rapid Sand Filter	RSF of 16.2 MLD capacity is proposed for Phase I. (Considering the demand upto Year 2026)																					
	Backwash reservoir	OHT 200 Cum (8 m high)																					
7	Project Components																						
	Reservoir Tanks	RCC reservoirs: <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>Sub Systems</th> <th>Reservoir sizes (Cu.m)</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>500</td> <td>At Phusre, deteriorated 1300 Cum steel plate tank shall be replaced by new</td> </tr> <tr> <td>B</td> <td>600</td> <td>New proposed near Panchkanya temple</td> </tr> <tr> <td>C</td> <td>3,000</td> <td>1000+2000Cum Existing at NWSC premises , good condition</td> </tr> <tr> <td>D</td> <td>500</td> <td>New proposed</td> </tr> <tr> <td>E</td> <td>1600</td> <td>Proposed for phasing , and thus 900 Cum is proposed to construct in Phase I.</td> </tr> <tr> <td>TOTAL</td> <td>6,200</td> <td></td> </tr> </tbody> </table>	Sub Systems	Reservoir sizes (Cu.m)	Remarks	A	500	At Phusre, deteriorated 1300 Cum steel plate tank shall be replaced by new	B	600	New proposed near Panchkanya temple	C	3,000	1000+2000Cum Existing at NWSC premises , good condition	D	500	New proposed	E	1600	Proposed for phasing , and thus 900 Cum is proposed to construct in Phase I.	TOTAL	6,200	
Sub Systems	Reservoir sizes (Cu.m)	Remarks																					
A	500	At Phusre, deteriorated 1300 Cum steel plate tank shall be replaced by new																					
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C	3,000	1000+2000Cum Existing at NWSC premises , good condition																					
D	500	New proposed																					
E	1600	Proposed for phasing , and thus 900 Cum is proposed to construct in Phase I.																					
TOTAL	6,200																						
	Household Connections ( for base year 2016)																						
	Shared taps	576																					
	Existing connection from NWSC (Nos.)	12,145																					
	Presently using community schemes and willing to get HH connection from the project	857																					
	Non Domestic	337																					
	New HH connection	9,686																					
	TOTAL tap connection ( for Base year)	23,601																					
	TOTAL tap connection ( for Design Year 2031)	40,732																					
	Total Length of pipe (Km)	Transmission : 55.906 Km Existing : 28.5 Km Proposed: 27.406 Km  Distribution : 386.5 km ( including Existing 39 Km)																					
	Electrical	Generators- 6, 150 KV, Transformers-6#, 11 KV Transmission 13 Km																					
8	Social Status																						
	Survey Year Population (2013)	Own house :120,374 Floating : 11,474																					
	Base Year Population (2016)	Own house :127,404 Floating : 12,073																					
	Design Year Population (2031)	Own house :169,852 Floating : 15,634																					
	Household Numbers (2013)	28,841																					
	Average Family Sizes	4.17																					
9	Total Water Demand																						
	Base year 2016 (m3/day)	Total 16,071.89																					
	Design year 2031 (m3/day)	Total 19,713.83																					
10	Total Cost of the Project (NRs.)	1,654.650 million with 10% contingencies & 13% VAT																					

Sl. No.	Items	Description		
11	Cost Sharing Arrangement for water supply component (NRs)	1,654.650 million		
	1) GoN / ADB contribution @ 50%	Rs 827.33 million		
	2) Municipality/ consumers contribution @ 15%	Rs 248.20 million		
	3) Loan through TDF @ 35%	Rs 579.13 million		
12	Per capita investment	Rs 13,745.91 ( survey year 2013) Rs 12,987.43 ( Base Year 2016)		
13	Tariff	Rs. / Cum		
		Shared Taps	Average HH	Non Domestic
	0-8 Cum / month	11.00	28.00	56.00
	9- 17 Cum / month	17.00	42.00	84.00
	>17 Cum / month	25.00	63.00	126.00
14	Low income Households	4,490		
	Shared Taps	576		
	Non Domestic	337		
	Average Households	18,198		
	TOTAL	23,601		
15	Economic / Financial @ FNPV 2.7%			
	FIRR	6.26 %		
	EIRR	33.94%		
	AIEC	55.20		
	AIFC	42.98		
15	Environment			
	ADB Category	Category B		
	IEE finding	No adverse effect, IEE required		

### 3.2 Description of Service Area

Dharan water supply project has been conceptualized as a piped water supply system considering conjunctive use of surface source from Khardu and Sardu kholas and ground water source. Moreover part of the proposed project is under operation. Similarly in some places structures like 2,000+1,000 m<sup>3</sup> reservoirs, 3 boring wells, and some transmission and distribution networks are operating in good conditions. A hillock ( Bijaypur height) needs separate distribution subsystem as it is situated in the relatively elevated area. Based on the topography, settlements and existing structures decentralized distribution system is adopted and are described below:

- i.) **Distribution system A (Phusre):** This subsystem covers mainly ward # 13. Portions of wards 1,4,16 are also catered by this subsystem. Surface source will be used to feed design year water demand of 1.48 MLD through a 500 m<sup>3</sup> reservoir proposed for distribution. The reservoir will be constructed at Phusre where 50 years old 1,300 m<sup>3</sup> deteriorated leaking reservoir is located.
- ii.) **Distribution system B (Bijaypur):** This subsystem is proposed to cover hillock portion of Dharan *ie* Bijaypur, Budhasubba area. Human settlement of ward # 14 is fully covered by this subsystem including part of wards 3,13 and 15. This subsystem will use surface sources ( Khardu & Sardu). Being situated in elevated portion water needs to be pumped from Phusre to the proposed distribution reservoir. A 600 m<sup>3</sup> reservoir is proposed near Panchkanya temple in community forest area (Government land).



- iii.) **Distribution system C (Sumnima):** It entirely covers whole area of wards 2,5,6,9,10,12,18,19 and partial area of wards 1,3,4,7,8,11,15,16,17. Existing reservoirs (2000+1000 m<sup>3</sup>) constructed in NWSC premises will be used.
- iv.) **Distribution system D (Railway):** This subsystem covers major portion of wards # 11 and 17. This subsystem is designed to cater by ground water throughout the year. One ground reservoir of 500 m<sup>3</sup> is proposed for distribution.
- v.) **Distribution system E (Pindeswor):** This subsystem will cater mainly ward no 15 and some portions of wards 7, 8. This subsystem is designed to feed from gravity surface source (Sardu & Khardu) during wet season and ground water during dry season.

**The subsystem D and E (Railway and Pindeswor respectively) are the new one where as other are rehabilitation only.**

The table below summarises the wards coverage, population and reservoir size required for each distribution zone.

**Table 3: Distribution Subsystems (Zones), Population and Reservoir Size required**

Distribution Zone	Area (Ha)	House hold	Population (2013)	Ward coverage		Reservoir Size (m <sup>3</sup> )	Remarks
				Full	Partial		
A	114.40	2224	8,706		1,4,13, 16	500	Presently served by deteriorated steel tank at Phusre , Proposed to construct new ( <i>Rehabilitation Scheme</i> )
B	220.20	2640	11,832	14	3,7,13, 15	600	Located in hillock of Dharan ,proposed to construct new ( <i>Rehabilitation Scheme</i> )
C	584.29	13481	51,301	2,4,5,6, 9, 10,12, 18, 19	1,3,4,7,8 ,11, 15,16, 17	3,000	Existing Reservoirs located at NWSC office premises ( <i>Rehabilitation Scheme</i> )
D	296.998	3349	17,826		11,17	500	Presently community managed small scheme, No proper piped water supply ( <i>New Scheme</i> )
E	351.50	7147	30,709	15	7,8,15	1600	Presently community managed small scheme, No proper piped water supply; <b>only 900 m3 capacity reservoir is proposed to construct in Phase I.</b> ( <i>New Scheme</i> )
Total	1567.37	28841				6,200	

The length of transmission pipe has been estimated as 40.3 km (including 28.5 km existing) . Similarly the length of distribution pipe network is estimated to be 381 km, including 39 km will be used from the existing). The cost of the Project is estimated at NRs 1,654.650 million including contingencies and VAT.

### 3.3 Materials to be Used

Following materials will be used

S. No	Materials to be Used	Quantity
1	DI Pipes 300mm	6 Km
2	DI Pipes 200mm	8 km
3	HDPE pipes	381 km
4	Reinforcement	69 tonnes
5	Cement	7250 bags
6	Aggregate	1000 cum
7	Sands	700 cum

8	bricks	26,000
9	Transformer	6 #
10	Borings	5#
11	House connection pipes	24 Km
12	Household water meter	5000 #

### 3.4 Emissions Resulting from the implementation of the Project

Few vehicular movement and construction equipment eg mixer, vibrator emit gases. The quantity is insignificant and their effect is temporary . No such remarkable emission will be evolved.

### 3.5 Energy to be Used

Fossil fuel energy will be used for the driving of vehicles and deep boring machine. Manual labour will be used for the excavation of trench in market area. No other heavy machineries will be used.

### 3.6 Human Resources Required

The Table 4 gives the details of human resource (skilled, semi-skilled and unskilled labor) required during the construction and operation and maintenance of the project.

**Table 4: Human Resources**

S.N	Activities	Type of Labour required (Quantity )		
		Unskilled labor	Semi-Skilled Labor	Skilled Labour
<b>Construction work</b>				
1.	Earthwork	4580		45
2.	PCC work	240		9
3.	Form work and scaffolding	450		21
4.	Water proofing work	22		8
5.	Reinforcement work	154		196
6.	Brick work	48		8
7.	Door and window work	8		65
8.	Cement and Plaster	125		98
9.	Floor and wall tiles	350		28
10.	Painting work	240		33
11.	Railing work	252		11
12.	HDPE pipe laying and jointing(butt welded joint) including fitting	22	11	11
13.	GI pipe laying and jointing (Socket joint) excluding fittings.	170	110	70
14.	Ductile Iron Pipe Laying & Jointing (Tyron joint) excluding fittings.	420	12	130
15	Miscellaneous works	179	100	59
<b>Operation and Maintenance work</b>				
S.N.	Personnel (monthly)	Number		
1.	Engineer/Manager	1		
2.	Administrator Chief/ Accountant	1		
3.	Plant / Supervisor/ Mechanical Overseer	2		
4	Plant Operator/ Pump Operator	2		
5	Office assistants, meter readers	3		
5.	Plumber	3		
6	Junior Office Assistants, Cashiers,Helpers	2		
7.	Meter readers	3		
6.	Watch man/peon	2		

### 3.7 Details of Technology

As described above no such high emission technology is used. Excavation will be carried out manually. Deep boring will be carried out by using machine. HDPE pipes are joined by applying heat and using mechanical jointing machine which facilitates to provide simple butt joint. Concreteing is produced and executed by traditional method just by using mixture machines.

### 3.8 Project Activities

Table 5 gives the details of the project activities during the construction and operation and maintenance phases of the project.

**Table 5: Project Activities**

S. N.	Description
<b>Construction Phase</b>	
<i>A</i>	<i>Preliminary and General Requirements</i>
1.	Work related to transportation facility, survey equipment and field assistance
<i>B</i>	<i>Civil work</i>
1	Land Development
2	Operator / Guard House
3	Boundary Wall (4*105=420 m), 1# of Gate for each pumping station 420 m barbed wire fencing
5	Ground water tank, Collection tanks :
6	Grit chambers, Collection chamber, Grit Sedimentation unit, Roughing units and Slow Sand Filters
7	Pump House
8	Concrete Valve Chamber (600 x 600 x 1000)
9	House connection
10	Pipe Trench
11	Pipe laying & joining
12	Pipe laying across bridge crossings
13	Fire Hydrant
<i>C</i>	<i>Pipe &amp; Fitting Works</i>
1	Distribution Pipe
2	Transmission Pipe
3	Pipe fittings
4	Tools & Plants
<i>D</i>	<i>Electrical Work / Mechanical</i>
1	Total Electrical Work
2	Pumping main work including pumps with installation cost
3	Generators
<i>E</i>	<i>Environmental Mitigation Work</i>
	Supply, plantation and caring of different species of plants (As per layout of the reservoir premises) and other measures as described in environmental management plan of the project and as directed by engineer
<b>O&amp;M Phase</b>	
	Operation and Maintenance activities including operating the system and managing personnel, energy, chemicals, office and water safety plan.

## 4. EXISTING ENVIRONMENTAL CONDITION

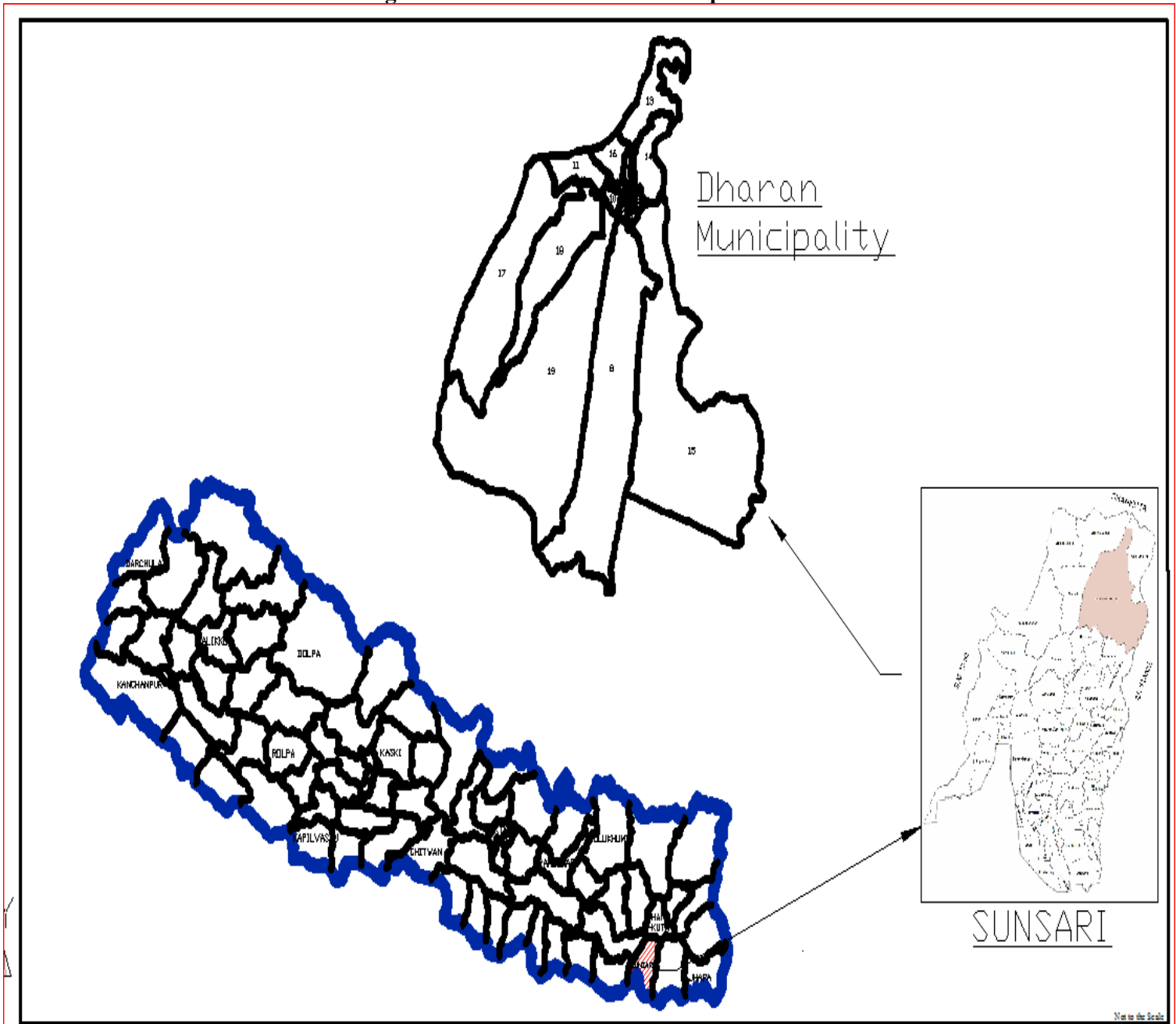
### 4.1 Physical

#### a. Geophysical Profile

##### i) Location and Accessibility

Located in the foothills of Mahabharata range, Dharan is one of the three major urban centers of the Sunsari District of the Eastern Development Region. It is located in the Latitude of  $26^{\circ} 46.30'$  to  $26^{\circ} 52.30'$  N and the Longitude of  $87^{\circ} 14.14'$  to  $87^{\circ} 18.27'$  E and situated at an altitude of 305 m to 700m above mean sea level. The municipality is bounded by Sardu Khola in the northwest and Seouti Khola in the east and Charkoshe Jhadi (Tropical forest belt in Terai plain) in the south. The neighboring administrative territories (VDCs/Municipality/District) are: Panchkanya VDC of Sunsari District and Yangshila and Kerabari VDCs of Morang District in the East; Bishnupaduka and Bharaul of Sunsari District in the East; Panchkanya VDC in the North and Itahari Municipality, and Hasposa, Baklauri, and Pakali VDCs of Sunsari District in the South.

Figure 1: Location of Dharan in Nepal



Biratnagar airport lies 42 km south of Dharan. It falls on Koshi Highway at 20 km from Itahari Municipality. Itahari is a medium sized town on the cross-road of East West Highway and North-South Koshi Highway. Dhankuta is the Regional Head Quarter of Eastern Region and is 50 km further North of Dharan. The distance between Biratnagar and Dharan is 50 km. Biratnagar is the largest industrial town of the country.

**ii) Climate, Topography and Geology**

The climate of Dharan Municipality is tropical to sub-tropical. The maximum temperature varies from 28-300 C in summer and 4 to 180 C in the winter. The average rainfall is 2626 mm. 80% of the precipitation is in monsoon period from June to August. The minimum precipitation has been recorded in the month of December (up to 8mm). Dharan, situated at an altitude from 305 to700 m above mean sea level. Southwardly it is extended to the edge of the Terai in Charkoshe forest. The terrain forms a sloppy landform. The slope decreases southward and covers 1223 hectares land of the municipality.

Dharan area is situated at sloppy terrain which mainly comprises of alluvial fan deposit. The sediment in the area is unconsolidated, highly permeable, ill- sorted, coarse sediments consisting of boulders, gravel, pebbles, sand and silty clay. Siwalik Foot Hills (Churia Range) consisting of sandstone, shale and mudstone is delineated by Main Frontal Thrust (MFT) to the south and Main Boundary Thrust (MBT) to the north. Various types of meta- sedimentary rocks like slate, phyllite, quartzite and schist of Lesser Himalaya occur in the northern hill slopes. At the base of the hill slope the geology is mainly represented by alluvial debris and further away by alluvial fan deposit of Sardu and Seouti River of Quaternary age. In this area the coarser sediments are normally found near to the source and finer materials further away towards south.(Source: Department of Mines and Geology)

**iii) Land Use Pattern**

The following table summarises the present landuse pattern of the project area.

**Table 6: Landuse pattern of Project Area**

S. No	Land use	Area (ha)	% Covered
1	Built up area (densely populated)	395	25%
2	Built up area (moderately populated)	784	50%
3	Agricultural/ Barren	283	18%
4	Recreational/ park	105	7%
5	Water Bodies	5	0.3%
<b>TOTAL</b>		<b>1567</b>	

Similarly land use of construction sites are also given below:

**Table 7: Landuse pattern of Construction Sites**

Land use type	Construction Sites	Area Sqm (ha)	Remarks
Forest	Deep tubewells	3042 (0.304)	Government land
	Reservoir near Panchkanya Temple	676 (0.067 )	-do-
	Intake rehabilitation Khardu and Sardu	400 (0.004)	-do-
<b>Sub Total</b>		<b>4118 (0.412)</b>	
Barren land	Reservoir at Bishnu Chowk	1032 (0.103)	Land to be procured
	Reservoir and RSF unit at Phusre	2595 (0.26)	Government land
	Reservoir at Pindeswor	1032 (0.103)	Government Land
<b>Sub Total</b>		<b>4659 (0.46)</b>	

**iv) Air and Noise Quality**

Koshi Highway passes through the project area. Numbers of vehicles passes through this highway and air and noise pollution can be experienced up to a certain extent along this highway. Air and noise quality of the rest of the area can be considered to be fairly less polluted. No polluting industries are located in and around the periphery.

#### v) Surface Water Quality

Saeuti Khola, Sardu Khola and Khardu Khola are the major surface water sources. Flowing from the North of Dharan Municipality Khardu (a tributary to Sardu Khola) and Sardu Khola are perennial in nature. Other few streams also flow through the project area but are dry in dry season.

Water sampling has been taken at seventeen different locations as shown in Table 6. Selection criteria include sources from surface waters (Sardu Khola and Khardu Khola), groundwater (old and new tubewells managed by NWSC), and Non-NWSC sources (small spring sources such as Kali khola, Tirke, Teendhare, Devi Khola etc. managed by the communities).

**Table 8. Sites selected with brief descriptions for water sampling**

Code	Location & site descriptions	Other descriptions
DH01	Water Supply Management Consumers' Committee, Dharan 11/17	Two sources in Pakuwa khola at different elevation, from spring source, across the Sardu khola, approx 300 beneficiaries.
DH02	Water Supply Management Consumers' Committee, Dharan 11/17, Pakuwa khola	
DH03	Devi marg, Jyoti Chowk, Ward no. 13.	Kali khola source, 78 households as beneficiaries,
DH04	Khatri-Ban khanepani samiti, SubediTole, ward no. 15	Seuti khola source, approx 60 households beneficiaries
DH05	Khatri water supply, Niranjan Tole, Ward no. 15, Dilip Shrestha household sample	Kali khola source, 590 households beneficiaries (190 metered, 400 non-metered)
DH06	Dugwell at Pindeshwor babadhaam Ward No. 14	35 feet deep dugwell
DH07	Tindhara Ward No. 14	Spring source
DH08	Sardu Filtration Plant	Sardu khola source, Sardu Intake, before treatment
DH09	Khardu Filtration Plant	Khardu Khola source
DH10	Sardu Khola downstream the concrete bridge	Sardu khola source
DH11	Phusre reservoir	Khardu & Sardu Mixed source
DH12	Deep Tubewell no. 3	Old tubewell source
DH13	Deep Tubewell No. 8	New tubewell source
DH14	Pumping Stations No. 1, Mixed Typed	Mixed source
DH15	HSPS2 (Swastika Chowk)	Ground Water mixed
DH16	NWSC reservoir, Dharan	
DH17	Bhima Tamang household ward no. 16, Ganesh Man Singh, now BDA office	Tap water

The test report reveals that the source as well as the distributed water contains total coliforms and e coli forms. The water quality test report is attached here with in Annex

#### 4.2 Biological:

##### a. Forest, Flora, and Fauna

Major vegetation constituting the dense forest south of Dharan are: Sal (*Shorea robusta*), Bot Dhainyaro (*Lagrestromeia parviflora*), Somekarma (*Adina cordifolia*), Asari (*Mussaenda frondosa*), Chilaune (*Schima wallichii*), Sirish (*Albizia saman*), Saaj (*Terminalia alata*), Curry tree (*Murraya koenigii*) and others. The project area bears five community forests and are listed in the Table 7.

**Table 9: Community Forests and their location**

S. No	Name of the Community Forests	Ward Number
1	Udaya Community Forest	17
2	Hariyali Community Forest	19
3	Yalambar Community Forest	8
4	Langhali Community Forest	8
5	Bajhagara Community Forest	15

Two deep tube wells will be located at Uday Community Forest, Ward # 17 and five tube wells will be at Langhalai Community Forest ward no 15. Some trees and bushes are to be cleared from the construction sites are given below:

**Table 10: Trees to be cut down for Construction works.**

Trees to be cleared					
<i>Construction site of 600m<sup>3</sup> Panchakanya Forest</i>				<i>Location:</i>	
SN	Type	Girth at 1.5 m from GL (cm)	Height	No.	Remarks
1	Sal	35	15	4	
2	Sal	30	15	6	
3	Chilaune	195	25	1	
4	Sal	65	20	4	
5	Sal	91	25	2	
6	Chilaune	127	25	2	
7	Sal	42	20	4	
8	Sal	122	25	1	
9	Chilaune	150	35	4	
10	Chilaune	85	20	1	
11	Sal	50	20	2	
12	Sal	35	20	5	
13	Lahara	40	25	4	
14	Sal	56	20	6	
15	Chilaune	50	20	2	
16	Sal	70	20	1	
17	Sal	83	20	1	
18	Chilaune	105	22	1	
19	Chilaune	60	22	1	
20	Sal	157	22	1	
21	Chilaune	104	22	1	
22	Sal	33	22	1	
23	Lahara	20	22	1	
24	Sal	50	22	2	
25	Sal	63	22	3	
26	Sal	46	22	4	
27	Sal	30	20	7	
28	Chilaune	115	22	4	
29	Lahara	48	40	1	
30	Chilaune	177	25	1	
31	Chilaune	35	20	1	
32	Chilaune	60	20	1	
33	Sal	25	15	2	
34	Tantari	60	20	1	
35	Lahara	40	30	1	
36	Chilaune	85	22	2	
37	Chilaune	68	22	2	
38	Chilaune	55	22	1	
39	Lahara	32	30	1	

40	Chilaune	145	22	2	
41	Sal	126	22	1	
42	Sal	55	20	1	
43	Sal	43	20	1	
44	Lahara	39	20	1	
45	Sal	38	20	1	
46	Chilaune	73	20	1	
47	Sal	78	20	1	
48	Chilaune	40	20	1	
49	Sal	34	20	1	
50	Sal	58	20	1	
51	Chilaune	112	22	1	
52	Sal	145	25	1	
53	Sal	112	25	1	
54	Chilaune	230	25	1	

<b>Sal</b>		<b>83</b>
<b>Chilaune</b>		<b>24</b>
<b>Lahara</b>		<b>9</b>
<b>Tantari</b>		<b>1</b>
<b>TOTAL</b>		<b>117</b>

<b>Trees to be cleared</b>					
Construction site of propose generator operation house			Location: Langhali Community		
S.N	Types of trees	Girth at 1.5 m from GL (cm)	Height (m)	No	Remarks
1	Sal	30	5	1	
2	Sal	60	10	1	
3	Sal	36	4	1	
4	Bungre	30	5	1	
5	Bungre	60	10	1	
6	Buipale	36	6	1	
7	Buipale	35	7	1	
8	Buipale	42	3	1	
9	Buipale	48	7	1	
10	Buipale	62	10	1	
11	Buipale	68	8	1	
12	Buipale	56	8	1	
13	voddangaro	68	10	1	
14	voddangaro	34	7	1	
15	Tantari	180	14	1	
16	Tantari	35	5	1	
17	voddangaro	46	6	1	
18	Tantari	33	5	2	
19	Tantari	45	6	1	
20	Tantari	35	6	1	
21	Tantari	99	12	1	
22	Tantari	27	4	1	



23	voddangaro	33	6	1
24	voddangaro	25	3	1
25	Tantari	200	20	1
26	Tantari	35	4	1
27	Tantari	30	4	1
28	Sal	300	25	1
29	Tantari	23	4	1
30	Tantari	24	4	1
31	Sal	28	10	1
32	Chilaunne	94	10	1
33	Tantari	46	10	1
34	Tantari	24	6	1
35	Sal	20	8	1
36	Sal	39	12	1
37	Tantari	28	6	1
38	Tantari	58	15	1
39	voddangaro	60	1.5	1
40	Tantari	26	6	5
41	Tantari	40	8	1
42	Sal	50	15	1
43	voddangaro	50	10	1
44	voddangaro	30	8	1
45	Tantari	58	10	1
46	Sal	40	10	1
47	Tantari	39	5	1
48	Tantari	56	10	1
49	Sal	27	8	1
50	Sal	40	10	1
51	voddangaro	35	8	1
52	Sal	31	8	1
53	Sal	48	15	1
54	voddangaro	94	20	1
55	voddangaro	54	15	1
56	Ruinna	35	8	1
57	voddangaro	35	10	1
58	Sal	140	25	1
59	Tantari	170	25	1
60	voddangaro	40	8	1
61	Tantari	28	6	1
62	Tantari	28	6	1
63	voddangaro	40	6	1
64	Tantari	52	8	1
65	Tantari	58	15	1
66	Tantari	124	20	1
67	Tantari	25	10	1
68	Tantari	220	15	1
69	Sal	107	20	1

70	voddangaro	35	8	1	
71	Sal	40	8	1	
72	Tantari	50	10	1	

<b>Buipale</b>			<b>7</b>
<b>Bungre</b>			<b>2</b>
<b>Chilaune</b>			<b>1</b>
<b>Ruinna</b>			<b>1</b>
<b>Sal</b>			<b>16</b>
<b>Tantari</b>			<b>35</b>
<b>Voddangaro</b>			<b>15</b>
<b>TOTAL</b>			<b>77</b>

Trees to be cleared					
Construction site of sardu treatment plant					Location: Sardu
SN	Type	Girth at 1.5 m from GL (cm)	Height (m)	No.	Remarks
1	Chilaune	45	4	1	
2	Sal	40	3	2	
3	Chilaune	290	6	1	

Similarly, various bird species like Kalij (*Lophura leucomelana*), Luiche (*Gallus gallus*), Peacock (*Pavo cristatus*), Common Dove (*Streptopelia chinensis*), Thulo Dhanesh (*Buceros bicornis*) and others are present. Among these, Kalij and Thulo Dhanes are protected species and Peacock falls under the list of CITES Appendix I. Major wild animals include Dear (*Cervis duvauceli*), Wild Boar (*Sus scrofa*), Syal (*Canis aureus*), Dumsi (*Hystrix indica*), Kharayo (*Caprolagus hispidus*), Salak (*Manis pentadactyla*) and others. Dear and Kharayo are enlisted in CITES Appendix I whereas Salak is protected species. Elephant herds also sometimes travel along the forest south of the project area.

#### 4.3 Socio-Economic and Cultural:

Dharan is one of the prominent urban centre of Eastern Development Region of the Country. Koshi Highway passes through this town. This is a popular residential hub for retiring British Gurkha soldiers.

##### a. Population and Communities:

The socio-economic survey of Dharan covers all nineteen wards of Dharan municipality. Total household and population are found to be 28,841 and 120,374 respectively. Female population is slightly higher (52.3%) than the male population as in the national context. Average size of the household is found to be 4.17. The table below (Table 9) depicts the total household and populations within the service area of the proposed project.

**Table 11: Total Households and Population by Wards**

Ward No	Household	Male	Female	Total
1	410	1148	1129	2277
2	379	708	653	1361
3	828	1223	3910	5133
4	722	1512	1472	2984
5	163	457	424	881
6	241	735	716	1451
7	549	1746	1729	3475
8	2821	5341	5303	10644
9	727	2201	2163	4364
10	1004	2812	2964	5776
11	3157	6031	6385	12416

12	528	1402	1412	2814
13	2604	3849	4262	8111
14	1218	1885	1755	3640
15	5481	10055	10775	20830
16	2787	5742	6140	11882
17	3235	5039	5628	10667
18	646	2977	3253	6230
19	1341	2572	2866	5438
<b>Total</b>	<b>28,841</b>	<b>57,435</b>	<b>62,939</b>	<b>120,374</b>

**b. Ethnic Composition:**

Dharan possesses heterogeneous character in terms of castes and ethnicity. Majority of persons belong to Janajati which shares 66% of the population. Accordingly Brahmin Chhetry also contributed to 18%. Dalits and Madhesi have 9% and 5% shares respectively (Table 10).

**Table 12: Ethnic Composition in Dharan Municipality**

<b>Ethnicity</b>	<b>Total Households</b>	<b>Percentage composition</b>
Brahmin	2108	7%
Chhetri	3128	11%
Dalit	2528	9%
Janajati	19178	66%
Madhesi	1419	5%
Other	480	2%
<b>Total</b>	<b>28841</b>	<b>100%</b>

**c. Health Facilities and Sanitation:**

BP Koirala Institute of Health Sciences (BPKIHS) a national level medical college and hospital is situated at Dharan. Other private hospitals e.g. Bijaypur Hospital, Manju Shree Hospital, Khalid Hussain Hospitals are also serving the area.

Dharan does not have a water-borne sewerage system. The current practice of human excreta management and disposal is on-site sanitation consisting of individual household or institutional septic tanks often without a proper effluent disposal system. The sludge from the septic tank are periodically withdrawn manually or by vacuum tankers and disposed to nearby streams. The existing practice is unhygienic and unaesthetic for the population. Availability of adequate water after the implementation of the proposed water supply project may further deteriorate the situation unless municipality finds resource to safely manage human excreta or invest in water-borne sewerage system with wastewater treatment facility.

Municipality doesnot have landfill site for the management of solid waste. Source separation of domestic, commercial and street solid wastes and their collection for composting, recycling and sanitary land fill is not a practice. Solid wastes are indiscriminately dumped in to the river banks. The hazardous hospital waste also mixed with the municipal wastes. Recyclable wastes comprising of metals, papers, plastics and certain brand of alcohol bottles are collected at household levels at cost by collectors from recycle shops. Composting of biodegradable wastes is not a common practice. The wastes finally arriving at the dumping sites are organic, non-recyclable plastics and other materials, street litters and debris.

**d. Educational Facilities:**

In Dharan 88% of the population are found literate. In aggregate, a high of 29% have obtained primary education followed by 24 % in secondary. The distribution of household population by educational status is outlined in Table-11

**Table 11: Distribution of Population by Educational Status**

<b>Educational Status</b>	<b>Total</b>	<b>Percentage</b>
Illiterate	14835	12%
Primary	35129	29%

Secondary	28378	24%
SLC	16813	14%
IA	12610	10%
BA	8827	7%
MA	3783	3%
<b>Total</b>	<b>120374</b>	<b>100%</b>

**e. Physical and Cultural Heritage:**

Dharan is rich in natural, cultural and historical aspects. It is home of many different races, castes, creeds and an ethnic group. Many famous religious spots are located in the town, which is considered as heart of Dharan. Some of them are listed in the Table 12 below.

**Table 12: Some religious places in the project area**

S.No	Name of Temples	Location
1	Ram Mandir	Ward No-1
2	Hanuman Mandir	Ward No-1
3	Mahadev Temple	Ward No-1
4	Sinha Devi Temple	Ward No-2
5	Balaji Temple	Ward No-2
6	Gita Temple	Ward No-2
7	Krishna Temple	Ward No-3
8	Masjid	Ward No-3
9	Sai baba Temple	Ward No-4
10	Church	Ward No-9
11	Singha Bhawani Temple	Ward No-10
12	Devi Temple	Ward No-13
13	Dantakali Temple	Ward No-14
14	Pindeshwor Temple	Ward No-14
15	Panchakanya Temple	Ward No-14
16	Ganesh Temple	Ward No-14
17	Hanuman Temple	Ward No-14
18	Church	Ward No-15
19	Harati Temple	Ward No-16
20	Church	Ward No-19
<i>Source: Field Research, Dharan Municipality 2013</i>		

**f. Employment:**

A high of 35% of the households (HH) have foreign employment as occupation followed by ex- British/Indian army pensioners of 17.7%. About 12.38% of the HHs main was found employed in government and other sectors. The distribution of household population by occupational status for the municipality is outlined in Table-13.

**Table 13: Occupational Status of Households' Main**

S.No	Occupation	Household	Percentage (%)
1	Agriculture	516	1.79%
2	Animal Farming	167	0.58%
3	Business	5015	17.39%
4	Wage/Labor	3273	11.35%
5	Foreign Employment	9959	35%
6	Others (retired from British and Indian Army)	4943	17.14%

7	Teaching	1249	4.33%
8	Government and other services	3571	12.38%
9	Unemployed	148	0.51%
	<b>Total</b>	<b>28841</b>	<b>100.00%</b>

#### g. Distribution of Monthly Income Levels

The table below (Table 8) shows the distribution of monthly income categories of the households of the Dharan Municipality. Almost 20.7 % of the population is found living within the poverty level considering the monthly income of Rs 8000.00 as below poverty line. About 15.57% of the households are found to have income level of Rs 8,000-16,000 monthly. Similarly, 41.23% of the households fall in the category of having monthly income of Rs 16,000-40,000. Following table (Table 14) depicts the income strata presented ward wise.

**Table 14: Distribution of No. of HHS by Monthly Income Levels**

Ward	Poor house holds	low income HH	Average Income group	High Income group	Total
	upto Rs 8,000	8,000- 16,000	16,000-40,000	above 40,000	
1	11	93	252	55	411
2	0	41	131	209	381
3	74	135	416	202	827
4	27	133	328	235	723
5	0	24	71	69	164
6	0	15	102	124	241
7	38	45.5	320	145	548.5
8	1606	309	463	441	2819
9	11	126.5	404	186	727.5
10	23	138	467	376	1004
11	1376	351	865	564	3156
12	0	101	269	159	529
13	476	508	953	666	2603
14	170	331	507	209	1217
15	1014	917	2838	711	5480
16	471	320	1177	819	2787
17	600	485	1456	694	3235
18	0	192	302	152	646
19	59	225	569	489	1342
<b>TOTAL</b>	<b>5956</b>	<b>4490</b>	<b>11890</b>	<b>6505</b>	<b>28,841</b>
<b>% age</b>	<b>20.70%</b>	<b>15.57%</b>	<b>41.23%</b>	<b>22.55%</b>	<b>100.00%</b>

#### h. Economic Development and Prospects for Growth:

**i. Economic Base:** Dharan is a growing town with an estimated population of 116,181 in 27,750 households as per the population Census 2011 (Central Bureau of Statistics (CBS, Vol 02 NPHC, Nov.2012 p.9), which is an increment of 20.5 percent over the population of 95,332 in 2001. Majority of the population live in an urban environment of the town which is expanding towards south-west and eastern areas of the Municipality. Dharan Municipality is one of the major market and distribution centers of the Eastern Region, and the transportation hub for the mountainous and Hilly districts of Eastern Region of Nepal. Major transitional exports from Dharan include agro based products, consumer goods, construction materials and industrial products to many of the Hill and Mountain districts of the Eastern Development Region. Following are the major sectors and the characteristics of the economy of Dharan.

**ii. Industry:** Dharan had around five dozen registered industries within the Municipality which increased to 116 in 2010 (Source: Periodic Plan, Dharan 2011). Around 60 percent of the total production of the industries was exported mainly to neighboring Hill districts of Dhankuta, Terathum, Bhojpur and Sankhuwasabha with an internal consumption of 40 percent. However, majority of industries are small scale and agro-based industries such as rice mills and, handicrafts related, furniture, noodles, packing materials, iron grill, readymade garments, plastic goods and food products. Some medium to large industries have created significant employment opportunities for the local population employing over 500 people each. Demand for labor in the Municipality is relatively high and significant numbers each day enter Dharan from the peripheral rural areas to work in the various businesses and trades, construction and related activities.

**iii. Commercial Sector:** Commercial and retail sector is growing in the Town with around 1400 hotels, restaurants and guest houses which support the development of tourism in the Municipality. Dharan is the entry-pot to a number of tourist attractions of the Eastern Hills of Nepal, including: Dhankuta, Taplejung, Kumbhakarna Himal, Kanchenjunga, Makalu-Varun National Park, Arun Valley, Tinjure-Milke (Rhododendron Protection Area), caves, lakes, etc. Around 2,000 shops operate in the municipal area supplying food and grocery, clothes and readymade garments, cosmetics, electronics and construction materials etc. The demand for consumption goods in the Municipality appears to be reasonably high as household incomes are relatively buoyant due to the inflow of remittance money and the presence of large number of clients in the social sector such as health and education.

**iv. Financial Sector:** There are around a dozen government and private commercial banks and two dozen finance companies in Dharan which are engaged in collecting financial deposits, undertaking investments in non-agricultural trades and industries, and collecting and distributing remittances from abroad. The later function is particularly important as remittances are a major source of income for many households in the Town. The activities of the banking sector support the local businesses. Many households' members are working or have worked in the British Gurkha Army and in the Singapore police in the past besides the current flow of outmigration to work in the Middle East and other gulf countries.

**v. Economic Trends, Potential and Challenges:** The Municipality has expanded and improved significantly since 2001 and particularly after the end of the insurgency in 2006. Industrial firms and commercial businesses have flourished in this important market Town which is also an important distribution hub for agricultural products, construction materials and consumer goods to and from the adjoining Terai and Hilly areas.

## 5. Methodology Adopted for IEE Study

The environmental assessment requirements of ADB and Environmental Guidelines for Selected Infrastructure Development Projects and the National Legislation / Policies of Government of Nepal (EPA-1996 & EPR-1997) and National Environmental Impact Assessment Guidelines, 1993 have clearly defined and explained about the procedure to be adopted while preparing the IEE report. The IEE approach, methodology and procedure shall follow the provisions of the EPA, 1996 and EPR, 1997. In this connection, following approach and methodology is adopted during the IEE report preparation.

### 5.1 Desk Study and Literature Review:

The following steps are taken during the desk review:

- i. Collection and review of secondary sources of information from various sources.
- ii. Initial interaction and consultation with the local community and district level Stakeholders.
- iii. Delineation of geographical boundary of the Zone of Influence (ZoI) on the Topographical map, and
- iv. Preparation of project specific checklist.

### 5.2 Field Survey and Data Collection:

Socio economic survey was conducted during the preparation of detailed design. Similarly secondary sources viz different publications and discussions were also considered. Visual inspection to the sites also provided vital informations.

### 5.3 Public consultation and information disclosure:

The role of public consultation and participation is to ensure the quality, comprehensiveness, effectiveness of IEE as well as to ensure that the public concerns are adequately taken into consideration in the decision making process. In order to ensure the public involvement, the following procedures are followed during IEE report preparation:

- i. Publication of notice- a public notice of 15 days was published in a national level daily newspaper (*Nagarik* daily) seeking written opinion from concerned VDCs, DDC, school, health posts and related local organizations. A copy of the public notice was affixed in the above mentioned organizations and deed of enquiry (*muchulka*) was collected.
- ii. Recommendation letter from concerned municipality was also obtained.
- iii. IEE team also carried out interaction with local communities and related Stakeholders and also collected the public concerns and suggestions.
- iv. Draft IEE report was sent to concerned municipality for information disclosure.
- v. The approved IEE report shall be made accessible to interested parties and general public through information center of DDC and concerned websites.

Dharan municipality is dependent on both surface and groundwater sources for drinking. Surface source such as from the streams mainly, Sardu khola and Khardu khola are the major sources during wet season, which is tapped to their full potential. But during the dry season, groundwater is the major source. Groundwater is available in the south and south west part of the Community Forest area to the south of Dharan.

At present Nepal Water Supply Corporation is operating three deep tube wells located in the southern part of the town about 5 km from the municipality boarder. A Hydro Geological and Geophysical study of Dharan and its periphery were completed recently. On the basis of the report (including information on existing NWSC tube wells), ground water is available.

### 5.4 Compilation of Information

Information on both primary and secondary sources thus obtained were compiled , analyzed and interpreted. The physical and biological information were tabulated to the extent possible whereas the socio-economic and cultural information were cross checked and analyzed.

### 5.5 Impact Assessment (Identification, Prediction and evaluation of the Impacts):

The impacts of the activities shall be on physical, biological and socio-economic and cultural resources defined in the respective zone of influence. The impacts shall be in terms of extent (site specific, local and regional), magnitude (low, medium and high) and duration (short term, medium term and long term) also with reversible, irreversible, severe, moderate and significant through a checklist prepared and approved earlier. The likely

impacts shall be assessed covering both adverse and beneficial ones. The methodologies adopted for impact identification and prediction are checklists and matrix method.



## **6. Impacts of the Implementation of the Proposal on the Environment**

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### **6.1 Beneficial impact:**

Beneficial impacts due to the activities were assessed by the study team in terms of impact on physical, biological, socio-economic and cultural system of the areas. The impact assessed categorized in the category of extent, duration and magnitude based on the identification and prediction of the impacts.

#### **A. Construction Phase**

##### **i. Employment Generation and Increase in Income**

One of the major direct beneficial impacts of the water supply and sanitation project at construction stage is the creation of employment opportunity to the local community. Financial gain in terms of wages will directly enhance various economic activities and enterprise development with multiplier effect.

##### **ii. Skill Enhancement**

Although many people in the project area are found unskilled at present, the construction of the water supply system and the distribution network is likely to enhance their skills in plumbing, fittings and other construction works. Furthermore, the project will also give on the job practical training to the workers which will enhance their technical skills. The skill and knowledge acquired from the project during construction will enhance employment opportunities of local people who can earn livelihoods from similar project in future.

##### **iii. Enterprise Development and Business Promotion**

During construction period, different types of commercial activities will come into operation in order to cater the demand and requirement of workers. As money flow begins, there will be a demand of different food items, beverage and other daily needs. Small shops and restaurants around the vicinity of the construction sites are likely to come to cater these demands. Various farm based enterprises including wide range of agricultural and livestock products will also gain momentum as a result of increased demand by labors during construction period. This will increase local trade and business in the area.

#### **B. Operation and Maintenance Phase**

##### **i. Improvement in health and saving of time**

After the water supply and sanitation project is complete, the people living within the project area will benefit from the supply of sufficient quantity and good quality water and improved sanitary conditions. Women and girl child will be directly benefited as they have to spend less time in fetching water and thus have more time for study, other household and income generating activities.

The impact will be augmented through regular maintenance of the water supply and sanitation system by the DWSMB.

##### **ii. Development of Market center/ Tourism attraction centre**

The calm, green and clean environment along with favourable climatic conditions of Dharan also has created the potential to develop tourism. Further more, the topography and climate of the area offer a tremendous potential to attract domestic and Indian tourists. The availability of good supply of drinking water will accelerate the rate of development of Dharan as a popular recreational area.

##### **iii. Appreciation of Land Value**

One of the major benefits of the project is that the land price will increase due to the availability of reliable safe drinking water and sanitation system. The unavailability of good drinking water could be one of the reasons for some persons to opt out for conducting their business in the project area. Upon completion of the present project, migration from nearby hills is expected.

In order to promote the land development in the area, the local people will be made aware that high value lands are acceptable to the banks and microfinance institutions to provide loans for them to start their own economic/social ventures.

##### **iv. Women Empowerment**

Women and girls in particular will largely benefit from this project, as they are the ones who spend a great deal of time in fetching water. With the operation of the water supply scheme, this time will be saved. As polluted

water can lead to infection by several diseases the women of the family also have to spend a good deal of their time to care for the poor health of the family members. With the improvement of water supply, there will be marked reduction in the occurrence of water borne diseases in the area. This will provide more time to spend on other economic and social activities leading to empowerment.

In order to augment the impact, the water supply system will be regularly maintained so that it operates smoothly and health and awareness programmes will be given to the local people

#### **v. Quality of Life Values**

The project is not expected to adversely affect any cultural or recreational resources but will increase the existing quality of life values due to improvement in personal, household and community hygiene practices and health.

The project may help to enhance the life quality of people by many ways, like by providing opportunities for jobs, providing good quality water, improved sanitation etc.

Beneficial Impacts are summarized in the Table 15.

### **6.2 Adverse impact:**

The likely adverse impact due to the activities and subsequent activities in terms of physical, biological, socio-economic and cultural aspects were identified, predicted and evaluated. Based on these, appropriate mitigation measures are recommended.

#### **a. Pre-construction Phase**

The pre-construction works involved field survey and investigation, development of design & detailed drawings, carrying out cost estimate *etc.* This also includes discussion with PIU, Municipality and local people and revision of design as necessary. Then bidding processes commence and finally the construction contract is awarded to the contractor.

As the works involve review of design, estimate, discussions with concerned stakeholders and bidding processes and no construction activities involved; no adverse impact will be met during the pre-construction phase.

#### **b. Construction Phase**

##### **i. Physical Environment**

##### ***Erosion and land surface disturbance***

Excavation and digging of trenches for pipe laying in the roads sides during construction may lead to erosion and caving thereby causing soil erosion, silt runoff, and unsettling of street surfaces. Haphazard disposal of the excavated earth can disturb the road surface. The activity as such will be a nuisance and discomfort to the road users and inhabitants.

During construction, precautionary measures will be taken, proper backfilling of excavated trenches will be done and the excavated soil will be stacked properly. Excavation activities particularly in the sloppy area will be avoided during the rainy season.

##### ***Impairment to the Existing Facilities***

During the construction time, while excavating the earth, existing water supply pipe network and telecommunication cable may get damaged in some places particularly in bazaar area in spite of great care.

##### ***Air and Noise pollution***

There will be some activities such as transportation, loading/unloading of construction materials such as sand and aggregates, stockpiling of construction waste and construction materials and earthworks. These will cause some impact on air quality and noise but will last for very limited period of time.

Use of power horns and movement of heavy vehicles at speed can cause a serious disturbance to the community, educational institutes, hospitals/health posts, residences.

### ***Impact on water bodies***

There will be some impacts on water bodies located within project area during construction phase. Possible activities, which may influence the water quality, are listed below.

- Haphazard disposal of solid waste in the vicinity of water bodies by workers during construction period.
- Sediment and excavated materials may be transported to the water bodies by rainwater.
- Leakage and disposal of oil and grease from the construction equipment.

Besides some of the activities *eg* Intake construction and protection works may have some impacts in water quality during construction phase. The excavation work for Intake Works will cause turbidity in water up to a certain extent. However the quantity is limited with respect to the discharge of water in Shardu and Khardu streams. Very minimal impact will be occurred for short period of time.

### ***Solid Waste Disposal***

There will be considerable quantity of solid waste from the labours camp and construction activities. Badly managed waste may cause serious health effect.

## **ii. Biological Environment**

The majority of the project area falls under built up area with agricultural land. Rehabilitation of existing intake works lie in Sardu forest area, similarly boring works are to be performed within the forest area south of Dharan.

Only scattered plants of local species are available within the project area and thus feeble impact to these is anticipated only during construction period. Pipe lines pass along the pedestrian track and roadside and only few numbers of plants and bushes have to be cleared up within the transmission pipe line stretches. The impacts to the human settlement including villages, cattle shed and farmlands will be very low.

The potential environmental impacts of the project on local flora and fauna during construction and post construction phases will be low as it involves no tree felling along the distribution line, minimum loss of grazing land, and no loss of agriculture lands. As compared to zero option of no project implementation, the adverse impacts on local flora and fauna by the project will be insignificant. Some of the impacts that may likely to occur are described below:

### ***Loss of vegetation cover***

The major construction works *eg*, pumping stations, sump wells, generator / operator houses, distribution reservoirs, rapid sand filters are located at in open grass land. During the construction, there will be loss of herbs and shrubs cover rather than trees.

Some of the topsoil and vegetation may also be lost during pipe laying works. To protect the topsoil and vegetation, the topsoil should be kept separately and replaced at its original position after placing the pipes.

Small portion of project area (surface intake, tube wells and transmission line only) fall within forest area and thus loss of forest land is tabulated below in Table 15

**Table 15: Loss of Forest land**

<b>Land use type</b>	<b>Construction Sites</b>	<b>Area Sqm (ha)</b>	<b>Remarks</b>
Forest	Deep tube wells	3042 (0.304)	Community Forest
	Reservoir near Panchkanya Temple	676 (0.067)	Municipality park
	Intake rehabilitation Khardu and Sardu	400 (0.004)	Government forest
<b>Total</b>		<b>4118 (0.412)</b>	

Accordingly 198 numbers of trees are to be fell down as mentioned in Table 10

The project components require a very small area of land for implementation; environmental impacts on the vegetation and natural eco-system do not seem to be significant.

#### ***Impact on Fauna***

The major project site is within the built up area. Population dynamics of habitat and migratory birds and reptiles at the project site may be affected during construction period due to various construction activities. But these effects will be of temporary in nature. The condition will be normal after completion of construction. The workers during construction should be monitored well not to allow the hunting of birds and animals.

#### ***Impact on aquatic life***

Some of the activities eg intake construction, gabion works etc will physically disturb the water quality for certain period of time and may cause impact on aquatic life. But these effects will be of temporary in nature. The condition will be normal after completion of construction.

### **iii. Socio-cultural Environment**

#### ***Disturbance to the community activities***

Construction activities particularly construction works in the roads may cause disturbances to the community activities, festivals and social events. The free movement of vehicular traffic and pedestrians will be affected. Noise produced due to the operation of machines and labours may affect the peace and serenity, health and sleep time in the neighbourhood of construction areas.

#### ***Social Dispute and Dissatisfaction***

There is possibility of influx of outside workforce and with them money from the construction work and unwanted communities can cause some strife with the local community. Local population may not get employment benefit from the project causing dissatisfaction and conflict in the area. There is possibility of social dispute in the community due to irresponsible behaviour of the workers such as gambling and alcoholism

#### ***Occupational health and safety (OHS)***

Life and health of workers particularly of those involved in concreting, trench excavation, formwork and rebar fixing , elctromechanical works are of prime concern. Risks like injuries from normal to serious may take place.

### **c. Operation & Maintenance Phase**

#### ***Impact on aquatic life***

Haphazard disposal of sediments from sedimentation tanks, water produced during cleaning of rapid sand filters may affect the aquatic life by eventually finding its way to Seuti stream.

#### ***Chemical hazard***

Bleaching Powder is toxic to human and the workers will have to deal with it during operation of the system. Ingestions, inhalations, application to body parts, especially to such parts as eyes nose mouth are of extreme hazard to the workers handling chlorine and bleaching powder.

## **7. Alternatives for Implementation of the Proposal**

The alternatives analysis of the project in terms of project location, technology, implementation procedures, and the raw materials used have been studied and analyzed. Similarly, comparison between with and without project or the "No project option" is also studied and analyzed.

### **7.1 Design**

NWSC in 2005 had carried out a study proposing Chatara as a source. It had proposed to construct infiltration gallery in Chatara Canal and to pump water to Dharan (Elevation of Chatara is about 100m and that of Dharan HSPS2 is about 360m from *amsl*). The 14 km long transmission pipe line encountered 4 major river crossings *viz:* Sardu 150m, Bagh Khola 150m, Babuwa 50m and Patnali 80m causing more vulnerability during monsoon. Similarly 4 villages have to be crossed which means additional social issues likely to be encountered. Based on present market rates it is estimated to be Rs 2,330 million including 10% contingency and 13% VAT. This alternative is quite costlier than the presently proposed one.

### **7.2 Project site (Route)**

No significant adverse environmental impacts are found with present location of project. The proposed surface intakes at Shardu and Khardu streams and new reservoirs have been proposed at appropriate sites from technical consideration and in consultation with the officials of PIU and local people where no or minimum environmental effects will be seen. The alignments of pipelines are also fixed with minimum impacts on environment.

The intake in the Shardu and Khardu streams are of small weir type (0.50m height). Additional source to serve the service area are from ground water. The location of the proposed intakes, and borewell sites were finalized on the basis of geo-hydrological requirements.

The location of structures especially the intake, borewells, treatment units, ground reservoirs, and distribution pipe line will be retained as decided during interaction with WUSC and beneficiaries. Therefore, the proposed location of the project is the best among the available alternatives.

### **7.3 Raw Materials (Resources) To Be Used**

Most of the technologies proposed in the project are labour intensive. Minimum mechanical equipment will be used during construction work. Ground reservoirs, Rapid Sand Filter units, pipe line laying, excavation and refilling work are some of the major components of project. All these work will be done by labour force by using simple mechanical equipment *viz,* concrete mixture machine, concrete vibrators etc except in the case of 5 numbers of deep tubewell drilling works. Obviously, this action will produce some environmental impacts. However, precautions will be taken and adequate protective measures will be applied for the working persons at and nearby this site.

The working procedures proposed are participatory one. In each and every activities of the project, the beneficiaries will be participating actively. The project will use the local raw materials as far as possible. Except for some mechanical equipment necessary for pipe fitting materials, most of the construction materials will be local. Sand, stones, bricks and labours are some of the examples.

### **7.4 No Action Option**

The analysis has also been done with and without project scenario. Implementation of proposed project will create lot of positive impacts on health and hygiene of people, public environment and improve socio-economic status of community as well. Provision of good quality water and sanitation facilities will help to enhance the quality of life of the people in the project area. The project will also help to create job opportunities to considerable number of people. The implementation of the proposed project will produce only negligible and insignificant environmental impacts.

On the other hand, if the project is not implemented, the people of the project area will have to continue to suffer from various problems they are facing currently. There is deficiency of drinking water in project site as well as untreated water is being used. This water contains biological impurities. Due to polluted water and unhygienic environment, there is occurrence of a large numbers of water borne diseases every year. Apart from unsanitary conditions and related diseases, the socio-economic status of the people will also not enhance if the project is not implemented.

## 8. Measures to Reduce or Control the Impact of the Implementation of the Proposal on the Environment

### 8.1 Enhancement of Beneficial Impacts

One of the major direct beneficial impacts of the water supply and sanitation project at construction stage is the creation of employment opportunity to the local community. In order to augment the impact, the local people particularly poor; dalit (occupational caste), ethnic minority and women will be given priority for employment and on the job trainings, whenever required, will be provided. Workers especially pipe laying persons will be given on the job training on plumbing bathroom fittings, and other construction activities which will enhance the skill of the local people. As money flow begins, there will be a demand of different food items, beverage

and other daily needs. Small shops and restaurants around the vicinity of the construction sites are likely to come to cater these demands. Various farm based enterprises including wide range of agricultural and livestock products will also gain momentum as a result of increased demand by labors during construction period. This will increase local trade and business in the area.

The project may help to enhance the life quality of people by many ways, like by providing opportunities for jobs, providing good quality water, improved sanitation etc.

**Table 16: Beneficial Impacts and Augmentation Measures**

Beneficial Environmental Impact	Affected Location	Beneficial Augmentation Measure	Enhancement Cost	Responsible Agency	
				Implementing Agency	Supervising Agency
<b>Construction Phase</b>					
Employment generation and increase in income	Dharan Sub metropolitan	<ul style="list-style-type: none"> <li>– Priority to local people particularly unprivileged group will be given</li> <li>– On job training will be given whenever necessary</li> </ul>	No extra cost	Contractor	DSC
Skill enhancement	-do-	<ul style="list-style-type: none"> <li>– On job training especially on plumbing, bathroom fittings, and other construction activities will be given</li> </ul>	No extra cost	Contractor	
Enterprise development and business promotion	-do-	<ul style="list-style-type: none"> <li>– Training programmes on skill augmentation and entrepreneurship development</li> <li>– Promotion of cooperatives and linkages with bank and other financial institutions will be done</li> </ul>	No extra cost. Included in the Community Development Programme	NGO/DSC/PIU	PMO
<b>Operation and Maintenance Phase</b>					
Improvement in health and saving of time	-do-	<ul style="list-style-type: none"> <li>– Regular operation and maintenance of the water supply and sanitation system</li> </ul>	No extra cost	DWSMB	Municipality
Development of market centre / Tourism area	-do-	<ul style="list-style-type: none"> <li>– Regular operation and maintenance of the water supply and sanitation system</li> </ul>	No extra cost	Municipality	
Appreciation of land value	-do-	<ul style="list-style-type: none"> <li>– Awareness programmes to the local people</li> </ul>	No extra cost		Municipality

Women empowerment	-do-	<ul style="list-style-type: none"> <li>- Health and awareness programmes to the local people</li> <li>- Time saving in the fetching of water</li> </ul>	No extra cost	PIU, Municipality and NGO	
Quality of Life Value	do-	<ul style="list-style-type: none"> <li>- Improves health &amp; hygiene, saves time in fetching water,</li> </ul>	No extra cost	Muhicipality, DWSMB	

## 8.2 Mitigation or Reduce or Control of Adverse Impacts

### 8.2.1 Physical Impacts

#### *Erosion and land surface disturbance*

During construction, precautionary measures will be taken, to avoid erosion by proper backfilling of excavated trenches will be done and the excavated soil will be stacked properly. Excavation activities particularly in the sloppy area will be avoided during the rainy season.

#### *Topsoil conservation*

Formation of topsoil is very long natural process and is the most fertile portion of the soil. Efforts should be made to safe guard the topsoil. The topsoil of about 20 cm thick shall be placed at separate place and remaining excavation shall be done. After placing the pipes in trenches and refilling with other soil and compaction, the topsoil should be replaced at its original position and compacted. Similarly, topsoil should be separately placed while constructing structures like reservoirs, treatment units, guard houses, boundary wall. Top soil thus removed will be used as landscaping works of the area.

#### *Impairment to the Existing Facilities*

During the construction time, while excavating the earth, existing water supply pipe network and telecommunication cable may get damaged in some places particularly in bazaar area in spite of great care. A repair team consisting plumber will be kept standby for the repair of water supply pipe line so that immediate repair can take place.

To avoid damage to telephone / telecom line coordination with the office will be set up. Layout drawing if possible will be received from concerned office to avoid possible damage.

#### *Air and Noise pollution*

The construction activity will comprise of construction of intakes in Shardu & Khardu streams, deep tubewells drilling and development works, Sedimentation tanks, Treatment Units, laying of pipes, transport and installation of pumps, and construction of 6 distribution reservoirs at different location of Dharan. The works do not involve heavy machines except for deep tube well drilling works which will produce some noise for short time.

Use of power horns and movement of heavy vehicles at speed can cause a serious disturbance to the community, educational institutes, hospitals/health posts, residences etc.

Mitigating measures to reduce air and noise pollution are:

- Provide information to the public about the work schedule
- Allow to use vehicles complying NVMES 2069 and ,or vehicles having green stickers for complying Vehicle Emission Standards 2057 ; during project construction period
- Limit the speed of vehicles.
- Ban the use of power horns in vehicles.
- Regular maintenance of equipment and vehicles.
- Prohibit the operation of plants and construction vehicles between 7 PM to 6 AM in residential areas.
- Avoid working at sensitive times (during religious festivals in the area)
- Increase the work force in sensitive areas so as to finish the work quickly
- Imposing ban on burning of solid waste particularly in workers camp and construction sites
- Not allowing burning of firewood as fuel in workers camp.

### ***Impact on water bodies***

There will be some impacts on water bodies located within project area during construction phase.

Besides some of the activities *eg* Intake construction and protection works may have some impacts in water quality during construction phase. The excavation work for Intake Works will cause turbidity in water up to a certain extent. However the quantity is limited with respect to the discharge of water in Shardu and Khardu streams. Very minimal impact will be occurred for short period of time.

The worker's camp should not be located at the vicinity of water bodies. Waste generated from the workers' camp will be stored in a yard. Organic waste like food waste and others should be properly buried. Inorganic waste should be collected in a bin and properly disposed off. Regular monitoring of the workers camp should be done.

Accordingly excavated soil should be properly deposited. Back filling should be done before rainy season so that most of the soils be consumed in the trenches. A separate area shall be allocated for the stacking and collection of construction wastes and should be put into the regular monitoring.

### ***Waste Management and Disposal***

Proper waste management and disposal system shall be done during construction period. Temporary sanitary toilets for the workers should be installed before starting the work. Mechanism for the safe disposal of waste like excess grease, solid waste and other construction waste shall be developed in project site before the actual commencement of work. The waste shall not be disposed in near-by irrigation canal and water bodies. Labour camps are proposed in Phusre, Bishnu Chowk, and near Saptarangi Park. Construction spoils can also be dumped in these places. These sites are identified and shown in the attached figure Fig 3.

## **8.2.2 Biological Environment**

### ***Loss of vegetation cover***

198 numbers of trees are to be cut accordingly some loss of shrubs will take place. Thus to mitigate the case trees will be planted in the forest and barren land. Total 4950 numbers of trees shall be plant. The costs have been included in the Bill of quantities.

### ***Impact on Fauna***

The major project site is within the built up area. Population dynamics of habitat and migratory birds and reptiles at the project site may be affected during construction period due to various construction activities. But these effects will be of temporary in nature. The workers during construction should be monitored well not to allow the hunting of birds and animals.

### ***Impact on aquatic life***

Some of the activities *eg* intake construction, gabion works *etc* will physically disturb the water quality for certain period of time and may cause impact on aquatic life. The workers during construction should not be allowed for fishing and related activities.

## **8.2.3 Chemical hazard**

Bleaching Powder is toxic to human and the workers will have to deal with it during operation of the system. Ingestions, inhalations, application to body parts, especially to such parts as eyes nose mouth are of extreme hazard to the workers handling chlorine and bleaching powder.

The storage, in-plant handling and dosages of bleaching powder will be addressed. Procedures and guidelines will be developed for its handling and first aid measures will be introduced for emergencies. Training on handling and on dosage of the chemicals will be given to the system staff.

## **8.2.4 Socio-cultural Environment**

### ***Disturbance to the community activities***

In order to minimize the disturbance to the community activities, a detailed Traffic Management Plan will be developed for areas along the construction works to minimize traffic flow interference from construction activities. Advance local public notifications of construction activities, schedules, routings, and affected areas



including road closures will be made. Signage in Nepali and English languages will be erected. The residents will be consulted and informed about the disturbances in advance.

### ***Social Dispute and Dissatisfaction***

There is possibility of influx of outside workforce and with them money from the construction work and unwanted communities can cause some strife with the local community.

An employment policy will be prepared so that the local people may not be deprived of the employment opportunities. Local people and women above the age of 16 will be given preference for employment. Wages will be settled based on DWEC (District Wage Evaluation Committee) with the list of employees.

### ***Occupational health and safety (OHS)***

Health and hygiene in the camp site (against unsafe working conditions, accidents, transmission of communicable diseases etc.) will be given top priority. Regular health checkups, proper sanitation and hygiene, health care will be provided. Awareness programs concerning human trafficking and the possibility of spread of STDs and HIV/AIDS will be conducted during focus group discussions. Personal Protection Equipment (PPE) eg, safety helmets, safety belt, boots, gloves will be provided to all construction workers. The loss of life or any type of injuries will be compensated and insurance to the workers will be provided. First aid kits, stand by vehicle, and fire extinguishers will be provided in camp sites. Adequate safety instructions should be provided to the contractor and monitored from the project side.

To avoid risks from accidents on site due to the movement of public and workers, the health and safety measures of the contract will also prohibit entry at construction sites to the public and the area will be barricaded and warning signs will be placed.

## **9. MATTERS TO BE MONITORED WHILE IMPLEMENTATION OF THE PROPOSAL/ ENVIRONMENTAL MANAGEMENT PLAN (EMP)**

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The project proponent has to develop an Environmental Management Plan (EMP) to systematically manage all the perceived environmental impacts of the project. It shall be therefore based on the mitigation measures for the project induced impacts. An Environmental Management Plan (EMP) has a dual purpose. It is designed to monitor the contractor's work during project implementation. It helps to check contractual compliance with specified mitigation measures. It also helps in making periodic checks on the actual environmental impacts of the Project over the years following completion of the works, and compares these with those impacts anticipated at the time of Project appraisal. The EMP therefore provides the necessary feedback required for correcting potentially serious Project deficiencies, and for planning of other projects.

The EMP shall include the responsibilities of different stakeholders based on preliminary plans and schedules. This program shall include measures required during the project design, construction and operational phases and shall include recommendations on allocation of components of the EMP to the various parties involved. Feasible and cost-effective measures to prevent/mitigate/reduce significant negative impacts should be recommended in an Environmental Management Plan. The impacts and costs associated with implementing the measures will have to be detailed. The EMP will include proposed work programs, budget estimates, schedules, staffing and training requirements, and other support services to implement the mitigating measures.

### **9.1 Environmental Management Roles and Responsibility**

The requirement for Environmental Impact Assessment or Initial Environmental Examination for any projects in consideration in Nepal is established by the National Environment Protection Act (1997) and Environmental Protection Regulations (1997) and its amendment of 20 August 2007. The purpose of IEE is to ensure that the proposed infrastructure components of the project are not damaging the environment and provide proper guidance in planning, construction and operation of the same. Projects that need EIA and IEE are listed in the EPR (1997). Ministry of Urban Development (MoUD) is the responsible government body for the approval of the IEE, whereas the responsibility of approval which requires a full EIA lies with the Ministry of Science, Technology & Environment (MoSTE).

The approach for the preparation of IEE in Nepal is as follows;

- i. A Terms of Reference (TOR) is prepared by the consultant in the format as described in Schedule 3 of EPR, 1997, and submitted to MoUD for approval.
- ii. MoUD reviews the TOR, and if not found satisfied, returns with comments for improvement to the consultant, and if found satisfied, the Ministry approves it and informs the consultant through the Department of Urban Development and Building Construction (DUDBC)
- iii. As soon as TOR is approved, DUDBC will arrange for the study to be conducted by a consultant, and the consultant prepares the report in the format as described in Schedule 5 of EPR, 1997.
- iv. A notice is published in local language in a national daily newspaper and also affixed in the concerned VDC or Municipality, DDC Office, hospitals and health offices, schools, concerned individuals and institutions, etc. requesting them to give written suggestions and comments and suggestions within 15 days about the likely impacts project may bring on environment at the time of planning, construction and operation.
- v. The IEE report once completed is submitted to the MoUD through DUDBC. DUDBC, after reviewing the report, forwards the same to the concerned Ministry for approval.
- vi. As per the EPR, 1997 DUDBC should implement the proposed project only after the approval.

### **a. Institutional Requirements and Environmental Monitoring**

The Ministry of Urban Development (MoUD) is the overall responsibility for environmental monitoring of all water supply projects.

### **9.2 Environmental Management Plan:**

The basic objectives of the EMP are:

- i. To ensure that all mitigation measures and monitoring requirements will actually be carried out at different stages of project implementation and operation - pre-construction, construction and operation and maintenance;

- ii. Recommend a plan of action and a means of testing the plan to meet existing and projected environmental problems;
- iii. establish the roles and responsibilities of all parties involved in the project's environmental management;
- iv. Describe mitigation measures that shall be implemented to avoid or mitigate adverse environmental impacts and maximizing the positive ones;
- v. Ensure implementation of recommended actions aimed at environmental management and its enhancement; and
- vi. Ensure that the environment and its surrounding areas are protected and developed to meet the needs of the local people, other stakeholders and safeguard the interests of the common people.

A Safeguard Unit within the project should be established and be headed by a senior environmental expert, a sociologist and a legal expert with adequate support staff.

### **9.3 Implementation Mitigation Measures:**

Most of the mitigation measures specified are part of contractual obligation during the project constructions and therefore will be integrated into project design and tender documents. By including mitigation measures in the contract of in specific items in the Bill of Quantities, monitoring and supervision of mitigation implementation will be covered under the normal engineering supervision provisions of the contract. The mitigation measures implementation earlier elaborated in Table 16 will be monitored through direct observation, records of contractors, consultation with people etc. weekly or daily as required.

#### **a. Project Design:**

For most of the adverse environmental impacts likely to occur during project construction and operational phase, mitigation measures will be integrated in the design of the project itself so as to strengthen the benefits and sustainability of the project. This will enhance the mitigation measures in terms of specific mitigation design, cost estimation of the mitigation measure, and specific implementation criteria. The proponent will ensure that the mitigations measures are included in the design of the project

#### **b. Project Contract and Form of Tender:**

The model form of contract will be ADB's Standard Bidding Documents for Procurement of Works (without Prequalification). International Competitive Bidding will be conducted in accordance with ADB's Single-Stage, Two-envelope Bidding procedure. It is based on the Master Procurement Document entitled "Bidding Document for the Procurement of Works", prepared by multilateral development banks and other public international financial institutions which reflects the majority view of these institutions. This document has the structure and the provisions of the Master Procurement Document, except where ADB-specific considerations have required a change.

The documents have been prepared in the following volumes:

Volume: I – Bidding Procedures

- Section 1 Instructions to Bidders
- Section 2 Bid Data Sheet
- Section 3 Evaluation and Qualification Criteria
- Section 4 Bidding Forms (including BOQ)
- Section 5 Eligible Countries

Volume: II – Requirements – Specifications

- Section 6A Technical Specifications

Volume: III – Requirements - Drawings

- Section 6 Drawings

Volume: IV – Conditions of Contract and Contract Forms

- Section 7 General Conditions of Contract
- Section 8 Particular Conditions of Contract
- Section 9 Contract Forms

**c. Bill of Quantities and Cost Estimate:**

**i) Unit Rate Analysis**

The unit prices or lump sum prices were analyzed considering the following:

- Standard GON NORMS of unit price analysis and other accepted norms in recent ICB and LCB contracts in the country
- Market Prices/FOB prices for imported materials as pipes, accessories etc
- Wages of skilled and unskilled labor
- Construction technology
- Mobilization and demobilization cost
- Overheads and profit
- Contract tax or VAT.

Break-down into plant, materials and labor component for all unit prices was derived. Unit rates for individual items were determined on the basis of basic inputs, overheads and profit including the determination of the foreign exchange component of each element.

**ii) Quantity and Cost Estimates**

Based on the detail design and drawings prepared, the bills of quantities have been prepared for all components of the project. Cost estimates were prepared considering the established quantity of works and unit prices. Capital cost estimates are included in a separate volume and include cost of materials, construction, and contingencies.

**9.4 Environmental Monitoring**

**9.4.1 Monitoring Responsibility**

Following table summarises the monitoring method, frequency and responsible agency.

**Table 17: Water Supply: Anticipated Impacts and Mitigation Measures – Pre-Construction Phase Environmental Monitoring Plan**

Predicted Impacts	Indicators	Location	Monitoring Method	Monitoring Frequency	Responsibility
<b>Physical Parameters</b>					
No such impacts are anticipated					
<b>Construction Phase</b>					
<b>Physical Parameters</b>					
Disturbance to the land system and soil erosion	Excavation technique	Construction site	Direct observation and record inspection	Daily during construction	Contractor DSC
	Soil disposal area				
	Stacking of soil				
Air and Noise pollution	Use of equipment and vehicles	Construction and Operation site	Record inspection	Weekly	DWSS DSC PIU, DWSMB
	Quality of fuel				
	Sprinkling of water				
	Use of mufflers				
<b>Biological Parameters</b>					
Loss of vegetation	Cleared area	Construction site	Observation and record inspection	Weekly	Contractor , DSC
	No of trees/shrubs planted				

Impact on aquatic animals	Increase in turbidity in water (due to erosion of loosely deposited excavated soils)	Construction site	Record inspection	Monthly	Contractor, DSC,PIU
<b>Socio-economic Parameters</b>					
Problems from outside workforce	Behaviour of the workers Uses of alcohol Records of fights	Project area	Record inquiry Local survey Communication with people	Monthly and as needed	Contractor DSC
Disturbance to the local people	Use of signboards, notice board Disposal area	Project area	Record inquiry Communication with people	Weekly	Contractor, DSC,PIU
Occupational Health and Safety	Type and number of accidents First aid and emergency services	Construction site	File record	Daily	Contractor, DSC,PIU

### Operation and Maintenance

<b>Physical Parameters</b>					
Water quality problems - Training and operational supervision of system staff	Water quality tests, such as, temperature, pH. Electric Conductivity, Total Dissolved Solids, Total Suspended Solids, Turbidity, etc. Complaint of water borne diseases	Treatment plants and household taps	Check if O&M manuals are followed; regular updating of staff on the requirements  (Regular O&M of chlorinators - Regular water quality monitoring of water in the distribution system - Immediate action in case of water quality problems - Training and operational supervision of system staff )	As needed	DWSMB,PIU
Drinking Water leakages from pipes	Water leak in streets or other places	Streets, distribution camp etc.	Frequent and regular walk away survey, Complain from users	Weekly , as and when required	DWSMB,PIU

#### 9.4.2 Environmental Monitoring and Environment management cost.

Monitoring cost has been estimated for 18 months of construction period. The monitoring will be conducted on physical, biological and socio-economic aspects. So the cost has covered all these parameters.

During post construction phase, monitoring will be done on water quality, maintenance system and outbreak of diseases.

Most of the monitoring cost for the proposed project is related to the expenses for experts for observation and monitoring during construction and operation phases of the project. The following monitoring costs are to be incurred by the project.

**Table 18: Monitoring and Environment management cost.**

S.No	Item	Duration (Month)	Rate	Cost (NRs)
1	Environmental Management Specialist	2.5	85,000	212,500
2	Sociologists	1.5	60,000	90,000
3	Support Staff	2	25,000	50,000
4	Cost for monitoring by MoUD / DUDBC		LS	300,000
5	Transportation		LS	80,000
6	Miscellaneous		LS	40,000
7	Health Awareness Campaign		LS	100,000
8	Training to DWSMB staffs & members		LS	75,000
9	Environment management cost (Plantation of 4950 trees)		P.S	988,591.78
<b>Total</b>				<b>1936,091.78</b>

#### c. Resettlement, relocation & compensation issues

NWSC owned land will be used for the construction of reservoir for scheme A. Reservoirs for schemes B and E will be constructed in community forest (land belonging to GoN) and within premises of Pindeswor Campus respectively. These land parcels can be used in the consent of concern agencies. Reservoir for Scheme C is to use the existing one. Land parcel for the construction of reservoir serving Scheme D is partly situated in the Government land. This land parcel is partly Government and partly private property. That small portion of the land needs to be procured. Pipes will be carried out within the public right of way accordingly so to the valve chambers and connector boxes. Deep boring will be carried out within the forest area, government land. Following table summarizes the relocation or compensation cases related to the project.

**Table 19: Resettlement Plan**

S.No	Location	Ward		Length/ Area	Property Intercept	Likely nature of Damage	Compensation
1	Bishnu Paduka VDC		Transmission main	2989 m	Government land	Temporary	No
			(Surface water)	700 m	do	do	No
2	Dharan Municipality	17,15,8	Transmission main (pumping)	4157 m	Government land and road	Temporary	No
2	Dharan Municipality	13,10,15	Reservoir, High speed pumping stations, TP (Existing)		Government / NWSC owned land	permanent	No
3	-do- ( Bishnu chowk and Pindeswor Campus)	17, 14	Proposed Reservoirs	1032 sqm (3 Katha) 1032	Private Public	Permanent	Required Negotiation with Campus administration)

				sqm (3 Katha)			
5	-do-	1 to 19	Distribution Line		Public Road/ Some Private Land/ Stream Bagar	Temporary	No
6	-do-	17, Uday tole	Tubewell	2 Katha	Government land , Community Forest	permanent	No
7	Railway scheme	Ward 7	Boosts pumping station, sub tank	2 Katha	Government Law	Permanent	No

NWSC owned land will be used for the construction of reservoirs except for zone D and F. Land owned by Pindeswor Campus will be used for zone D and land has to be procured for the next zone. Pipes will be carried out within the public right of way accordingly so to the valve chambers and connector boxes. Deep boring will be carried out within the forest area, government land. Following table summarizes the relocation or compensation cases related to the project.

#### 9.4.3 Environmental Procedures & Institutions

##### Existing Institutional Issues:

Dharan municipal water supply system is looked after by a branch office of Nepal Water Supply Corporation. The main institutional issues in water supply management of Dharan are as follows:

- i. Centralized decision making system and lack of delegation of authority,
- ii. Very poor consumer relation,
- iii. Very low staff morale and low productivity,
- iv. Unbalanced staffing,
- v. Lack of policies and guidelines for a good corporate atmosphere,
- vi. Lack of business plan and production and supply strategies,
- vii. Poor coordination with local authorities,
- viii. Big demand and supply gap,
- ix. High non revenue water,
- x. Very low budgetary allocation for repair and maintenance,
- xi. Financial constraint for production augmentation and system rehabilitation,
- xii. Nation wide uniform tariff structure,
- xiii. Very low revenue collection efficiency,
- xiv. Conventional type systems of operation, etc.

##### National Urban Water Supply Sector Policy:

National Water Supply and Sanitation Policy, 2054 has emphasized decentralized management, people's participation, private sector involvement in infrastructure development and systems operation, cost recovery of capital investment, legal frame work, etc for urban water supply and sanitation services.

The National Concept Paper, 2064 BS published by Ministry of Physical Planning and Works has targeted to provide potable water to by 2017. It has visualized that water supply and sanitation projects will be operated locally by involving private sector and women and the central Government will support by providing necessary software packages.

##### Formation of Water Supply Management Board for Improved Service Delivery:

As agreed by Government of Nepal, Dharan Water Supply Management Board will be established under prevailing Nepalese law as per Water Supply Management Board Act, 2063 B.S. DWSMB will be the owner of water supply systems in Dharan and will be responsible for its smooth operation. DWSMB will be formed before awarding construction contract of the project. Existing assets and liabilities of Nepal Water Supply Corporation, Dharan Branch will be handed over to DWSMB as early as possible and the new assets constructed by the project will also be taken over immediately after its completion.

The consultant will assist DWSMB for smooth operation of water supply systems and improved service delivery by;

- Drafting required operating policies, guidelines and regulations
- Developing new organization structure, staffing plan and preparing TOR for Executive Director.
- Assessing training need for its staffs and directors.
- Designing developing and implementing Capacity Development Programs
- Preparing assets taking over program from NWSC and others operators in the city.
- Preparing assets taking over program under the project
- Transfer plan for NWSC and others staffs
- Preparing procurement plan of required working tools, equipment, computer (Hardware and software), vehicles and other accessories
- Prepare transition Management Plan.



## 10. Reviews of Acts/Rules, Plans/Policies, Guidelines, Standards and Conventions

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### 10.1 Constitution

The current policies of the Government of Nepal (GoN) stress the importance of environmentally sound economic development and growth through economic liberalization. The proposed Water Supply Project is in line with these policy measures to the extent possible. Some of these policies relevant to the proposed project are described below.

- **Interim Constitution of Nepal, 2063 BS (2007 AD)**

The interim constitution of Nepal realized environmental protection as the policy of the state. Clause (4) of Article (35) of the constitution states that ‘The State shall, while mobilizing the natural resources and heritage of the country that might be useful and beneficial to the interest of the nation, pursue a policy of giving priority to the local community’. The Clause (5) states that ‘The State shall make necessary arrangements to maintain the natural environment. The State shall give priority to special protection of the environment, and rare wildlife, and prevent further damage due to physical development activities, by increasing awareness of the general public about environmental cleanliness. Provision shall be made for the protection of the forest, vegetation and biodiversity, their sustainable use and for equitable distribution of the benefits derived from them.

### 10.2 Plan/Policy, Guidelines and Standards

- **Second Three Year Interim Plan, 2068-2071 BS (2011-2015 AD)**

The interim plan provides the most recent guidance on urban sector priorities highlighting, in particular, the need to address the effects of rapid urbanization on service levels, water quality and scheme maintenance. It proposes the full integration of sewerage, on-site sanitation and solid waste management in all urban schemes and specially endorses cost recovery from consumers. Local authorities are responsible for overseeing project implementation but with private sector organizations playing increasing roles.

- **National Urban Water Supply and Sanitation Sector Policy, 2066 BS (2009 AD)**

It was formulated to provide the overall policy support and guidance towards achieving equity in service delivery by ensuring that the financially marginalized households within the system areas are mainstreamed as valid customers of service through design and implementation of financial incentives where so required. It aims to ensure that the roles and responsibilities of central and local government bodies, external development partners, private sector including NGOs and user groups are clearly defined in scheme implementation and regulation and performance management in accordance with national decentralization policy

- **National Policy on Rural Drinking Water Supply and Sanitation, 2004**

Provides guidance on water and sanitation service provision in rural areas using community led participatory approaches. While partially relevant in the urban context, particularly around the integration of inputs and local capacity building, it generally fails to address the complex operational challenges to be faced by Municipal authorities in implementing and managing urban services.

- **National Drinking Water Quality Standards (NDWQS) and Directives, 2005**

NDWQS provides details of the water quality standards to be applied to all water supply schemes. These set out the water quality parameters, which the water suppliers should adhere to. The directives also ensures that the water sampling, testing and analysis procedures used to certify that the drinking water supplied or to be supplied conforms to the NDWQS and also sets the monitoring and surveillance procedures to certify that the quality of supplied water conforms to the standards.

- **Water Resource Strategy, 2002**

This provides a systematic framework for water resource development and identifies action plans to avoid and resolve conflicts and achieve water related development objectives. It has identified the need to integrate and coordinate all the uses of natural resources within the catchment basis and has laid emphasis on the development and management of water resources in a holistic, systematic manner, relying on integrated water resources management.

- **National EIA Guidelines, 2050 BS (1993 AD)**

In the process of implementing National Conservation Strategy (NCS) in 1990, the Government of Nepal in collaboration with The World Conservation Union - IUCN developed a locally suitable environmental assessment guideline. Although National EIA guidelines are procedural guidelines, it substantially encouraged the proponent to prepare an EIA report of the prescribed development projects and programmes and serves as the primary source of integrating environmental aspects in major development projects. The National EIA Guidelines contains objectives, methods of screening projects requiring the level of environmental assessment (IEE or EIA), scoping, impact identification and prediction, report review, monitoring and evaluation and impact auditing ensuring public participation during the preparation of the IEE/ EIA report.

### 10.3 Acts/Rules

- **Child Labor Prohibition and Regulation Act, 2001**

The section 3 of the act prohibits a child from engaging in work, sub clause 1 of the clause 3 states “Nobody shall engage a child in a work as a labour, who has not completed fourteen years of age” and sub clause 2 states “Nobody shall engage a child in a risk full occupation or work set forth in the Schedule”. The section 4 states “Child not to be engaged in work against his will by temptation or fear or pressure or by any other means”

- **Local Self Governance Act, 1999 & Local Self Governance Regulations, 2000**

The Act empowers the local bodies for the conservation of soil, forest and other natural resources and implements environmental conservation activities. It also describes about the user group formation to implement the programs in the local areas. The Regulation has provisions for Village Development Committee (VDC), District Development Committee (DDCs) and municipality to coordinate and implement development projects/programs and to provide approval or clearance of the proposed project.

- **Water Resources Act, 1992 & Water Resources Regulation, 2000**

Water Resource Act is an umbrella act governing water resource management. It declares the order of priority of water use; vests ownership of water in the state; prohibits water pollution; and provides for the formation of Water User Association and system of licensing. The Regulation sets out the procedure to register a WUA and to obtain a license and sets out the rights and obligations of WUA and license holders.

- **Environmental Protection Act (EPA), 1997 & Environmental Protection Regulations (EPA), 1999 (and amendments)**

EPA and EPR have several provisions to institutionalize environmental consideration in development projects. Section (5) of EPA stipulates that ‘a proponent who is desirous of implementing any proposal shall have to submit such a proposal, accompanied by the report on Initial Environmental Examination or Environmental Impact Assessment of the proposal, to the concerned agency for the approval of such a proposal. The EPR elaborates provisions to prepare and submit the scoping report, Terms of Reference (TOR), and IEE/EIA report for approval and includes public consultation processes. As per the EPR, the Environmental Assessment report, in general, should include detail information on impacts and environmental protection measures, including implementation plan, monitoring and evaluation and environmental auditing. Public consultation is a pre-requisite in all the prescribed projects.

- **Drinking Water Regulations, 1998**

Regulates the use of drinking water and deals with the control of water pollution and maintenance of quality standards for drinking water. It also sets out the conditions of service utilization by consumers.

- **Forest Act, 1993 & Forest Regulations, 1995 (including amendments)**

Since forest has an important role in managing water resources, Forest Act has many provisions effecting the integrated water resources management of the country. The basic objective is developing and conserving the forests of the country. The government can provide parts of any type of forest for the implementation of national priority plan with the assurance that it does not adversely affect the environment. The Regulation further elaborates legal measures for the conservation of forests and wild animals.

- **Labor Act, 1992**

The Act emphasizes on occupational health and safety of workers and stipulates provision of necessary safety gears and adopting necessary precautionary measures against potentially hazardous machine/equipment in the

workplace. It also stipulates to make arrangements such as removal of waste accumulated during production process and prevention of dust, fume, vapour and other waste materials, which adversely affect the health of workers

- **Nepal Water Supply Corporation Act, 1989 (and amendments) & Water Supply Management Board Act, 2006 & Water Supply Tariff Fixation Commission Act, 2006**

These acts facilitate the improved management of water and sanitation services. They establish the legal basis for private sector management of schemes and independent fee setting and regulation applicable to all urban schemes.

- **Solid Waste Management and Resource Mobilization Act, 1987 & Solid Waste (Management and Resource Mobilization Rules), 1990**

As solid waste has direct impact on water supply system, discharge of solid waste in either public or private places have been prohibited under this Act. The rules entrusts Solid Waste Management and Resource Mobilization Centre, established under the Act, to provide necessary service to individual or institution in managing solid waste. As such any water resource projects may obtain such service and maintain the water resource clean.

- **Town Development Act, 1988**

The Act has provisions about the formation of town development committee in any town area to implement town planning and in carrying out the developmental and reconstruction work of that town.

- **Land Acquisition Act, (2034 BS) 1977 & Land Acquisition Rules, 1969**

These are two main legal instruments that specify procedural matters of land acquisition and compensation. Under these, the Government is allowed to acquire any private land paying reasonable compensation to the affected party for any public purposes or for operation of any development project initiated by government institutions and the water resources laying and originating within such acquired area is spontaneously acquired under this process.

- **Water Tax Act, 1966**

Under the Act, the water user who use water through a tap distributed by the government is obliged to pay water tax as fixed by prevalent laws and charges are levied if the tax is not paid within the time as fixed by the law.

## 11. Grievances and Redress Mechanism

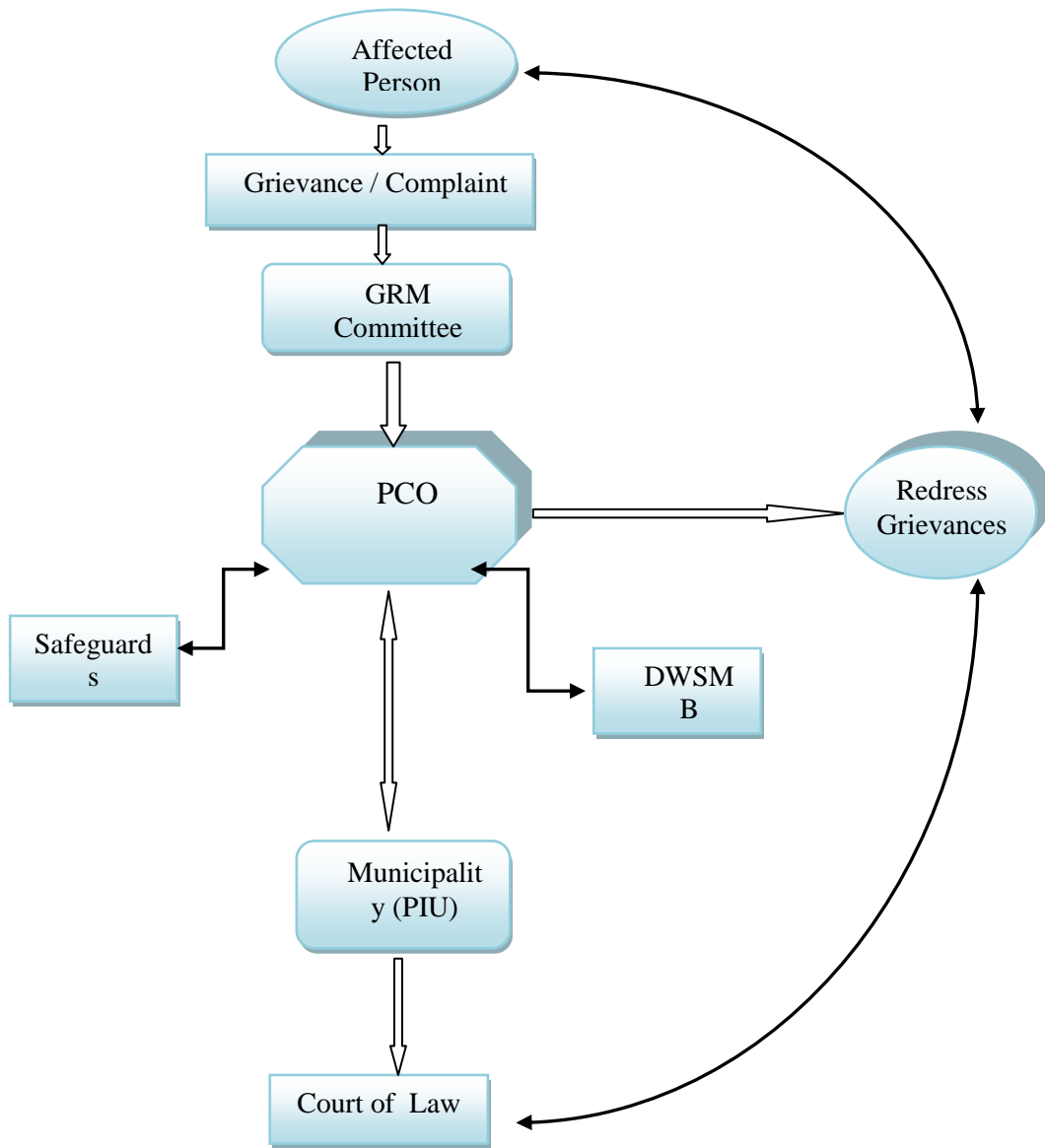
Dharan Municipality (PIU) will be responsible to address the issues and problems raised by the local communities regarding the loss of assets, water and sanitation etc. during the implementation of the project. The Municipality (PIU) shall ask the Environment Safeguard Specialist of the DSC to assist in the handling of grievances and the community level stakeholders should be encouraged to help in the handling of grievances at the project sites.

However, all the stakeholders are to be made aware of the project-specific GRM so that there is an appropriate channel of communication and a formalized procedure to settle dispute. A Greivances Redress Committee has been formed for this project. Details of members are mentioned below:

- |  |   |                          |
|--|---|--------------------------|
| 1. Executive Officer, Dharan Sub-Metropolitan City Office          | : | Coordinator              |
| 2. Sr. Administrative Officer, Dharan Sub-Metropolitan City Office | : | Member                   |
| 3. Social Development Officer, Dharan Sub-Metropolitan City Office | : | Member                   |
| 4. Legal Assistant, Dharan Sub-Metropolitan City Office            | : | Member                   |
| 5. Social Safeguard Specialist, DSC                                | : | Member                   |
| 6. Representatives from Affected Persons                           | : | Mrs. Kala Subba (Member) |
| 7. Project Manager –IUDP-PIU                                       | : | Member Secretary         |

The process requires a GRM committee to be established as a local level to assure accessibility to the Affected Person or Stakeholder. The committee should consist of members with sufficient knowledge about the project, with technical know-how and expertise and someone aware about the socio-cultural dynamics of the community. The GRM requires that issues and comments are first lodged with the local level GRM committee for handling of grievances at project site. The GRM committee should conduct their meeting within 3 weeks of receipt of complaint and solution needs to be provided at meeting or within 3 weeks.

The affected person / community will submit grievances / complaints to the Municipality through Project Implementation Unit (PIU). The GRM committee will try to solve the grievance at the project level. If the grievance cannot be solved at the project level, GRM committee will forward it to Project Coordination Office (PCO). In case the PCO, Kathmandu cannot resolve the issues it will be referred to the relevant court of law.



**Figure 2: Process flow of Grievance Redress Mechanism**

## **12. CONCLUSION:**

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The planned water supply and sanitation project for Dharan Municipality will have only minor adverse impacts on the environment which can be easily mitigated and with least costs through appropriate mitigation measures and regular monitoring during the design, construction and operation phases.

A significant improvement is expected in personal, household and community level hygiene practices, and environmental sanitation thereby increasing the quality of life and community health.

No adverse or harmful impacts of any significance are likely and a full scale EIA is not required, thus IEE study is carried out.