

**Environmental Impact Assessment and
Environmental Management Plan
– Thimphu Tech Park, Bhutan**

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1. Introduction

1.1. General Background

Bhutan is a small economy with a GDP of Nu 32,814 million (US\$ 735.6 million). Landlocked between China and India, its population is estimated at 679,700¹. The Himalayan Kingdom has a land area of about 47,000 square kilometers. Over the past 25 years, the country has achieved rapid economic, social and human development, driven by the exploitation of vast hydropower potential and donor support. Urbanization has accelerated and Thimphu, the Kingdom's capital, is growing fast at around 10% per year. Real GDP growth averaged more than 6% a year over this period, and sustained growth has increased Gross National Income (GNI) per capita in 2004 to about US\$720. The economy is modernizing rapidly, although agriculture continues to account for about 26% of GDP, with industry and services representing 43% of GDP and 31% of GDP respectively. Much of the transformation that has taken place since the opening up of the economy in the 1960s is attributed to the initiatives spearheaded by the government. Public sector enterprises are a central feature of the Bhutanese economy, with expenditures amounting to 16.6% of GDP in 2004². These are estimated figures for 2004-05, as reported by the National Statistical Bureau, Royal Government of Bhutan (RGoB).

1.2. Information and Communications Technology Sector

Information and communications technology (ICT) - along with other export oriented industries - is one such sector which has been recognized as an "unmatched developmental tool as well as an area of new business and employment opportunities for all Bhutanese people." ICT plays both to Bhutan's strengths and avoids the country's major constraints. For instance, ICT services would take advantage of the disciplined, English speaking workforce and relatively developed telecommunications network. Yet it would not be constrained by the mountainous terrain, extreme weather and geographic isolation. In addition, the development of this sector would help create jobs for the increasingly unemployed youth, and would be gender-sensitive in impact. According to the RGoB's Information and Communications Technology (ICT) Master Plan, the development and application of IT will be guided by three broad policy objectives: use IT as an integral tool to enhance good governance; develop IT and IT-enabled industries in the private sector to generate income and employment; and apply IT to improve the livelihood of all Bhutanese. The sector also holds promise for improving productivity and increasing competitiveness in existing public and private sectors and industries.

¹Labor Force Survey, 2009 Kuensel Newspaper, 2009, <http://www.kuenselonline.com/modules.php?name=News&file=article&sid=13328>,

² Non-commercial organizations/authorities such as the Royal Monetary Authority of Bhutan (MA) and the National Pension and Provident Fund (NPPF) are not included.

1.3. Thimphu Tech Park

The Royal Government of Bhutan (RGoB), with financial assistance from the World Bank, is implementing the Private Sector Development (PSD) Project, aiming to increase productive employment in Bhutan through promotion of enterprise development in the Information Technology/Information Technology Enabled Services (IT/ITES) sector, enhanced IT skills, and improved access to finance.

This project consists of three components:

1. Development of IT/ITES Sector

This component focuses on the development the IT/ITES sector in Bhutan, using an integrated approach that includes (i) establishment of IT Park and related infrastructure and (ii) IT promotion services.

2. Development of IT/ITES Skills Program

This component focuses on development of skills, through collaboration with international institutions at the following three levels (i) Generic Skills for the IT/ITES Sector; (ii) Distance learning facilities/Course Management System for IT Skills development; and (iii) IT Entrepreneurship Development Program.

3. Strengthening Financial Sector through IT Use

This component aims at achieving greater efficiency in the financial sector through IT use, comprising the following three activities: (i) IT system up-gradation in the Bank of Bhutan; and (ii) developing a 'Financial sector IT development strategic plan'; and (iii) establishing the Inter-bank Electronic Fund Transfer Clearing System at the Royal Monetary Authority (RMA).

The first component of the project includes the development of a 50,000 sft IT Park in a 5-acre parcel of land at Babesa, within Thimphu municipality, which will consist of facilities such as an incubation center, shared technology center, data center and office building. There will be no manufacturing facility in the IT Park. Thimphu Tech Park Pvt. Ltd., a joint venture company of Assetz Property Group Pte Ltd of Singapore and Druk Holding & Investments Ltd of Bhutan, has been selected through an international competitive bidding process to design, build, finance, own, operate, and transfer the IT Park facility.

1.4. Purpose and Objectives of Environmental Assessment

The World Bank's environmental screening has categorised this as a category B project and the World Bank's safeguard policy on Environmental Assessment (OP 4.01) is triggered requiring an environmental assessment to be carried out. The Environmental Assessment (EA) and Environmental Management Plan (EMP) are therefore to be prepared before the commencement of the IT Park infrastructure activities.

The overall objective of the proposed EA Study is to identify the impacts on physical, biological, socio-economic and cultural environment of the project due to execution of project activities. The objective of the EA is also to influence the project as it evolves and takes shape: make it environmentally sound, tailor it and help fit it in the local environment including social and institutional context. More specifically, it includes:

- Identification of the positive and/or negative impacts on environmental resources due to natural phenomenon and induced human activities during construction and operation of the proposed IT Park;
- Identification of the major issues that may arise as a result of proposed works on the bio-physical, socio-economic, cultural and religious environment of the project area; and
- Identification and recommendation of measures for minimizing environmental impacts from proposed construction by employing the principles of prevention, mitigation and controls.

1.5. Methodology

Secondary information related to the project and the environmental baseline were collected and reviewed. These primarily included the proposed project details from the project developers and designers, prevailing environmental legislation, policies and guidelines related to the project such as Environmental Assessment Act 2000, Regulation of Environmental Clearance of Projects, 2002, Guidelines for Preparation of Environmental Management Plan, documents related to Sustainable Construction practices, etc. In addition, information related to environmental conditions in terms of geology, soil, topography, drainage patterns, water resources, air resources, protected areas, forest resources, and socioeconomic data around the project site were collected. An interaction with stakeholders, which mainly included DIT officials, TCC officials, NEC officials and other line agencies of Royal Government of Bhutan to understand the projects and the local environment, was also carried out. During this period of study, based on the understanding of project activities and local environment, the generic impacts were identified.

Public Consultation

A public consultation with local residents of the project site area was carried out during October 2009. The land for the IT Park is designated as institutional by the National Land Commission Secretariat and is owned by the Department of Information Technology (DIT), Ministry of Information & Communications. No acquisition of privately owned land or displacement of people is required under this project, including any land for access roads or ancillary infrastructure. A consultation with households and businesses above and below the IT Park and surrounding access roads was carried out using a structured questionnaire to clarify if they have any concerns regarding slope stabilization, dust during construction, movement of trucks, and other construction and operation related impacts, as well as to identify any potential social impacts on neighbouring communities, if any. This consultation process was carried out by the consultants accompanied by representatives of TCC and DIT. During this process, project related activities and their potential impacts on the local environment were discussed.

Preparation of EA Report

After the accomplishment of the above tasks, the EA team compiled and interpreted the environmental baseline information in terms of physical, biological, social and cultural aspects. Similarly, the project related information in terms of its planning, design, and cost estimation were collected from the project developers and updated. Based on this information, potential environmental impacts were identified, predicted and evaluated in terms of magnitude, duration, extent, and their significance. On the basis of impact evaluation, an EMP has been prepared covering mitigation measures to be adopted, identification of responsible persons or agencies for the implementation of mitigation measures, and an environmental monitoring plan covering monitoring indicators and frequency of monitoring.

2. Policy Context

This section reviews the existing policy framework relevant to the environmental context of the proposed IT Park development and this Environmental Assessment.

2.1. World Bank Safeguard Policies

Based on the attributes of the proposed development, ‘**OP 4.01: Environmental Assessment**’ of the World Bank safeguard policies is of relevance to this project. The policy implication is stated as follows in the World Bank Project Appraisal Document:

‘This is an umbrella policy that gets triggered if a project is expected to have potential environmental risks and impacts. The IT park project is classified as ‘B’ category and triggers the policy’.

This Environmental Assessment study was carried out conforming to these requirements. Guidelines for Environment Management and institutional mechanisms for their implementation are provided in the Environmental Management Plan of this document.

2.2. Bhutan - National Policies relevant to Environmental Protection

Environmental Assessment Act, 2000, and Regulation for the Environmental Clearance of Projects, 2002

This Act establishes procedures for the assessment of potential effects of projects on the environment, and aims to determine measures to reduce potential adverse effects and to promote environmental benefits. Regulation for Environmental Clearance defines responsibilities and procedures for the implementation of the Environmental Assessment Act, 2000 for issuance and enforcement of environmental clearances. Clauses of relevance to the proposed development include:

- *‘[...]To ensure that all projects are implemented in line with the sustainable development policy of the Royal Government of Bhutan*
- *To ensure that all foreseeable impacts on the environment, including cumulative effects are fully considered prior to any irrevocable commitments of resources or funds;*
- *To ensure that all feasible alternatives are fully considered;*
- *To ensure that all feasible means to avoid or mitigate damage to the environment are implemented; and*
- *To ensure that concerned people benefit from projects in terms of social facilities [...]*’

National Environment Protection Act, 2007

The aim of this Act is to enable an effective system of conserving and protecting Bhutan’s environment. This system is constituted of the National Environment Commission or other designated Competent Authorities and advisory committees responsible for independently

regulating and promoting sustainable development in an equitable manner. The Act provides a framework for developing measures and standards to protect Bhutan's environmental quality. Guidance relevant to this project includes:

- Handling of hazardous substances, which states that *'no person shall handle or cause to be handled any hazardous substance except in accordance with such procedure and after complying with such safeguards as may be prescribed under national and international instruments'*; and
- Discharge of environmental pollutants the Act states that *'no person shall discharge or emit or be permitted to discharge or emit any pollutants in excess of such standards as may be prescribed'*.

Waste Prevention and Management Act of Bhutan, 2009

This Act defines the institutional framework for preventing and managing waste in Bhutan. It sets out the principles, measures, mechanisms and responsibilities for reduction, segregation, and appropriate disposal of waste to protect the country's environment.

Waste management requirements of relevance to the proposed development include:

- *'Non-hazardous waste:*
 - *'Implementing agencies shall ensure that the reduction, reuse, recycling and disposal of non-hazardous waste are addressed in an environmentally sound manner. In doing so, agencies shall:*
 - *Provide waste segregation and reduction mechanisms at source; and*
 - *Ensure collection and adequate management of waste at an approved site or facility inter alia composting for organic wastes.*
- *Hazardous waste:*
 - *Implementing agencies shall prevent manufacturing of products with the potential to generate hazardous waste. The agencies shall also ensure that the reduction, storage, treatment, and disposal of hazardous waste are addressed in an environmentally sound manner. In doing so, agencies shall:*
 - *Undertake segregation and relevant pre-treatment; and*
 - *Ensure collection and adequate management of hazardous waste at an approved site or facility.*
 - *Hazardous wastes shall not be imported into the Kingdom of Bhutan.*
 - *Hazardous wastes may only be exported subject to the prior written consent of the country of import.*
- *E-waste:*
 - *Implementing agencies shall ensure that the minimization, storage, treatment and disposal of waste from the production and use of electrical and electronic equipment are addressed in an environmentally sound and safe manner. In doing so, a system shall be established by the relevant implementing authority to provide for the proper*

collection, treatment and safe disposal of end-of life electrical and electronic equipments.'

General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries, 2006

OHS Rules and Regulations aims *'to assure safe and healthful working conditions for working men and women as well as other persons present at workplaces from work related risks to their health, safety, and well being.'*

Regulations under the OHS guidance of relevance to this project are listed below and detailed in **Appendix 1:**

- Health and Safety Program – the employer of an enterprise is expected to prepare and implement an occupational health and safety program.
- Appointment of Health and Safety Representative – employees at a workplace should elect a representative.
- Self Inspections by Employers – every employer shall ensure that regular inspections are made of all workplaces, including buildings, structures, scaffoldings, grounds, excavations, tools, equipment, machinery and work methods and practices, at intervals that will prevent the development of unsafe working conditions.
- Reporting – an employer shall submit a report on self-inspection carried out under subsection (14.1) to the Department of Labor on quarterly basis.
- Minimum safety standards for the construction industry.

In addition, employers, workers, supervisors and suppliers should be made aware of their respective general duties as well as the guidelines on personal protective clothing and equipment.

The Labor and Employment Act of Bhutan, 2007

The labor and employment act of Bhutan 2007 provide policies and programs in the areas of employment promotion, labor protection and relations, vocational education and training, and occupational standards setting and certification.

The proposed development will adhere to the policies provided under the following sections of the Act and any other regulations of the Act of relevance to the project:

- Prohibitions;
- Contracts of employment;
- Compensation and benefits;
- Hours of work and leave;
- Wages;
- Occupational health and safety; and
- Employment of foreigners.

2.3. Local Rules and Regulations

Thimphu Municipal Development Control Regulations, 2004

The Thimphu Municipal Development Control Regulations supersedes the Bhutan Building Rules for Thimphu City. The regulations have been developed to supplement the Thimphu Structure Plan 2002-2027 through regulations and procedures.

Procedures stipulated within the development control document deal with obtaining development / building permissions and during development / building construction. Under procedures during building construction, clauses relevant to the proposed development include:

- *‘Temporary Service Connections – an applicant with a certified copy of building permit may apply to the respective agencies for temporary connection of services like electricity, water and sewerage*
- *Loading and Unloading and Stacking of Materials and Equipment – the use of a public street / road or a public place for loading and unloading and stacking of materials of construction and construction equipment and excavated materials shall not be allowed, unless permitted by the Implementing Authority. Material or equipment found on public street/road or public land without prior approval is liable to be confiscated and the owner shall be liable for penal charges.*
- *Documents at Site – the person to whom development permission is issued shall during construction, keep –*
 - *posted in a conspicuous place, at the site for which permission has been issued a copy of the development permission and*
 - *a copy of the approved drawings and specification on the site for which the permit was issued.*
- *Child Labor – it is incumbent that the architect/engineer/site supervisor sees that no under-age workers, or children, are present on the construction site, either as employees, guests, or as dependents of legal employees. A construction activity of a built-up area of 5000 sq.m or more shall provide a crèche or day care centre for the laborer’s children, where one, or more, women are employed on site.*
- *Safety on Site – all construction sites must be organized in a manner that the safety of all persons (particularly laborers) on the site, at all times is assured. Every person on the construction site should be well equipped with helmet, boots, gloves, safety belts, first aid kit etc. On such sites safety barriers will be erected around all chutes, shafts, floor openings and slab edges, etc. All the workers at site should be insured.’*

3. Project Description

This chapter provides a description of the project site and details of the proposed project.

3.1. Project Objectives & Development Principles

The IT Park is envisioned to – ‘... become a cyber hub and technological gateway for visionary Multinational Corporations into the Himalayan Kingdom of Bhutan. Cherishing the traditional values by choice and practicing the principle of ancient reason in modern life.’ The aspiration of the RGoB for setting of this IT Park is with the objective of ‘creating a platform for business, trade and technology to flourish symbiotically while enabling the assimilation of the “Spirit of the Place” ‘.

The development principles guiding the design of the IT Park propose:

- Enhancing the work sphere towards synergy and productivity;
- Integrating amenities and world class services in IT and ITES, having a bandwidth of staff and customer interface with technological support systems;
- Creating an environment which sustains and enhances the socio-cultural principles of work and recreation by appropriate architectural space planning; and
- Creating spaces like the open – air amphitheatre as a platform to showcase and promote the culture of Bhutan.

3.2. Project Site Location

The five acre project site lies about 10 kilometers south of Thimphu City centre, and falls under the Extended Municipal Boundary of the Thimphu City Corporation. The site is located in an area known as Babesa along the Thimphu-Phuentsholing Highway.

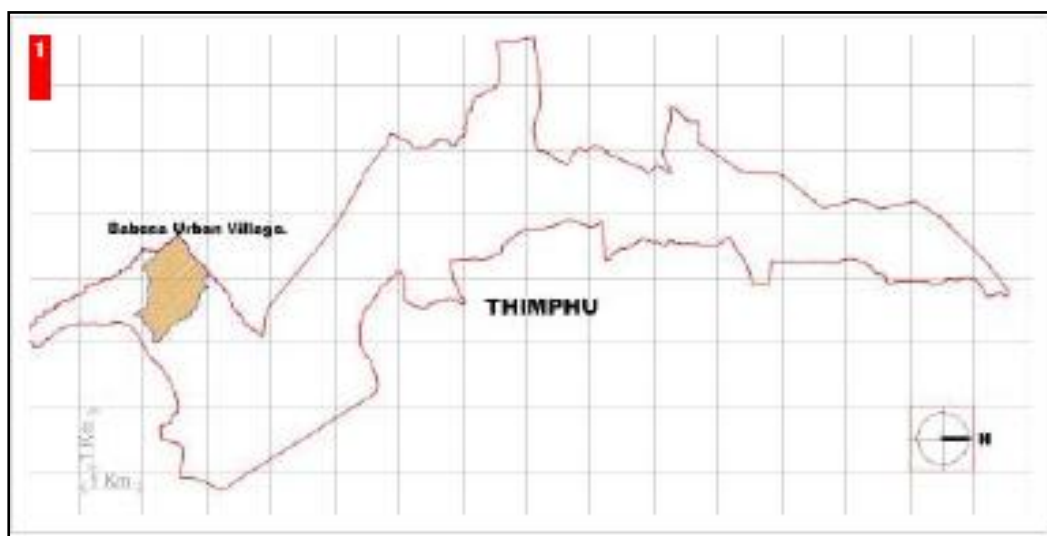


Figure 1: Location of Babesa Local Area

Babesa covers an area of just over 100 hectares and its boundary is defined by the Wang Chhu River, its tributary Ngabe Rong Chhu and the highway. There are a number of institutional and government properties situated within close proximity of the project site, such as the Royal Botanical Garden, Royal Bhutan Agro-Industry facility, Ministry of Agriculture's Animal Husbandry Institute (National Livestock Breeding Programme) and Babesa Primary School. A few residential properties and a poultry farm are also located in the area. The land in Babesa has a gentle to moderate slope and is terraced in areas where the land was previously used for paddy cultivation.

The project site is skirted by the Pheuntsholing highway along its northern boundary. The Babesa Primary school is located to the north of the site. The 13-acre land adjoining the project site's western boundary is presently used for grazing by the Animal Husbandry Institute of the Ministry of Agriculture. However, the Institute is in the process of relocating its activities and this land has been earmarked for development by the Local Area Plan for Babesa. It has also been proposed to use this land for future phases of TTP. A natural stream flows east of the site. The Local Area Plan designates an area of 15m on either side of this stream as an Environment Conservation Precinct. An access road connecting the Phuentsholing highway to the Botanical garden runs along the southern edge of the site. The project site is presently vacant and is mainly used for grazing by the Animal Husbandry Institute. The land is also occasionally used for recreational activities such as archery by local residents. The landuse map of the area around the site is provided in **Figure 2**. The project site's location is marked in the land use map.

The southern end of the site is about 30m higher than the northern end. The central area of the site is relatively flat and the building footprint is proposed in this portion of the site. A large marshy area has been formed within the site and is likely to be due to effluent from the Bhutan Agro Industries flowing in a channel along the western boundary of the site.

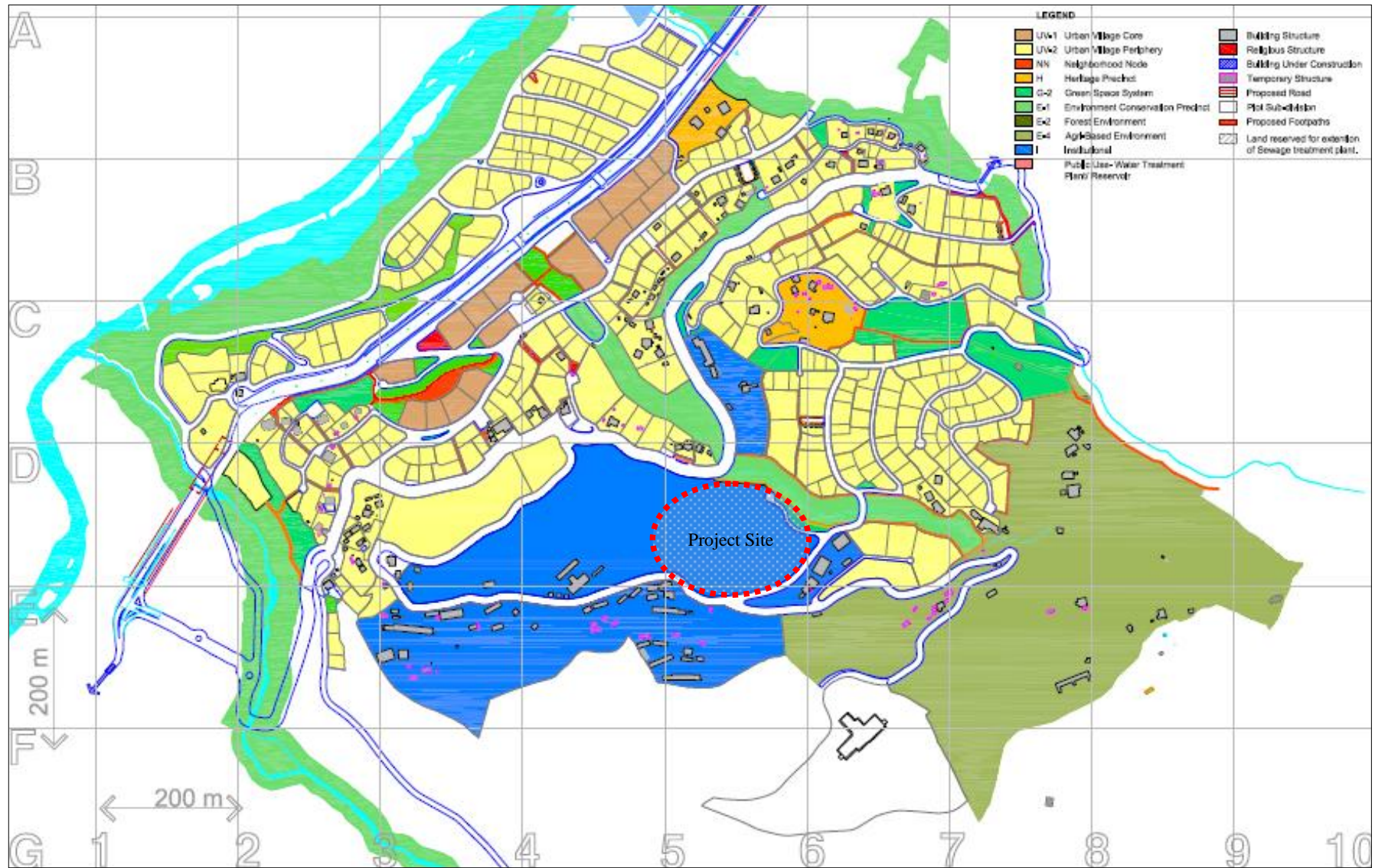


Figure 2: Landuse around the project site

Source: Local Area Plan (Babesa), RGoB, May 2006.

3.3. Project details

The master plan (provided in **Figure 3** below) for the IT Park takes into account the design principles and the attributes of the site – geometry, site forces, terrain and approach.

The proposed site is irregular in shape with about 150m road frontage and 180m depth. The approach to the site is from the road along the southern boundary, with road entry at the highest point enabling a bird-eye view of the entire proposed development. The IT Park is proposed on the flattest region of the five acre terrain. The main entry to the IT Park is proposed from the east enabling a large green space around the building. Surface car-parking is proposed north and south of the building. Services for Electrical Power, Water and Sewage are located towards the northern zone of the site as a centralized area.

The building shape seeks inspiration from the traditional building typologies of Bhutan. The plan has a ‘H’ shape with the longer lengths facing south to minimize solar heat gain during Summer and minimize operational costs for mechanical heating and cooling. The orientation of the building is also sympathetic to the traditional values, climatic influence and the entry to the park.

The proposed building will include IT/ITES space, Service and Administration Corridors in about 50,000 square feet of built-up area over G+2 levels, as detailed in the table below:

Table 1: Breakup of building areas

Facilities	Area (sq. ft.)
IT/ITES space	35,000
Service provider + common facilities	5,000
Incubation space	5,000
Data center	2,500
Shared technologies	2,500
Total	50,000

The facility has been designed for an occupancy of 100sft/person. All areas in the facility will have ramps/provisions for disabled people entry/exit. The foundations will have a combination of independent and combined footings designed based on geo technical investigation. The proposed structure is cast in situ reinforced concrete cement construction and the configuration for the super structure is a Beam-Slab system with Shear wall to account for Seismic Zone V effects in which Thimpu is situated.

Windows are proposed to be provided with double glazing consisting of 8mm glass – 12mm air gap – 6mm clear glass double glazed unit. The high performance glass will be provided with low-emissivity coating. The glazing system will be designed such that it is operable during all times for the purposes of any fresh air intake, ventilation and necessary maintenance and/or as part of a fully integrated smoke ventilation strategy to meet statutory requirements.

The floor plans, sections and views of the proposed building are provided in **Appendix 2**.

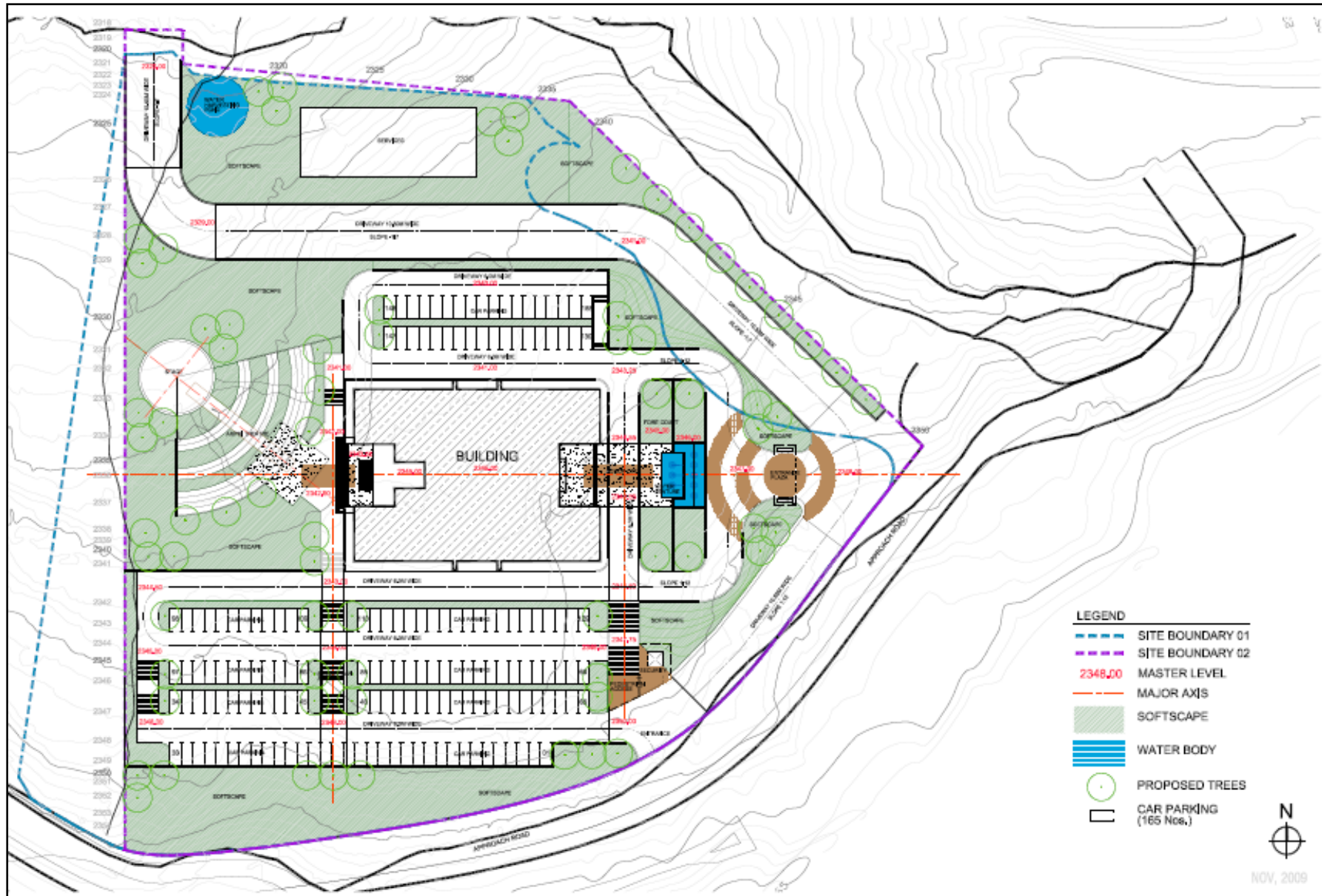


Figure 3: Master plan of the Thimphu Tech Park

The design and construction of Thimphu TechPark will be oriented towards environmental sustainability and will incorporate features that aim to minimize environmental impacts. Thimphu TechPark will attempt to achieve 'gold' rating status under the United States Green Building Council's LEED (Leadership in Energy and Environmental Design) rating. This would ensure that the facility, during construction and operation, would have minimal impacts on the site, reduce water use and recycle water, minimize operational energy, use appropriate building materials that are locally available, and ensure good indoor air quality.

3.4. Proposed Mechanical, Electrical and Plumbing Services

3.4.1. Electrical Services – Power Supply System

The proposed IT Park's incoming raw power will be supplied through a 11KV system. The power supply will be backed up 100% by primed diesel generator sets. The facility will be provided with UPS units to back up critical loads as well as additional protective and safety features. Lighting within the IT Park will be designed to meet LEED requirements. All lighting equipment and lamps will be energy efficient and environment friendly. The average illumination level will meet required standards. Common area lighting will be set to suit functional requirements. The building will be designed so as to allow maximum day light while minimizing heat gain through an optimum window wall ratio.

3.4.2. HVAC Systems

Based on the design parameters and considering the favorable climatic condition of the area, an economy air cycle has been proposed for the entire building during the summer/monsoon season. For ease of air-distribution and scalability, each floor is sub-divided in 4-zones. Each Zone will be provided with ceiling suspended Air-Handling Units fitted with coil and filters for supply of fresh air from outside. Each unit will have damper arrangements at the air-intake side with actuator so that the unit may operate at 100% fresh air mode or min fresh air mode depending upon the comfort level and outdoor condition. Each zone will also be provided with exhaust fans to operate in tandem with the supply fan for economy air cycle during favourable weather.

For winter heating, one of the AHU's will be provided with hot water connection from solar heating panels (with provision for electrical heaters during overcast days of winter). Each zone shall be provided with adequate power sockets to plug space heater in case of night operation or as a back-up facility for winter heating. During summer, the second AHU within a zone will be connected with a DX-outdoor condensing unit, for cooling requirements. This system would have significant energy savings compared to a conventional system.

3.4.3. Water supply and distribution

About 33.0 cubic metres of water per day is the estimated demand for the facility. This quantity of water will be supplied through piped water by Thimphu City Corporation. The raw water will be stored, treated and pumped to an overhead tank from where it would be distributed to toilets and other areas through gravity flow.

Water for domestic usage and fire fighting will be stored in underground sumps. It is proposed to treat the raw water with a pressure sand filter and disinfection by chlorine dosage. The sump will have a capacity to store a day's domestic water and a day's treated water requirement as well as the fire fighting static requirement. The sump would be suitably partitioned by RCC walls to separate Fire, Domestic and treated water storage. In addition to the underground sump, the domestic and fire fighting water will be stored in overhead tanks, provided at terrace level.

Appropriate storage for fire water will be provided as will a supply to hydrants within the site. Individual electrical water heaters (geysers) will be provided for hot water in toilets and pantries. Hot water is supplied only to the wash basin located in all toilets. A solar hot water system is proposed to preheat the water supplied to the geyser: the hot water outlet from the solar panels is connected to the inlet of the geyser located in each toilet. The water from the geysers would be connected to wash basin mixers.

Sanitary fixtures include, low flow fixtures, dual flush fixtures for WC, and sensor fixtures for urinal flushing and wash basins, to reduce the water demand. Rooftop rainwater would be stored in a separate tank and used to augment the domestic water requirements during the monsoon season. This would also reduce the water demand.

3.4.4. Sewerage System and Sewage Treatment Plant

Sewage from the toilets is proposed to be conveyed to an on-site sewage treatment plant with a capacity of 27 cum per day. However the scheme proposed is expandable and additional units can be added as and when other buildings are added. Treatment would be upto tertiary level and is based on extended aeration process - the air shall be distributed through diffused aeration system using coarse bubble and fine pore diffusers.

The waste water, generally free from oil & grease, first enters the plant through the solid separation zone at the desired rate. It is expected that larger solids (larger than 80 mm & not bio-degradable) will be separated and taken out before the raw sewage is pumped into the plant. At the solid separation chamber, relatively heavier solid particles would settle at the bottom of the tank and thus earn themselves a longer time to degrade biologically. Relatively clear sewage flows to the pre-aeration chamber. After pre-aeration, the waste water over flows to contact aeration chamber. At this point, BOD load is less than 60% of its initial value. In the contact aeration chamber, the waste is aerated in the presence of contact media, which helps grow MLSS (Mixed liquor suspended solids). The MLSS overflows to the sedimentation chamber for effective liquid-solid separation. The thick sludge is returned to the aeration chamber while the clear supernatant is allowed to flow out for disinfection & further treatment.

After tertiary treatment, treated effluent is stored in a treated water storage tank as a final sump. The treated water will be used for flushing in toilets. The remaining treated water will be used for landscape & excess overflow will be diverted to the natural stream.

The quality of the effluent before and after the treatment process is given below:

Table 2: STP effluent quality

Parameters	Before treatment	After Treatment
BOD5	300 – 350 mg/lit	Less than 10 mg/lit
TSS	400 mg/lit	Less than 30 mg/lit
pH	6.5 – 7.5	6.5 -7.5

Details of the STP are provided in **Appendix 3**.

3.4.5. Life Safety and Security Systems

The IT Park will have the following life safety and security systems:

- sprinkler for the building as per National Building Code of India / local codes;
- analog addressable, intelligent smoke detection system for office areas;
- turnstiles / flab barriers at building entry;
- surveillance cameras for monitoring; and
- access control at building / floor entry.

Following the completion of this phase of building, it is envisaged that future phases will be developed in the adjacent 13-acre plot.

4. Environmental Baseline

This chapter sets the environmental, social and economic baseline context for the proposed project. Baseline information has been collected on the physical, ecological and social environment of areas of potential impacts due to project implementation. The contextual boundaries have been delineated as follows: project site, Babesa and larger Thimphu area.

4.1. Physical Environment

4.1.1. Topography

The altitude of the Thimphu valley ranges from 2,248 to 3,800 meters. The slope analysis provided within the Thimphu Structure Plan characterizes the topography of Babesa area as a 'low/gradual slope'³ although there are areas with moderate slopes. The project site lies within an area where the slope ranges from 2.9 – 5.7 degrees and has a slope ratio of 1:10 (one meter vertical rise in 10 meters horizontal distance). The site itself generally slopes from the south to the north.

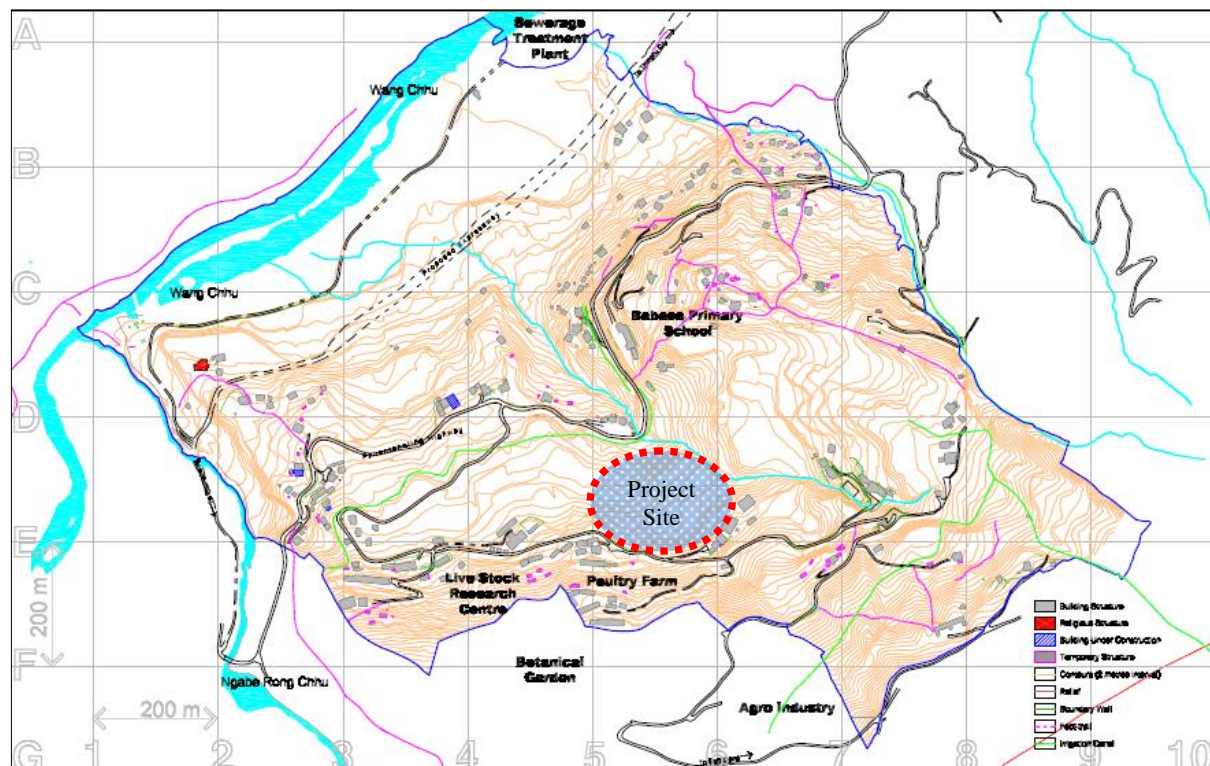


Figure 4: Terrain of Babesa Local Area

Source: Local Area Plan (Babesa), RGoB, May 2006.

³ Low / gradual slope – These slopes are considered suitable for urban development, and most of the existing developments are on these slopes. Providing infrastructure facilities like roads and other networks is better compared to other higher slope categories. Since most of the existing urban settlements are on this slope category, any new development on these slopes can use the existing infrastructure.

4.1.2. Geology

The geological formation of Thimphu district mainly consists of highly metamorphosed gneisses, schist, and subordinate quartzite, calc silicate rocks and marbles⁴. The geophysical survey of the project site carried out by the Geological Survey of Bhutan, Department of Geology & Mines found that the rock type belonged to the Thimphu Group, consisting of crystalline rocks – garnet, kyanite, silliminate paragneiss, schist and flaggy quartzite. Basic and igneous intrusions are said to occur as a thrust sheet⁵. The report further classifies the rocks as mostly belonging to the Takhtsang Formation (named by Gansser, 1964), which is constituted of *'garnet-silliminate, biotite, gneiss largely devoid of muscovite. The gneisses are mostly feldspathic biotite-muscovite gneisses, fine to medium grained and foliated. Quartz veins are also seen in some of the exposures. Thin to medium bands of schist occur within the gneissic rocks'*⁶.

The field survey of the site, suggests that the general trends of the rock are from northwest to southeast with north-easterly dips ranging from 10° to 35°. They also observed that there are no exposures of in situ rocks within the survey area. Bands of pegmatite were seen in some areas in and around the project site⁷.

4.1.3. Soil

A study of the quaternary deposits of Thimphu Valley carried out by the Division of Geology and Mines has classified the valley into three types – Alluvial deposits, River Terrace deposits and Colluviums formation. According to this classification provided in the Thimphu Structure Plan, the soil composition of the Babesa area is predominantly 'Alluvial Fan Deposits' of the type 'A'. This soil is formed by several layers of debris flows, or floods on a large scale from upper stream tributaries.

Results from the subsoil investigation for the project site identify the soil composition as gravelly sand with a high amount of silt/clay. Hard and compact alluvial soil is found at a depth of up to one meter from the top and is followed by residual deposit⁸. Results from the soil investigation show that the liquid limit of the soil ranges from 16.2% to 18.35%, the plastic limit from 9.62% to 10.32% and the plasticity index from 5.88 to 8.73. This shows that the material is of similar nature throughout the study area. Natural moisture content ranges from 9.84% to 14.21%. The specific gravity values ranges from 1.95 to 2.42. Direct Shear Box Tests show that the site has an Ultimate Bearing Capacity ranging from 317.21kN/m² to 409.29kN/m² and an allowance safe Bearing Capacity ranging from 126.88kN/m² to 163.71kN/m². D20 grain size or the 20% passing of material from the sieve is almost same for all the samples collected during the soil investigation which shows a co-efficient of permeability of 1.80 cm/sec. The Portable Penetration Test shows different "N" values and the corresponding bearing capacities gets better with depth⁹.

⁴ DUDES, 2004, *Thimphu Structure Plan 2002-2027*, DUDES

⁵ Chhetri, I.K., Tshering, T. and Dorji, P., 2009, *Report on Subsoil Investigation and Geophysical Survey Work at DIT-IT Park Site, Wangchu Taba, Thimphu*, Geological Survey of Bhutan, Department of Geology & Mines.

⁶ ibid

⁷ ibid

⁸ ibid

⁹ ibid

4.1.4. Surface and Ground Water Hydrology

The water quality survey carried out by NEC since 1997 indicate that most rivers and tributaries of Bhutan are of pristine quality. Most surface water is characterized as highly oxygenated, slightly alkaline with low conductivity and no recorded salinities¹⁰. However, increasing localized water pollution is affecting the quality of rivers and streams. Surface drainage, grey water sullage from domestic households and uncontrolled seepage or overflow from septic tanks and pipes enter into the water courses¹¹. These problems are particularly evident for the Wang Chhu which flows through Thimphu city and along the northwestern boundary of Babesa. The conductivity and turbidity characteristics of the river are found to decrease downstream. In addition, at locations downstream of Thimphu vegetable market, the coliform count is found to be higher by several times than upstream of the market¹². The Ngabe Rong Chhu tributary of the Wang Chhu flowing through Babesa and the natural stream adjacent to the project site (Environment Protection Precinct) are likely to share similar characteristics and standards.

Information on ground water characteristics and quality in and around Thimphu is not available. However, with respect to the project site, the geophysical survey conducted by Department of Geology and Mines observed the water conducting layer at a depth of about 1.5 meters. The report has identified water seepage as one of the main problems in most areas of the site, with the depth of water seepage reaching as far as 15 meters which is the depth of the bed rock. This seepage has resulted in marshy areas around the site, which is said to be unfavorable for foundations. Therefore, the report recommends a proper drainage system be built to improve the area¹³.

4.1.5. Air quality and Noise

There is only one air quality monitoring station in Bhutan. Monitoring ambient air quality has been done only in Thimphu since June 2004. Between June 2004 and May 2007, NEC has recorded ambient air quality data for 180 sample days in the premises of Tashichhoe Dzong. The analysis of the recorded data showed an average Respirable Particulate Matter (PM10) concentration of 20 $\mu\text{g}/\text{m}^3$, which is considerably lower than internationally set PM10 concentration levels. The United States Environmental Protection Agency's (US-EPA) guideline has set the PM10 concentration level at 50 $\mu\text{g}/\text{m}^3$ while the European Union's (EU) guideline has set it at 40 $\mu\text{g}/\text{m}^3$ for a 24 hour average¹⁴.

Particulate matter concentrations have been found to be higher during winter. This can be attributed to emission from point sources, the constant winter high pressure system that sits over the South Asian region and temperature inversions during dry winter seasons. Recorded ambient air quality data for Thimphu show that the concentration of oxides of sulphur and nitrogen are presently below detectable level¹⁵.

¹⁰ NEC, 2008, *Bhutan Environment Outlook*, NEC.

¹¹ *ibid*

¹² *ibid*

¹³ Chhetri, I.K., Tshering, T. and Dorji, P., 2009, *Report on Subsoil Investigation and Geophysical Survey Work at Dlt-IT Park Site, Wangchu Taba, Thimphu*, Geological Survey of Bhutan, Department of Geology & Mines.

¹⁴ NEC, 2008, *Bhutan Environment Outlook*, NEC.

¹⁵ *ibid*

On the basis of analysis of ambient air quality data for Thimphu, it can be said that ambient air quality in most other places such as Babesa will be even more pristine because of smaller population, fewer vehicles, and less industrial activities.

4.2. Biological Environment

4.2.1. Flora and Fauna

Bhutan's location at the junction of two major bio-geographic realms – the Palearctic realm of the temperate Eurasia and the Indo-Malayan realm of the tropical Indian subcontinent – and its extremely heterogeneous physical relief and climatic conditions, have given rise to diverse ecosystems.

The Royal Botanic Garden of Edinburgh, which has published the Flora of Bhutan, recorded 5,603 species of vascular plants, including 579 species of orchids and 46 species of rhododendrons. 82 of the recorded plant species are said to be endemic to Bhutan. The Forest and Conservation Act of Bhutan, 1995 has classified seven plant species as totally protected (see **Appendix 4**), and of these seven only one currently belongs to the globally threatened status. The Nature Conservation Division of the Department of Forestry is at the present reviewing the totally protected species list with the intent to rationalize it based on a comprehensive set of national, regional and international criteria¹⁶.

Bhutan's wild fauna includes more than 600 species of birds and 190 species of mammals, of which 14 bird species and 26 mammal species are globally threatened according to the Red List of Threatened Species maintained by the World Conservation Union (IUCN). Many of these globally threatened species such as the golden langur, capped langur, takin, wild dog, and black-necked crane occur in abundant numbers in Bhutan as a result of strict conservation laws and programmes. There has been limited survey and documentation of herpetofauna. However, wildlife experts suggest that the country is likely to be rich in reptiles and amphibians particularly in the tropical/sub-tropical regions. 23 species of reptiles and amphibians were recorded in the Royal Manas National Park. The recorded list included globally threatened species such as the gharial (*Gavialis gangeticus*), Indian python (*Python molurus molurus*) and yellow monitor lizard (*Varanus flavescens*).

The Forest and Nature Conservation Act of Bhutan, 1995, lists a total of 30 species of flora and fauna as totally protected species (**Appendix 4**). These include 5 species of bird, 1 species of fish, 17 species of mammal, and seven species of plant. Mechanisms such as strict laws and severe penalties have been put in place for protecting endangered and vulnerable species¹⁷.

There is limited information on the species of flora and fauna found in Babesa. The classification of flora and fauna provided in the Thimphu Structure Plan describes lower Babesa and parts of Wangchutaba areas as Wet Lands – Paddy Fields. These areas are characterized by paddy terraces found at altitudes of 150 to 2,800 meters¹⁸. Babesa has come into the urban folds of Thimphu. This

¹⁶ NEC, 2008, *Bhutan Environment Outlook*, NEC.

¹⁷ *ibid*

¹⁸ DUES, 2004, *Thimphu Structure Plan 2002-2027*, DUES.

project site is away from significant conservation areas and is characterized by shrubs and ground cover with little evidence of any significant floral or faunal species in the area.

4.2.2. Protected Areas

Bhutan has demarcated a sizeable portion of the country as protected areas. The national protected areas system covers a total area of 10,879 km² and is made up of a strict nature reserve, four national parks and four wildlife sanctuaries. One of the National Parks (Jigme Dorji National Park) is located within Thimphu district¹⁹ but is at a fair distance northwest of the city area. There are no nature reserves, national parks or wildlife sanctuaries near the project site.

Babesa Local Area Plan has designated certain areas under the provisions of the Environmental Conservation Precinct. No development is allowed within a fifteen meters wide strip along each side of minor streams or rivulets. The Wang Chhu and the major streams are protected by a thirty-meter wide strip along each side. The eastern banks of the Wang Chhu, the stream bounding the north boundary of Babesa local area and the Ngabe Rong Chhu, bounding the southern boundary of Babesa local area are protected under the regulations of this precinct. In addition, the stream flowing adjacent to the eastern boundary of the project site has also been classified as an Environmental Conservation Precinct²⁰.

4.3. Socioeconomic and Cultural Environment

4.3.1. Population

Thimphu has more than 40% of the total urban population in Bhutan with a density of 54 persons per km². As a result of rural-urban migration and the influx of expatriate workforce for construction work in the urban centers, there is an increased squatting population, pollution and land degradation²¹. Other demographic concerns include lopsided age distribution of the population. With nearly 45% of the population under 20 years of age, population growth rate is likely to increase significantly in the near future²².

Although Babesa is within the Thimphu Municipal Boundary, it is a predominantly rural area. The Local Area Plan estimates the existing population to be in the range of 1,700 to 1,800 persons²³. The concentration of population is mainly along the Phuentsholing Highway. The average net population density in this area is approximately 30 to 35 persons per hectare, and six to seven dwelling units per hectare²⁴. Most of the housing in Babesa is located along the Thimphu- Phuentsholing Highway, and some clusters of traditional houses are found near the River. Along the road leading to the agro-industry estate, the density is moderate with housing for government officials located along the road bordering the project site. The density of settlements reduces towards the Botanical Gardens, the

¹⁹ NEC, 2008, *Bhutan Environment Outlook*, NEC.

²⁰ Thimphu City Corporation, 2006, *Local Area Plan: Babesa*, RGoB.

²¹ *ibid*

²² NEC, 2008, *Bhutan Environment Outlook*, NEC

²³ The population estimation is based on the ground verification of dwelling units and the assumption that a family consists of five members.

²⁴ Thimphu City Corporation, 2006, *Local Area Plan: Babesa*, RGoB.

Agro-industry estate and beyond²⁵. An increase in density is planned under the local area plan for Babesa providing for an estimated 2676 dwelling units.

The residents of Babesa are mainly of the middle-income group having moderate land holdings, developed as single-family houses. There is a small portion of lower-middle income cottages and wooden shacks also. A map showing the structures around the project site is provided below:

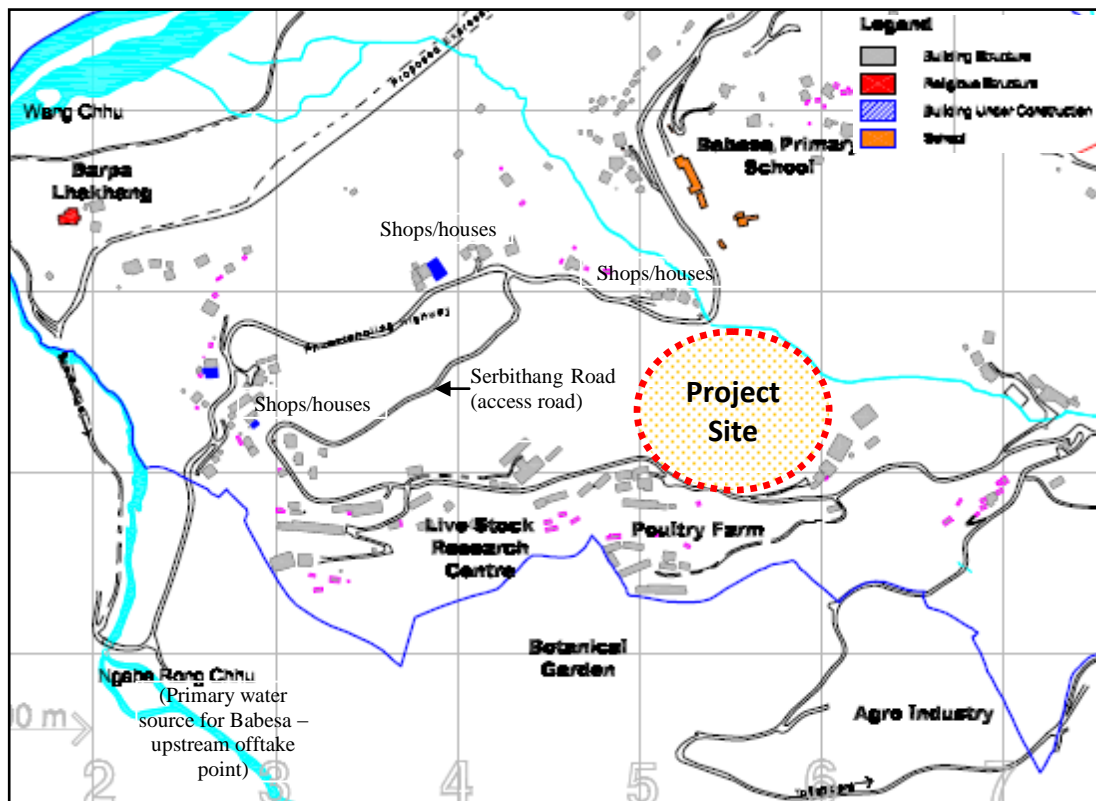


Figure 5: Structures around the project site

Source: *Local Area Plan (Babesa)*, RGoB, May 2006.

A public consultation was conducted using a face to face survey of households and businesses around the IT Park. The respondents of households that participated in the public consultation were equally represented by males (52%) and females (48%) and their ages range from 23 to 56 years. The household size ranges from 2 to 7 with an average size of 4.9. The households surrounding the project site largely comprises at least one member employed by the Government operated livestock breeding center – 43% of households that participated in the public consultation have at least one member employed by the Government. Housing has been provided for these households on government owned land. The employees of the livestock center are mainly low skilled workers employed as livestock attendants, drivers, etc. The average annual incomes of these households are therefore low and below Nu 1,00,000. The remaining households that participated in the public consultation live along the access road (Serbithang Road) and along the Phuntsholing highway and live in privately owned or rented accommodation. About 38% of the households that do not have a

²⁵ *ibid*

member employed by the government have small household business establishments such as grocery stores. The incomes of these households are higher – between Nu 1,00,000 and 5,00,000. Almost all structure are observed to be of a permanent nature and are one or two storey buildings.

4.3.2. Literacy and education

Adult literacy level in Bhutan was reported at 53% in the 2005 PHCB report and the PHCB suggests that Bhutan has a low level of literacy by both international and regional standards. Thimphu town has a significantly higher literacy rate of 75%. Educational facilities in Babesa are limited to one primary school, which is located immediately north of the project site. There is a nursery school at Dantak and the nearest junior high school is the Chhoden School at Lungthenphu²⁶.

About 52% of the respondents that participated in the public consultation indicated that they have had no formal education. Only about 14% of respondents were graduates.

4.3.3. Health

There has been a significant improvement in the country's health indicators, as seen in the life expectancy at birth which increased significantly since 1950s, from 36.1 years to 66.1 years at present. Infant mortality has decreased from 185/1000 live births to about 40.10/1000 live births²⁷. Nevertheless, with rapid development taking place in Bhutan there is a shift in disease pattern from infectious diseases to chronic diseases like hypertension, cardiovascular disease, cancers and diabetes. The infectious disease trends also have taken a challenging shift from curable to incurable like HIV and other viral diseases. The change in disease trends has place greater demand on quality tertiary care. Despite the increase in health work force and improvements in health infrastructure, there are still limitations in health care delivery²⁸.

This lack of adequate infrastructure in rural areas is reflected in the case of Babesa. There are currently no hospitals, dispensaries or basic health units in Babesa. The settlement's nearest medical facility is the Dantak Dispensary²⁹.

4.3.4. Economy

Bhutan is a predominantly agrarian society with 69% of the population living in rural areas and subsisting on an integrated livelihood system of crop agriculture, livestock rearing and use of a wide range of forest products. Sustainable management of agricultural crops, livestock and forest resources, collectively known as renewable natural resources (RNR), is therefore critical for rural economic development. The Gross Domestic Product (GDP) share of the RNR sector was 21% of the total GDP in 2004, making it the single largest sector contributing to the GDP. While the GDP share of the RNR sector has diminished over the years, the GDP amount of the RNR sector has grown from Nu 3,161 million in 1995 to Nu 8,256 million in 2005³⁰. In addition to the RNR sector, the country's economy also relies on hydropower production, tourism, and industrial development.

²⁶ Thimphu City Corporation, 2006, *Local Area Plan: Babesa*, RGoB.

²⁷ Ministry of Health, RGoB, 2009, *Annual Health Bulletin – 2009*, RGoB.

²⁸ *ibid*

²⁹ Thimphu City Corporation, 2006, *Local Area Plan: Babesa*, RGoB.

³⁰ NEC, 2008, *Bhutan Environment Outlook*, NEC.

Industrial development the country is inhibited by demographic and biophysical factors. Nevertheless, as of 2006, the Department of Industry had issued 14,730 industrial licenses – about 63% more than in 2000 when licenses issued numbered 9,016. However, a large percentage of the industrial licenses that have been issued do not actually materialize into industrial operations. In 2006, out of the total 14,730 licenses issued, 9,743 (i.e. about 66%) were operational. 97% of these operational licenses belonged to cottage-scale enterprises. In terms of type, more than 60% pertained to the service sector and about 29% were construction contracts. Only 8.5 percent were production and manufacturing industries³¹.

Tourism has grown into a major revenue-generating industry. It has provided an impetus to the development of the service sector and the promotion of Bhutanese culture. The average annual tourist arrival is 7,888 tourists (1995-2006), which results in average annual earnings of US\$ 9.8 million (1995-2006). In 2006 alone there were 17,344 tourist arrivals and gross earning of US\$ 23.9 million compared to and 4,765 tourist arrivals and gross earning of US\$ 5.8 million in 1995³². Babesa's economy appears to be based mainly on RNR, with livestock management being widely practiced in the area.

4.3.5. Employment

According to the 2006 Labor Force Survey, 96.9% of the total economically active population is employed. This employment rate however, has been decreasing over the years, with a drop from 98.2% in 2003 to 96.9% in 2006. The geographic distribution of employed persons shows the densest concentration in Chukha district followed by Samtse and Thimphu³³. Approximately 71% of employed persons worked in the agricultural, hunting and forestry; and public administration and defense sectors, in 2006. The 2009 Labor Force Survey data suggests that there is an overall growth in non-agricultural employment over the last two years. Agriculture and forestry still lead the way employing 204,400 or 65.37% of the labor force.

The 2009 survey results show that majority of the employed, 51.77%, are within the family business or profession and around 22.47% as self employed workers, indicating that small-scale enterprises are the biggest job generators³⁴. The latest study also shows that there is a higher rate of unemployment in the urban areas at 7.5%, compared to 3% in the rural areas. The unemployment rate in Bhutan has increased to 4% in 2009 from 3.7% in 2007, according to the 2009 survey. The increase translates to 13,000 unemployed people.

The unemployment group shows that people dropping out of school at the high and higher secondary level are the most unemployed, with around 5,000 in total, more than the illiterate, who number around 3,900. There are also 500 unemployed graduates³⁵.

³¹ ibid

³² ibid

³³ Ministry of Labor & Human Resources, 2006, *Labor Force Survey 2006*.

³⁴ Kuensel Newspaper, 2009, <http://www.kuenselonline.com/modules.php?name=News&file=article&sid=13328>,

³⁵ ibid

In Babesa, the agro-industry estate is the biggest work place. Other important work places include the poultry farms and the Live Stock Fertility Research Centre. The Botanical Garden is another work place, but is not fully developed yet and employs only a few gardeners. The paddy fields and orchards could be termed as seasonal work places. The city's sewage treatment plant is an intermittent work place. Small general stores and bars are the only commercial activity, operating on a regular basis. There are no major business houses in Babesa³⁶.

4.3.6. Transport and Traffic

Babesa has about 3.840 kilometers of surfaced roads and 2.948 kilometers of unsurfaced roads. Babesa is connected with other city areas by the Phuentsholing Highway. The Thimphu-Phuentsholing Highway, a 6.0m wide road, is the primary road traversing through Babesa. It is the arterial road from which different roads branch off to serve the Serbithang and the Wangchutaba areas. This road traverses through considerable slopes and the roads that branch off are steep, particularly at their junctions with the Thimphu-Phuentsholing Road. The only road that branches off the Thimphu-Phuentsholing highway and one which can be considered as a secondary road is the Serbithang Road, which leads to the Botanical Garden and the agro-industry estate³⁷. This is the road that also provides access to the Thimphu Tech Park. This is proposed to be developed as a 10.0m wide secondary road as part of the local area plan for Babesa. At present, this road carries very low traffic, mainly vehicles that access Bhutan Agro Industries and the botanical gardens.

Thimphu is the only urban center with a city bus service. The Thimphu city bus service was introduced by the Thimphu City Corporation in 1999 with a fleet of four buses covering Dechencholong, Hejo, Motithang and Babesa areas. In 2000, the Bhutan Post took over the Thimphu city bus service. Today, Bhutan Post has increased the fleet size to 14 buses, including one bus maintained as standby. The coverage of the city bus service was expanded to two additional areas namely Jungshina and Changbangdu.

One route of the city bus service caters to the population of Babesa. This bus route, Number 3, operates between the city bus stand and Babesa, the terminal point being the junction of the Thimphu-Phuentsholing Highway and the Serbithang Road. The bus stops are at Babesa Primary School, the DANTAK CSD Canteen and the DANTAK Wet Canteen, besides the terminal stop. The frequency during weekdays is once in the morning and twice in the evening while during weekends and holidays it is once in the morning, in the afternoon and in the evening³⁸.

The bus stops are at the junction of the Thimphu-Phuentsholing Road and the Serbithang Road and at the Babesa Primary School. The stops at DANTAK CSD Canteen and at DANTAK Wet Canteen are out of the Babesa local area. There are no taxi stands in Babesa. Two locations where spontaneous taxi parking is observed are at the Direction Deity Statue and at the junction of the Thimphu-Phuentsholing Road and Serbithang Road³⁹. Not all residences have proper parking areas within their

³⁶ Thimphu City Corporation, 2006, *Local Area Plan: Babesa*, RGoB.

³⁷ *ibid*

³⁸ *ibid*

³⁹ *ibid*

premises and it is common to see vehicles parked on the Thimphu-Phuentsholing Highway and the Serbithang Road, particularly during nighttime⁴⁰.

4.3.7. Water Supply

While at the macro level water availability in Bhutan is hugely positive, localized water shortages occur in several places due to growing human population, difficult terrain constraining tapping of water sources, and poor maintenance of water storage and distribution facilities⁴¹.

The water supply system in Babesa is presently a part of a Rural Water Supply Scheme. The Rural Water Supply Scheme provides untreated natural water tapped from the Ngabe Rong Chhu and an irrigation canal flowing through upper Serbithang. The distribution network consists of privately owned PVC, or galvanized iron pipes, and hoses attached to a main line laid out by the Public Health Engineering Division of the Ministry of Health and Education. This network does not follow any hierarchical structure and connections are made on an “as and when needed” basis. Due to this, there is no data available for the number of connections or the consumption pattern. There are no water meters. The Babesa local area water supply system covers most areas between DANTAK and the junction of the Thimphu-Phuentsholing Highway and the Serbithang Road. In this system, water is tapped from the irrigation canal running outside the municipal boundary and distributed from the storage tank near Bhutan Agro Industries in Upper Serbithang. TCC has provided a separate water line from this source to Babesa Primary School. As part of an Asian Development Bank funded scheme, TCC is planning a new water line from the Ngabe Rong Chhu with filtration and chlorination for supply to the community. This is expected to be completed by 2012⁴². The population that is not covered in this scheme is presently dependent on natural streams and springs for their drinking water⁴³.

4.3.8. Storm Water Drainage

Roads serve as storm water drains in most of the local area and this has resulted in a deterioration of the roads’ surfaces, as they become natural flow paths for the rain. The Thimphu-Phuentsholing Highway has a storm water drain all along its eastern (upper) edge. Serbithang Road has a storm water drain as well that was recently completed. Other areas or roads do not have storm water drains. Most areas are still dependent on natural slopes, gullies and the natural drainage pattern for storm water runoff. Below the Thimphu- Phuentsholing Highway, in the paddy fields, the natural streams are channeled to irrigate the fields, before eventually merging into the River⁴⁴.

4.3.9. Sewage and Sewerage System

At present, only the cities of Thimphu and Phuentsholing have sewerage systems. The sewerage/waste water treatment plant in Thimphu has a designed capacity of 1,750 m³ per day. The actual volume of sewerage/ waste water treatment at present ranges between 1,300-1,500 m³ per day⁴⁵. The treatment is a natural system consisting of aerated lagoons. This system treats about 40%

⁴⁰ ibid

⁴¹ ibid

⁴² Based on discussions with TCC.

⁴³ Thimphu City Corporation, 2006, *Local Area Plan: Babesa*, RGoB.

⁴⁴ ibid

⁴⁵ NEC, 2008, *Bhutan Environment Outlook*, NEC.

of Thimphu's wastewater and is operating at capacity. Though the sewerage treatment plant is located in Babesa, the local area does not form part of the city sewerage management network.

Houses in Babesa employ 'septic tank-soak pit' systems. Private septic tanks were made mandatory only in 1997. An overall level of hygiene is maintained in the area and open sewerage flow is uncommon. It is difficult to clean the septic tanks by mechanical cesspool cleaners due to the remoteness of such tanks, particularly in areas adjacent to the agro-industry estate⁴⁶. A new decentralized wastewater system is being planned for Babesa further south with assistance from the Asian Development Bank.

4.3.10. Solid Waste

Over the last decade, solid waste generation and disposal has grown into a major environmental problem especially in urban centers across Bhutan. Existing solid waste management is basically limited to waste collection and disposal in landfills. Increase in consumption patterns, the absence of waste segregation and the lack of application of proper landfill management practices have resulted in the overfilling of the existing landfills.

According to a survey conducted by the Royal Society for the Protection of Nature (RSPN) in August 2005, per capita solid waste generated in Thimphu is estimated to be 0.46 kg per day or 168 kg per annum. Solid waste generation in Thimphu has seen an increase of nearly 67% since 2003, when daily solid waste generation in the city was estimated to be 22 tonnes. The generation of municipal solid waste has been so enormous that it has exceeded the capacity of the existing landfill at Memelakha well before its expected life span⁴⁷. Thimphu City Corporation operates a fleet of trucks for collection of garbage from various locations at a frequency of two-three times a week from residential areas and on a daily basis (excepting Sunday) from commercial areas. There is currently no practice of segregating the waste at the collection point. As the existing landfill in Thimphu has exceeded its capacity, a new landfill site has been identified⁴⁸.

Babesa has recently been covered under TCC's solid waste collection and management system. The frequency of solid waste collection from TCC is two to three times per week. The agro-industry estate, the Livestock Fertility Research Centre and the poultry farms are supposed to manage the solid waste generated in their own premises. Waste segregation has been attempted at the Botanical Gardens, but does not appear to be successful.

4.3.11. E-Waste

With e-equipment usually being passed down to family and friends, Bhutan's generation of e-waste is still comparatively small. Discarded e-equipment in Bhutan is also regularly 'cannibalised' or recycled by local hardware shops to make other e-equipment. No studies have been done on the country's e-waste situation, but it has been reported that cell batteries and fluorescent lights were

⁴⁶ Thimphu City Corporation, 2006, *Local Area Plan: Babesa*, RGoB.

⁴⁷ *ibid*

⁴⁸ *ibid*

the primary e-waste pollutants entering the environment. While some initiatives have been made to address e-waste, they have largely been ineffective⁴⁹.

According to the Department of Information Technology (DIT), the government owns 90% of an estimated 10,000+ computers (and peripherals) in Bhutan, and is getting rid of its e-waste by simply auctioning it to scrap dealers. The Department of National Properties (Ministry of Finance) collects e-waste and auctions between 1,800 to 2,400 items that the government surrenders annually. Some are bought by local dealers for reuse of parts, but most end up in India⁵⁰.

DIT is also in the process of forming rules to reduce e-waste generation by the upcoming IT Park. Companies may be required to purchase mostly 'green' e-equipment with biodegradable parts, and with a 'take back' option, which means e-equipment once not usable can be returned to the manufacturer. Companies will also be required to send their e-waste to only approved recycling companies⁵¹.

4.3.12. Power, Telecommunications and Cable Network

The Bhutan Telecom has recently established a new exchange above DANTAK. It will cater to the demand generated in Simtokha, Babesa and Serbithang. All connections are served by an overhead network in the absence of any underground network. The present demand, as well as the anticipated demand for the future, is taken care by this new exchange. Overhead high-tension lines span across the Ngabe Rong Chhu, traverse the Upper Serbithang area, terminating at the Simtokha Power Station. The power distribution system is an overhead network system and nowhere in Babesa, are there any underground power distribution networks.

At present, a power line runs through the project site. This is proposed to be relocated to run along the Serbithang road.

4.3.13. Open Space and other amenities

There are presently no police posts, fire stations, public libraries or postal facilities in Babesa. The only organized recreational space in Babesa is the Royal Botanical Garden founded in 1999 in Serbithang. This falls outside the Babesa Local Area Plan area. There are no other organized play areas, parks or gardens⁵². The project site is occasionally used by the local community for archery, the national sport. However, other open lands are also used in the broader area for this purpose.

There are no commercial complexes, community shopping centers or fair price shops. However, there are numerous general stores and a few bars cum restaurants scattered along the Thimphu-Phuentsholing Highway that are run by the owners themselves. A couple of shops are located on the Serbithang road leading up to the Royal Bhutan Agro-industry estate. These shops fulfill the day-to-

⁴⁹ Kuensel Newspaper, 2009, <http://www.kuenselonline.com/>

⁵⁰ ibid

⁵¹ ibid

⁵² Thimphu City Corporation, 2006, *Local Area Plan: Babesa*, RGoB.

day shopping needs of the local residents, while they have to go to the city core for weeklong supplies of vegetables and household items⁵³.

4.3.14. Aesthetics and Heritage

According to the Thimphu Structure Plan, the natural features of visual importance within the city have been analyzed using the following parameters:

- ‘The formation of visual corridors and the visual experience they offer
- The boundaries demarcating elements of the valley
- The extent of vision and comprehensibility of the “Visual Scale” of the valley
- The physical structure of the city
- Locations of strategic importance in terms of views and visual access’

According to the Structure Plan’s map, Babesa is located within a ‘visual corridor with views of interesting hill compositions’⁵⁴. Also along the existing expressway, there are two clusters of five to eight houses each, built in traditional style and materials. This is a traditional settlement, probably the oldest settlement in Babesa Village, and one of the oldest in the Thimphu Valley. Similar old traditional houses can be seen near the Barpa Lhakhang⁵⁵.

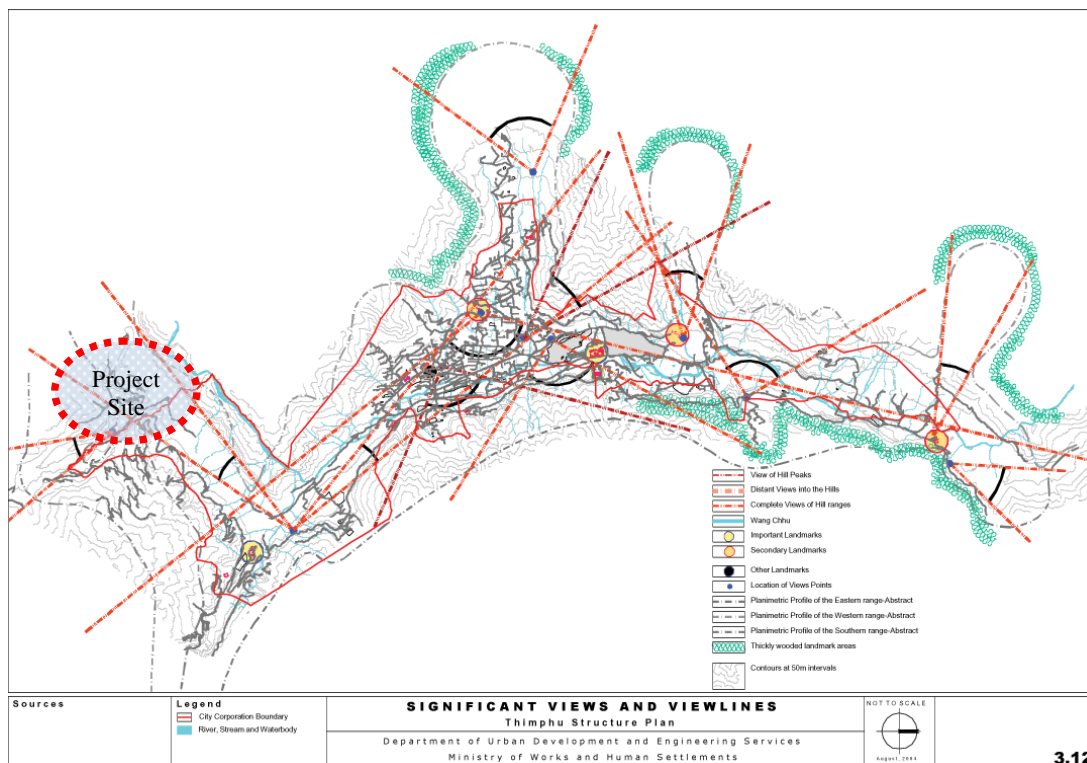


Figure 6: Significant views and viewlines in Thimphu

Source: *Thimphu Structure Plan*

⁵³ *ibid*

⁵⁴ DUDES, 2004, *Thimphu Structure Plan 2002-2027*, DUDES.

⁵⁵ Thimphu City Corporation, 2006, *Local Area Plan: Babesa*, RGoB.

5. Assessment of Environmental Impacts

Implementation of the IT Park project is likely to bring about changes in the physical, biological, socioeconomic and cultural environment, which can have beneficial as well as adverse impacts. This section assesses the environmental impacts generated as a result of developing this project.

The environmental impacts have been identified based on the activities that are to be undertaken by the project and its expected outcome on the environmental baseline presented in the previous chapter. Each of the environmental aspects has been examined in terms of the current condition, likely impacts during construction and subsequent operational phases. The impacts have been predicted in terms of their magnitude, significance and nature.

These possible impacts (positive and negative) from the proposed IT Technology Park during construction and operation are detailed in the following sub-sections and a summary of the impacts is presented in the table below.

Table 3: Summary of Environmental Impacts

Environmental Components	Impact Description	Impact Criteria		
		Type		Nature
		Beneficial	Adverse	
Construction Phase				
Land	Impact on site topography due to construction work		√	Permanent
Soil	Impact on soil erosion		√	Permanent
Air Quality & Noise	Impact due to use of equipment and construction traffic		√	Temporary
Surface Water	Impact on drainage pattern and stream water quality		√	Temporary
Ground Water	Impact on ground water quality		√	Temporary
Flora & Fauna	Impact on vegetation and wildlife found on site		√	Temporary
Protected Areas	Impact on Environment Conservation Precinct		√	Temporary
Population	Impact due to migrant laborers		√	Temporary
Economy	Impact on land prices and local economy	√		Permanent
Employment	Impact on employment	√		Temporary
Health	Impact on health of laborers and local residents		√	Temporary
Open Space & other amenities	Impact on recreational space and activities		√	Temporary
Transport & Traffic	Impact due to construction activities		√	Temporary
Water Supply	Impact on source of water supply		√	Temporary
Storm Water Drainage	Impact on volume of stream flows		√	Temporary
Solid Waste Disposal	Impact on solid waste disposal infrastructure		√	Temporary
Power & Telecommunications	Impact on power line running through project site		√	Temporary
Aesthetics & Heritage	Impact on views and visual corridors		√	Temporary
Operational Phase				
Soil	Impact on soil erosion	√		Permanent
Air Quality & Noise	Impact due to building equipment and systems, and traffic		√	Permanent
Surface Water	Impact on drainage pattern		√	Permanent

Environmental Components	Impact Description	Impact Criteria		
		Type		Nature
		Beneficial	Adverse	
Flora & Fauna	Impact due to landscaping	√		Permanent
Protected Areas	Impact due to development adjacent to ECP		√	Permanent
Population	Impact due to increase in population	√		Permanent
Economy & Employment	Impact on land prices, local economy and employment	√		Permanent
Education	Impact on education infrastructure and local skills set	√		Permanent
Transport	Impact on transportation facilities and infrastructure	√		Permanent
Traffic	Impact on traffic volume		√	Permanent
Water Supply	Impact of water supply infrastructure	√		Permanent
Solid Waste Disposal	Impact on solid waste disposal infrastructure		√	Permanent
Aesthetics & Heritage	Impact due to project building architecture	√		Permanent

5.1. Construction Phase

5.1.1. Physical Environment

Land

Construction related activities include site clearance, excavation, back filling and compaction work. The topography of the site is likely to be changed due to changes in levels and gradients not only for the building footprint, but also for parking areas, interior roads/pathways as well as services. Since the design of the building and siting of services largely takes into account the site topography, the quantum of cut and fill is not very high. The impact is therefore likely to be low to moderate in *magnitude*.

Alteration of the topography of the project site could cause a number of *indirect* impacts on soil, surface water, drainage and vegetation, which are discussed in detail under separate sub-sections. The *significance* of the indirect impacts of changes in topography are therefore considered to be very high.

The potential impacts of altering the topography of the project site are permanent in nature and adverse, which will require adequate mitigation measures for the indirect impacts.

Soil

Clearing the project site of vegetation, excavation and back filling for foundation and leveling work can cause significant impacts on the soil in terms of erosion. This is exacerbated due to the site slope and the nature of the soil.

Construction activity can cause loss of nutrient rich top soil and gullying. The predominant gravelly nature of the soil with high amounts of clay is likely to easily increase erosion once the top-soil is excavated. This degradation of soil indirectly impacts natural drainage patterns which could exacerbate scouring erosion, particularly during the monsoon. Run off from the project is likely to contain more sediments which increases siltation in the stream flowing adjacent to the project site.

These impacts are likely to be high in magnitude and also in significance. Although adverse, the impacts are temporary in nature. However, with appropriate mitigation measures adopted during construction the magnitude of the impact can be reduced.

Air Quality and Noise

The project implementation would involve the use of a number of equipment and heavy machinery⁵⁶ for construction related activities. In addition, construction requires vehicles such as dump trucks for transportation of materials as well as disposal of construction wastes. Given the low volume of traffic movement or other development in Babesa, activities associated with the construction of the IT Park are likely to increase noise levels and generate dust as well as vehicular pollution affecting the air quality of the local environment. The magnitude of the impact is therefore likely to be moderate to high.

These impacts are temporary but will adversely affect local residents and environment. The impacts are therefore considered to be moderately significant. Appropriate mitigation measures could reduce the magnitude of the impacts.

Surface Water

Surface water in Babesa includes the Ngabe Rong Chuu tributary of the Wang Chhu and other small streams that flow adjacent and through the project site.

Site clearance, excavation and other construction related earthworks which alters the topography and vegetation on the project site are likely to significantly impact drainage patterns and volume of flood flow on site. Less vegetation will potentially increase stream flows during heavy rains and also siltation of the existing stream around the site. Change in landscape could aggravate the impacts on drainage patterns of excess rain water that falls on the project site. Waste water from labor camps is also likely to increase the flow and quality of surface water. However, as with the magnitude of impacts on land, the magnitude of impact on surface water is also likely to be low to moderate. Since the quality of stream flows are important sources of water in Thimphu, the significance of the impact is considered to be high.

These impacts are likely to temporarily affect the surface water and its drainage on the project site and surrounding areas adversely unless adequate mitigation measures are implemented.

Ground Water

The existing quality of ground water at the project site is unknown. However, waste water from construction labor camps could affect the quality of the ground water if it is untreated and discharged over land or into streams. This impact however, is temporary and low in magnitude given the small number of laborers (60-80) likely to be on site at any given time. Since groundwater is not used in the area, the impact is not considered significant.

⁵⁶ Construction equipment include bull dozers, excavators, concrete mixers & pumps, compactors, vibrators, plate compactors, mobile/tower cranes, flame torches, hand tools – arc welding machine & electrodes, water pumps and generators.

Appropriate mitigation measures will ensure there are no adverse effects on the quality of the ground water.

5.1.2. Biological Environment

Flora and Fauna

There are no protected species of plants, animals or birds found on site. However, the existing micro environment of the project site is likely to be affected due to changes in topography and site clearance activities.

Construction operations are likely to damage vegetation and cause soil erosion (discussed earlier) that could affect micro habitats. Increased noise level from operation of heavy machines and movement of workers could also raise the level of the impact. The magnitude of impact could be moderate. Since there are no threatened species or important habitats that are impacted, the significance of the impacts is low.

These potential adverse impacts on the flora and fauna of the project site are expected to be temporary, and mitigation measures can ensure the restoration of biodiversity on site following the construction phase.

Protected Areas

The Environment Conservation Precinct adjacent to the northern boundary of the project site restricts development within 15 meters from either side of the stream. Construction activities could increase the flow of surface water on site can increase the silt load entering this protected stream. Waste water from the labor camp can also affect the water quality of the stream. Other potential impacts could include dumping of construction material in the protected area. The magnitude of the impact could be moderate and the significance high.

These adverse impacts are temporary and can be easily mitigated with proper management of construction activity and site.

5.1.3. Socioeconomic and Cultural Environment

Population

Given the small and relatively unskilled local population of Babesa, construction of the IT Technology Park will inevitably require laborers and specialists from outside the area and possibly the country. It is estimated that during the construction phase around 250-300 people will be employed at the project site, of which 100-125 are likely to come from outside Bhutan.

Impacts due increase in population in the local area include stress on infrastructure/amenities and possibly social tension between local residents and migrant workers. Nevertheless, these potential adverse impacts are likely to be temporary and small in magnitude given the very small number of migrant workers on site at any given point in time. The significance of the impact is considered moderate since the non-local population in Babesa is very small at present.

Economy

Currently the local economy of Babesa is predominantly based on crop and livestock management. Construction activity related to the development of the IT Park can trigger an increase in agricultural and residential land values in areas adjacent to the project site. The impact is likely to be moderate in magnitude due to direct and indirect impacts but high in significance since Babesa has only recently been incorporated into Thimphu city limits. The construction of the IT Park would also provide a boost to the local economy, which would benefit the area - migrant construction workers employed at the project site can create a demand for some services such as food, lodging and entertainment, which will enhance the local economy.

Hence, these impacts can be highly beneficial and permanent to landowners around the area as well as for the local economy of the area.

Employment

There is very limited employment generation activity in Babesa. Construction of the IT Technology Park is expected to create between 200-250 temporary construction jobs. The table below provides details of the construction workers to be employed on site.

Table 4: IT Park construction related employment

Workers	Number
<i>Total National</i>	90-105
Professional / Technical	5
Casual / Seasonal	85-100
<i>Total Non-national</i>	100-125
Professional / Technical	5
Casual / Seasonal	95-120

The table shows that a majority of the construction laborers are likely to be seasonal or casual workers and non-nationals. At any given time, it is anticipated that 50-60 number of people will be employed at site.

The creation of employment opportunities for local people in the area is likely to be a beneficial but temporary impact during construction. Since the local population of Babesa is relatively low, the magnitude of the impact could be moderate to high. Construction related work would provide opportunities to local people with low level of skills currently engaged as casual laborers in the agricultural sector. Indirect employment is also likely to increase. Thus, the impact of this could be significant. The attitude of the local people around the site towards the construction of the IT Park is highly positive largely due to the opportunities that the construction activity will generate (discussed in detail in the chapter on the public consultation process).

Health and Safety

The occupational hazards of a construction site are likely to raise the level of risk in terms of health and safety of the workers at the project site. Without adequate mitigation measures to tackle pollution resulting from dust and emissions due to earthwork and transportation of construction material, there can be potential adverse impacts on health of laborers on site as well as local

residents. Other significant impacts on health and safety as a result of accidents onsite can be avoided by implementing appropriate health and safety regulations during construction. Since the impacts are both direct (for the workers on site) as well as indirect (for the local residents around the project site), the significance of the impact is considered moderate. The magnitude of the impact is considered low since no toxic pollution is expected.

Transport and Traffic

The main arterial road servicing Babesa is the Phuentsholing highway. This road connects the area to the main urban center of Thimphu. Within Babesa, the Serbithang road services the project site. These roads currently handle very less and infrequent traffic at present.

Construction of the IT Park will require the transportation of a significant amount of material and waste. In addition some laborers from surrounding areas are likely to travel to the area. The increased traffic in the area will potentially impact the current transport infrastructure. This increased traffic on the narrow roads servicing the project site is likely to affect smooth traffic flow. Although TCC has proposed to widen the Serbithang road as part of the Babesa local area plan, this is unlikely to commence before construction begins for the Thimphu Tech Park. Parking of trucks and other vehicles visiting the construction site are likely to create problems given the current lack of public parking spaces in Babesa. Laborers travelling to the site from other areas can further stress the current limited and infrequent bus service to Babesa. The magnitude and significance of this impact could be moderately high.

These impacts although temporary, are likely to be adverse if adequate transport and traffic management measures are not adopted.

Open Space and other amenities

The main open space of significance in Babesa is the Royal Botanical Garden, which is located at a fair distance from the project site and which is accessed from the same Serbithang road as the IT Park. Hence, there are likely to be no significant impacts on the open space although construction related traffic on the road could impact accessibility to the Botanical Garden.

The project site and the adjacent 13-acre land, which is presently used for grazing purposes by the Livestock Breeding Centre, is also occasionally used for recreational purposes (archery practice), which is likely to be disrupted due to the construction activity. Since other similar areas are available for informal recreational activity, the impact is negligible in magnitude and is also low in significance.

Water Supply

The Rural Water Supply Scheme in Babesa, which provides untreated natural water tapped from the Ngabe Rong Chhu. An off-take point near the Agro Industry provides water to a majority. Currently, there does not appear to be any stress on water supply in the area. However, the local residents experienced shortages during the construction of the Botanical Gardens which used water from the same source. For the purpose of the IT Park construction, water will be provided from the same supply line to the neighbouring Babesa primary school, which is tapped from another point of the

Ngabe Rong Chuu. Thus, there is unlikely to be any impact on water supply in the area during construction of the IT Park.

Storm Water Drainage

Most rural areas depend on natural slopes, gullies and the natural drainage pattern for storm water runoff. Construction activity at the project site can increase the runoff from the site altering natural drainage patterns as well as overloading existing culverts. Additionally, construction material and waste, and waste from labor camps that are not appropriately stored or disposed can clog the storm water drains. Site clearance and excavation can also affect the silt loads adversely. Since this impact is both direct as well as indirect and affects other environmental aspects such as erosion, it is considered to be high in significance. The large area of site clearance and changes in levels could result in impacts that are moderate to high in magnitude.

Appropriate mitigation measures can ensure that these temporary adverse impacts are avoided.

Solid Waste Disposal

During the project construction stage, a significant quantity of construction waste can be generated from site clearance and waste material. Although excavated material is expected to be significant, this would be used up on site for filling requirements. Improper storage of construction wastes on site can lead to increase in silt loads and dust apart from visual pollution. The disposal of this waste could also result in dust during its transportation. The transportation of this material for disposal could also result in dust, vehicular emissions and also affect traffic flow on the narrow access roads. In addition, labor generated waste can also pose an environmental problem if it is not managed properly. The magnitude and significance of this temporary adverse impact, if adequate mitigation measures are not adopted, are likely to be moderate.

Power and Telecommunications

The power distribution system in Babesa is an overhead network, with one line running through the project site. There are no reported issues with regards to power supply in the area. Telephone line and electricity lines run directly over the project site, which need to be relocated suitably without major services disruption. Construction activity is estimated to use around 150,000 units of power per annum. The existing network appears to be adequate for supplying power to the project site.

However, construction activity onsite can potentially affect the power line running through the site disrupting power services in the area unless relocated before commencement of the project construction. The magnitude and significance of the impact is likely to be low.

Aesthetics and Heritage

According to the Thimphu Structure Plan, Babesa is located within a 'visual corridor with views of interesting hill compositions'⁵⁷. Construction of the IT Park could have a potential adverse but temporary impact by obstructing views within the visual corridor. However, the small scale of the project would result in a low magnitude of impact although the significance is high.

⁵⁷ DUDES, 2004, *Thimphu Structure Plan 2002-2027*, DUDES.

5.2. Operational Phase

5.2.1. Physical Environment

Soil

The IT Technology Park, once completed, would have a significant level of landscaping in terms of vegetation and paving. The vegetation used will prevent the erosion, gullyng and loss of nutrient rich top soil. Hence, landscaped areas will have a permanent beneficial impact on soil. However, areas that have recently been leveled and terraced for the parking and other services and where vegetation is not provided could have increased erosion levels.

Air Quality and Noise

During the operational phase, the IT Park is likely to use a number of equipment for HVAC, water pumping, diesel generators during power outages, and movement as part of building use, maintenance and management. These equipment and machinery are likely to create a certain amount of noise and release fugitive emissions affecting the air quality. Transportation of employees and workers at the facility will increase traffic movement to and from the area. Emissions and noise pollution from vehicles is likely to have a permanent adverse impact of the air quality and noise environment of the area. The magnitude and significance of the impacts are likely to be moderate.

Appropriate mitigation measures to ensure lesser traffic movement and equipment provided with noise suppression lower emissions could have impacts of lower magnitude.

Surface Water

The increase in paved areas of the site is likely to inhibit the percolation of rain water falling onsite. As a result, the increased runoff from the site is likely to affect stream flows. Additionally, the drains provided on site could carry a heavier silt load from landscaped areas of the sloping site, which could in turn affect siltation in the adjacent stream into which the site would drain. The magnitude and significance of the impact are likely to be moderate.

Allowing for some percolation by providing semi-permeable paving in certain areas and also providing silt traps/bioretenion basins near the outlet of the site drainage could mitigate this impact.

5.2.2. Biological Environment

Flora and Fauna

Landscaping within the IT Technology Park will replace and increase the vegetation cover on the project site. The endemic plants used within the landscaped areas could rejuvenate the micro environment and enhance the flora and fauna from its present state. This will be a permanent benefit to the flora and fauna in the area. The impact would be moderate in magnitude and significance since the aesthetic quality would also be enhanced.

Protected Areas

The IT Technology Park is situated within close proximity of the Environment Conservation Precinct in Babesa. With increased population in the area in terms of employees, there are likely to be some indirect impacts on the precinct. Waste disposal and runoff from the site can potentially pollute the

stream and degrade the pristine environment. These potential adverse impacts will need to be mitigated appropriately.

5.2.3. Socioeconomic and Cultural Environment

Population

The operation of the IT Technology Park is likely to create an influx of people into the area. This increase in population will include, employees working at the IT Park (see below) who have migrated to Babesa or commute from surrounding areas. It is also likely to include people migrating to meet the potential demand for services supporting the facility and its employees. This increase in population could potentially create sufficient demand for local economic, social and infrastructure development. The impact is considered to be positive since Babesa has recently been incorporated into Thimphu City and is still predominantly rural in character. The operation of the Thimphu Tech Park is likely to increase the density of the area. The direct and indirect impacts are likely to be moderate in magnitude over the long term and high in significance.

Economy

The IT Park at Babesa is aimed at providing infrastructure to support the IT industry that is likely to contribute not only to the local but also, more importantly, to national economic development. The Technology Park is likely to increase the value of agricultural and residential land surrounding the site, which will benefit landowners. Informal development and demand for supporting infrastructure and services in the area could potentially shift the basis of the local economy away from agriculture and animal husbandry. Impacts of the facility are likely to permanently benefit the area through the improvement of infrastructure and the development of the local commercial and retail economy. The magnitude and significance of the impact are likely to be high over the long term.

Employment

The IT Technology Park is expected to create between 350-450 permanent full-time and part-time jobs in the area during the operational phase. The table below provides details of the numbers of local and non-local workers likely to be employed in the IT Park.

Table 5: IT Park operation related employment

Workers	Number
<i>Total National</i>	225-275
Professional / Technical	225(depending on skilled labor)
Casual / Seasonal	25-30
<i>Total Non-national</i>	125-150
Professional / Technical	125
Casual / Seasonal	10-20

About a third of the employees at the IT Park are likely to be non-nationals. Nevertheless, direct or indirect employment opportunities are likely to have beneficial impacts on the employment levels and profiles of local and regional population. The magnitude and significance of the impact is expected to be high.

Education

It is recognized that the availability of a stream of trained IT manpower is a pre-requisite for the success and sustainability of the IT Park in Bhutan. One of the aims of the IT Technology Park is to promote the development of a three-tiered skills program for promoting the IT/ITES industry. In addition the employment opportunities generated by the IT Park is also likely to create a demand of skilled laborers, which could encourage local people to improve their educational qualifications.

This is likely to have a permanent beneficial impact on education albeit indirectly. The magnitude and significance of the impact is expected to be moderate.

Transport and Traffic

Improved road infrastructure servicing the IT Technology Park, is likely to improve the accessibility in the area. However during the operational phase, the increased traffic to and from the IT Park is likely to impact the movement of local residents. Additional environmental externalities from increased traffic cause potential adverse impacts, requiring suitable transport and traffic management. The impacts are likely to be moderate in magnitude and significance.

Water Supply

During operation the IT Park is expected to use approximately 9,450,000 litres of water per year. The water supply for operations will be provided through an Asian Development Bank funded scheme being planned for the entire Babesa area. Therefore water supply infrastructure will not be impacted. The IT Park will have several water efficiency features built into the design such as rainwater harvesting, low water consumption fixtures, using treated wastewater for flushing and low water consuming landscaping. These features would ensure the least possible demand for fresh water supply, which would place minimum stress on the water supply infrastructure.

Power and Telecommunications

Operating power for the Data Center, electrical raw power, lighting, AC, and other services within the IT Park is expected to use 3,450,000 units per annum. The existing infrastructure likely to be able to support this demand for power and hence will not have any significant impact.

Solid Waste Disposal

During the operation stage there is likely to be an increase in solid waste generated. This waste will mainly consist of paper waste, STP sludge, organic waste from litter and e-waste. Solid waste disposal infrastructure is collected and transported by Thimphu City Corporation at present. The increase in quantity is likely to have an adverse impact on TCC's resources. The magnitude of the impact is expected to be low since the quantity of waste generated on site is unlikely to be high.

Aesthetics and Heritage

The IT Technology Park will be built in harmony with the Bhutanese traditional architecture to blend with the local environmental setting. Preserving the architectural traditions will have a beneficial impact on the aesthetics and heritage of the country. The facility will be a three-storey building which will have no significant impact on the visual corridor and views of the hill compositions.

6. Social Impacts

Section 3.5 of the Bid Document dated 6th May 2009 (Appendix 3(c): Technical Standards, pg 9 of 9) mentions that “As part of the environmental assessment, a basic social assessment will need to be conducted by the successful private investor bidder, to ensure access for those households and businesses above and below the IT Park and surrounding the access roads”.

Potential social impacts discussed in detail in Chapter 5 are summarized below. The mitigation measures for potential adverse social impacts occurring during different phases have been detailed in Chapter 8.

6.1. Construction Phase

6.1.1. Beneficial Impacts

The construction of the IT Park would provide a boost to the local economy, which would benefit the area - migrant construction workers employed at the project site can create a demand for some services such as food, lodging and entertainment, which will enhance the local economy. The impacts on the local economy and to landowners can be highly beneficial and permanent.

The creation of employment opportunities for local people in the area is likely to be a moderate to highly beneficial but temporary impact. Construction related work would provide opportunities to local people with low level of skills currently engaged as casual laborers in the agricultural sector. Indirect employment is also likely to increase, thereby having significant impact. The attitude of the local people around the site towards the construction of the IT Park is highly positive largely due to the opportunities that the construction activity will generate (discussed in detail in Chapter 7).

6.1.2. Adverse Impacts and Mitigation Measures

The five acre land allocated by the RGoB for the IT Park is part of an 18-acre parcel in Babesa classified as ‘Institutional’. The five acre parcel has no structures on it and is vacant. An electricity and telecom line run through the site. Since the land acquired for the IT Park is vacant and no displacement was required, there are no directly affected persons as a result of land acquisition for the project. The site has direct road and power access available and there is no requirement for any additional ancillary infrastructure. There is therefore no displacement of people with regard to the IT Park or ancillary facilities. Thimphu City Corporation proposes to widen the existing access road from 6.0m to 10.0m as part of the Babesa Local Area Plan. The land required for this purpose is also government owned land requiring no displacement. A map indicating land ownership patterns around the project site is shown in **Figure 7** below:

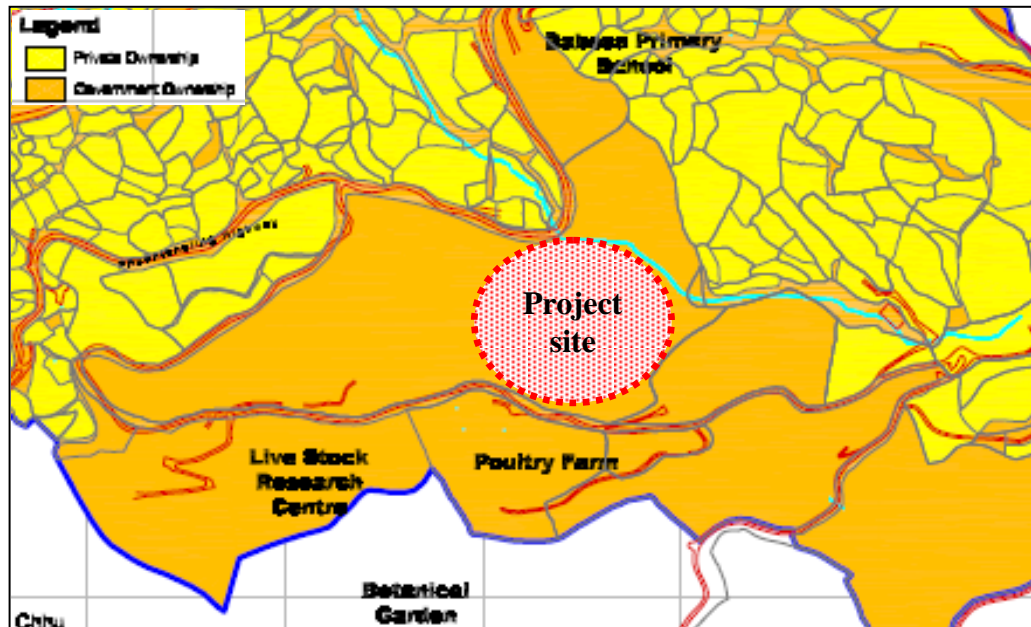


Figure 7: Land ownership pattern in Babesa
(Source: Babesa Local Area Plan, 2006)

The land for the IT Park is presently used for grazing by the Livestock Breeding Centre of the Ministry of Agriculture and is also occasionally used for recreational purposes (archery practice).

There are no private individuals that use or depend on the land for their livelihoods. The 13-acre parcel adjoining the IT Park site has a few structures belonging to the Livestock Breeding Centre. These structures are for housing cattle and some are also quarters provided by the Centre for caretakers of the cattle. The residents of all the housing quarters are employed by the Livestock Breeding Centre. The Livestock Breeding Centre is presently in the process of shifting to another location and freeing up the land it currently occupies for other urban facilities proposed in the Local Area Plan for Babesa. The employees would be provided accommodation at the new location. A few of these residents were interviewed as part of the public consultation process and expressed that the IT Park would benefit Bhutan and were therefore positive about this development despite their impending shift to another location. With regards to the current activities carried out onsite, they are likely to be disrupted due to the construction activity. Since other similar areas are available for informal recreational activity, the impact is negligible in magnitude and is also low in significance.

Other pre-construction and construction related activities are likely to result in some adverse social impacts. Air and noise pollution emanating from construction activity is likely to have a moderately significant but temporary impact on the local residents' quality of life. However, impacts on health and safety of workers and local residents (indirect) are considered to be low in magnitude given the unlikelihood of toxic pollution. In addition dust suppression; and noise attenuation and regulation of working hours will mitigate impacts due to air and noise pollution.

Increase in population in the local area includes stress on infrastructure/amenities and possibly social tension between local residents and migrant workers. Nevertheless, these potential adverse impacts are likely to be temporary and small in magnitude given the very small number of migrant

workers on site at any given point in time. The significance of the impact is considered moderate since the non-local population in Babesa is very small at present.

This increase in temporary population in the area and the inadequacy of existing transport infrastructure is likely to result in short-term moderately high impacts. However, appropriate traffic management measures will ensure accessibility is not affected. There is unlikely to be any impact on the accessibility to the Royal Botanical Garden.

The influx of migrant workers can also have a moderately significant but temporary impact on solid waste disposal in the local area. Local water supply is unlikely to be impacted due to the proposed different off-take point from the Ngabe Rong Chuu.

6.2. Operational Phase

6.2.1. Beneficial Impacts

There are a few private properties along the access road to the IT Park. These are mainly residences and a few private shops run by households. These are small shops that cater to the local population. Discussions with the owners of these establishments also indicate their positive attitude towards the development of the IT Park during construction and operation. The expectation that local job opportunities would increase and benefit their business as well as increase land values was very high.

Informal development and demand for supporting infrastructure and services in the area could potentially shift the basis of the local economy away from agriculture and animal husbandry. Impacts of the facility are likely to permanently benefit the area through the improvement of infrastructure and the development of the local commercial and retail economy.

Increase in population as result of the development could potentially create sufficient demand for local economic, social and infrastructure development. The impact is considered to be positive since Babesa has recently been incorporated into Thimphu City and is still predominantly rural in character. The operation of the Thimphu Tech Park is likely to increase the density of the area. Direct or indirect employment opportunities are likely to have beneficial impacts on the employment levels and profiles of local and regional population. IT Park is also likely to create a demand of skilled laborers, which could encourage local people to improve their educational qualifications. This is likely to have a permanent beneficial impact on education albeit indirectly.

These direct and indirect impacts are likely to be moderate in magnitude over the long term and high in significance.

6.2.2. Adverse Impacts and Mitigation Measures

During the operational phase, transportation of employees and use of generators, HVAC systems and pumping systems are likely to have a permanent adverse impact of the air quality and noise environment of the area. The magnitude and significance of the impacts are likely to be moderate.

Appropriate mitigation measures to ensure lesser traffic movement and equipment provided with noise suppression lower emissions could have impacts of lower magnitude.

The IT Park is expected to use approximately 9,450,000 litres of water per year. The water supply for operations will be provided through an Asian Development Bank funded scheme being planned for the entire Babesa area. Therefore water supply infrastructure will not be impacted.

There is likely to be an increase in solid waste generated during this phase, mainly consisting of paper waste, STP sludge, organic waste from litter and e-waste. The increase in quantity is likely to have an adverse impact on TCC's resources. However, the magnitude of the impact is expected to be low since the quantity of waste generated on site is unlikely to be high.

7. Public Consultation

7.1. Consultation process

In order to assess the attitudes and views of the local people living around the project site for the proposed Thimphu Tech Park, a public consultation was conducted using a face to face survey of households and businesses around the IT Park.

The IT Park falls within the administrative boundary of Thimphu City Corporation, which is the 'Competent Authority' identified by NEC for screening and issuing environmental clearance for projects within its jurisdiction. TCC therefore delegated a representative to assist with the public consultation. A representative of DIT was also available for this process, which was carried out during October 2009.

As part of the consultation, the head of the household or the owner of the business was contacted. Where the head was not available, an adult member of the household was requested to participate. The project was first explained to the participants. Although almost all participants were aware about the development of the Thimphu Tech Park in the area, there were varying perceptions about the scale of the project. The actual scope of the IT Park was conveyed to them.

A structured questionnaire was then used to elicit responses. This questionnaire was designed to first capture their attitude towards the construction and operation of the IT Park separately on a scale ranging from highly negative to highly positive. The respondents were then prompted about potential environmental impacts that could result from the construction and operation phases and were asked to rank the three most significant impacts. Finally, the respondents were again asked to list the positive and negative aspects of the IT Park during construction and operation. The responses were recorded in the questionnaire provided in **Appendix 5**. A list containing the names of the people that participated in the consultation is provided in **Appendix 6**. An estimated 50 households live around the project site and along the access road. Of these, 21 households participated in the public consultation and is expected to be a fair representation of the community. The socio-economic profile of the households that participated in the consultation has been provided in Section 4.3.1.

7.2. Summary of public consultation

Almost all participants expressed that the IT Park would benefit the community by providing greater employment opportunities during the construction and operation phases. Their attitude was therefore 'highly positive' towards the project.

When asked to rank the top three impacts, 'increase in employment opportunities' was again cited. This was particularly evident among households with small business establishments. Increase in land value in the area was also a positive impact listed among the top three impacts. Among negative impacts that were believed to be significant, an increase in dust, noise and traffic were the most

commonly listed in the top three impacts. Disposal of construction wastes was also cited as a potential significant impact. A few respondents indicated that an increase in population because of the construction could also adversely impact the area. Water was also perceived to be a cause for concern if the same water source presently used by the community were to be utilized for the construction.

With regard to the operation of the facility too, an increase in employment opportunities was perceived to be the most significant and highest ranked impact among almost all participants. Increase in land value was again cited as the second most significant impact. Apart from a few negative responses such as increase in vehicular traffic, there were no other adverse impacts that were considered significant during the operation of the IT Park. Water pollution due to the operation was not thought to be a significant impact because of the onsite treatment that would be provided.

8. Mitigation Measures and EMP

This section delineates actions that reduce, avoid or offset the potential adverse environmental consequences of the project activities. These preventive measures would be adopted to mitigate any likely negative impacts during and post construction.

8.1. Mitigation of Adverse Impacts

Construction and operational activities, as discussed in the chapter on environmental impacts, could result in erosion, siltation, disruption of drainage patterns, increase in stream flows, and dust and noise pollution. Labor, transportation and other activities as part of construction and operational phases are likely to affect protected areas, raise labor related issues, and increase solid waste and traffic in the area.

Although most of the construction phase related impacts are expected to be temporary in nature and gradually diminish following the completion of construction activity, the following mitigation measures will be considered for both phases to minimize the magnitude of the impacts.

8.1.1. Erosion Control

The following measures are required to be considered to minimize the impact on the land and soil environment:

Construction phase

- An area within 15m from the site boundary will not be cleared of vegetation. In addition, a combination of silt traps and basins shall be located along the northern portion of the site to prevent sedimentation in receiving streams or storm water drains.
- Prior to any earthwork excavation, the topsoil shall be removed and stock-piled in a safe location for reuse covering over cut slopes and for planting of native plant species. The topsoil shall be covered with tarpaulins.
- A balanced cut and fill process will be maintained at the construction site by ensuring a slope gradient not exceeding 1:0.8 – 1:1 (V:H). This process will be followed by proper compaction of backfill.
- Identifying an onsite location for storage of excavated topsoil, construction waste as well as material storage.

Operational phase

- Immediate re-vegetation of cut and fill slopes or exposed area following all construction activity by using suitable native species. Local plants such as Gawangshing (*Alnus nepalensis*), Kharshing (*Erythrina arborescens*), Weeping Willow (*Salix babylonica*), Deshing (*Daphne*

bholua), Small bamboos (*Yushania microphylla*, or similar native species, will be used for bio-engineering to bind soil and prevent erosion.

- Vegetated swales and bio-retention basins will be appropriately located around the site and integrated into the landscaping scheme to reduce runoff as well as sedimentation.
- A green belt with appropriate groundcover, shrubs and trees, will be developed at the site periphery to prevent soil erosion and washing away of topsoil. It will also aid the stabilization of the functional ecosystem and restore water balance.

8.1.2. Dust and Noise Suppression

The use of heavy machinery and increased vehicle movement is likely to affect air quality and generate noise during the construction phase. These impacts are reversible in nature and will be eliminated once the activity is completed. Nevertheless, mitigation measures listed below will be employed to reduce the magnitude of these adverse impacts. The measures will be specified in the scope of works within the tender document for contractors.

- Water will need to be sprayed on compacted areas and access roads to reduce dust pollution particularly during the dry seasons.
- Trucks carrying construction material and waste to and from the project site will be covered with tarpaulins.
- The contractor shall ensure that the following Ambient Air Quality limits are not exceeded during the construction phase:

Table 6: Ambient Air Quality Standards (Maximum permissible limits for Mixed Areas)

Parameter	Limits ($\mu\text{g}/\text{m}^3$)
<i>Total Suspended Particulate Matter</i>	
24-hour average	200
Yearly average	140
<i>Respirable Particulate Matter (PM10)</i>	
24-hour average	100
Yearly average	60
<i>Sulphur Dioxide</i>	
24-hour average	80
Yearly average	60
<i>Nitrogen Oxides</i>	
24-hour average	80
Yearly average	60
<i>Carbon Monoxide</i>	
8-hour average	2000
1-hour average	4000

- The contractor shall ensure that vehicles used for the project will comply with emission standards prescribed by NEC given below:

Table 7: Vehicle Emission Standards

Parameter	Measuring System	Maximum Permissible Limit (%)	Unit
Diesel Vehicle	Bosch	80	Hertz Smoke Unit (HSU)
Gasoline Vehicle	Normal	5.0	Volume CO

- Construction activity noise levels will be maintained below 65 dB (A) during the day and 55 dB (A) during the night by using construction equipment and machinery that are provided with appropriate noise suppression measures.
- Regular maintenance of machinery will be carried out by the contractor and personnel protective equipments/ aids such as mufflers will be provided to laborers working in close proximity to noise generating equipment or activities.

Once the IT Park is operational, there is no source of air or noise pollution except emissions from the D.G. sets that would be on standby and used only during power outages. The impacts resulting from the use of D.G. sets will be mitigated by ensuring that:

- The D.G. Set will be provided with a stack height of 6m above building height.
- Fugitive emissions shall also be controlled through good housekeeping.
- A closed yard area will be designated for storing diesel fuel and other hazardous material.
- The generator set shall be installed as per NEC guidelines in an acoustic chamber to control noise. The D.G. set shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB (A) to attenuate the noise level to desired standards.
- A proper routine and preventive maintenance procedure for the D.G set would be set and followed in consultation with the manufacturer which would help prevent noise levels of the DG set from deteriorating with use.
- The effects of the vibrations coming out of the base of the body over the surrounding civil structures will be minimized by providing damping pads or resilient mounting.
- In addition to the above-mentioned measures, the green belt developed will serve as a barrier between the source and the surrounding areas. The green belt will help capture the fugitive emission and to attenuate the noise generated apart from improving the aesthetics.
- Workplace emissions will be maintained within the limits specified by the National Standards 2007, given below:

Table 8: Workplace Emissions for 8-hour averages

Parameter	Standards (mg/m ³)
Total Suspended Particulate Matter	10
Respirable Particulate Matter (PM10)	5
Sulphur Dioxide	1
Nitrogen Oxides	1
Carbon Monoxide	5

8.1.3. Safeguarding Protected Areas

A low hard green hedge with railings around the project site is proposed to be erected as part of the project. In order to mitigate impacts on the Environmental Conservation Precinct adjoining the site, this will be erected before the major construction of the project commences. This hedge will act as a barrier that will prevent construction waste and other solid wastes from the site from being disposed in this Precinct. The hedge will also prevent laborers from using the stream. During the operational phase, the hedge will prevent any disturbance to the environment of the ECP.

8.1.4. Labor Camp

In selecting the contractor to execute the work, preference shall be given to those that are able to provide housing and other facilities for labor in offsite locations and arranging for local transportation for the laborers to the site. In the event that suitable offsite locations are unavailable and the labor camp is located onsite, the measures listed below are required to mitigate anticipated impacts during the construction. The onsite labor camps will be designed to incorporate the measures listed below. The contractor will be responsible for the implementation of these measures, which will be incorporated within the tender document.

- Labor camps will be established and located appropriately onsite.
- Housing for the laborers shall be secure and be able to protect the inhabitants from rain, excessive sunshine and other extreme conditions.
- Laborers will be provided with cooking gas or kerosene to discourage use of firewood.
- Proper waste disposal facilities such as dustbins and garbage pits shall be made available at the camp sites.
- Portable toilets / pit latrines will be constructed onsite with appropriate septic tank and soak pit provision; drinking water will be supplied.
- Migrant laborers will be briefed on local culture, laws and rules on illegal activities such as felling of trees, hunting, fishing and other prohibited activities.
- Once construction is complete, camp areas shall be cleaned and bare surfaces re-vegetated to restore the area.
- Other measures as required by the national and local laws will be implemented wherever appropriate.

8.1.5. Occupational Health and Safety

Measures to ensure the occupational health and safety of the construction workers are given below and these will be incorporated within the tender document for contractors:

- Compliance with General Rules and Regulations on Occupational Health and Safety 2006.
- Erect signs and signal hazardous areas onsite, which will be visible from a distance.
- Laborers will be provided with helmets, boots, gloves, masks, and earplugs depending upon the nature of work.

- There will be provision of first aid health facility at work sites and necessary information on rescue during emergency.
- No underage workers, or children, shall be present on the construction site, either as employees, guests, or as dependents of legal employees.

All these OHS requirements will be included within the tender document.

During the operational phase:

- Compliance with General Rules and Regulations on Occupational Health and Safety 2006
- Fire extinguishers and first-aid kits shall be provided in common areas of the facility.
- An operational manual will also be developed for the building facilities management.

8.1.6. Solid Waste Management

Construction waste will be managed as per TCC's norms. A suitable location will be identified for safe and easy storage of waste on site. This will be carted away by the contractor to a location identified by TCC for filling purposes. Solid waste from the labor camp⁵⁸ will be stored in bins provided, which will be collected by TCC as part of the area's solid waste management disposal plan.

Solid waste generated by the IT Park during operation will be managed as per the Rules and Regulations for Thimphu Municipal Solid Waste Management 2007. The IT Park will adhere to the following minimum standards and requirements for segregation and storage of solid waste:

- Waste will be segregated into biodegradable, recyclable and non-recyclable materials; stored in separate containers.
- The solid waste container depending on its use will be properly marked or identified for on-site collection as "compostable", "non-recyclable" and "recyclable" or any other classification as determined by the Thimphu City Corporation.
- Appropriate storage and handling of waste at the premises will be ensured until safe transportation and disposal by TCC.
- Sludge from the treatment plant will be de-watered, dried and used for soil conditioning.

8.1.7. E-waste management

Bhutan does not have any policy on e-waste yet and DIT has been identified as the nodal agency for e-waste management. At present e-waste generated in Bhutan are recycled or cannibalized for parts, but most of it ends up in India through informal channels. Bhutan and India do not have any bilateral agreement as yet for trans-boundary movement of hazardous material, and this is therefore in contravention of the Basel Convention. There are no e-waste treatment facilities in Bhutan although DIT is in the process of developing a national e-waste policy and is exploring the option of setting up an e-waste treatment facility through private investment.

⁵⁸ If the labor camp is located onsite

However, until such national policy is developed, it is recommended that the following Operating Procedure be implemented with support from the DIT to mitigate the e-waste generated at the IT Park:

- Include e-waste management under the agency responsible for facilities management.
- This agency will be responsible for inventory and tracking e-waste onsite using appropriate software that records the details of the status of each item and identifies material which reaches its end of life.
- Allocation of adequate storage – fragile items like CFLs and fluorescent lamps should be stored in drums, a dedicated bin for cartridges, etc. This should be separate from other solid waste like paper waste and organic waste which would be carted away at more frequent intervals by TCC.
- Identify a registered e-waste recycler or ensure that the e-waste is sent back to the supplier. If the e-waste is recycled, it is necessary to ensure that this e-waste returns to the clean e-waste channel for safe disposal after re-use/re-cycling. An alternative option for disposal is to donate equipment (bonded and non-bonded) to charitable institutions and schools.
- Documentation of all e-waste leaving the facility for recycling or treatment.

8.1.8. Traffic Management

Parking problems resulting from increased traffic during the construction phase will be mitigated by:

- Ensuring that no construction vehicle servicing the construction site will be parked on the access roads.
- Dedicated parking spaces will be provided on site.

During operation, the following measures could be implemented to mitigate the increased traffic resulting from employees travelling to and from the IT Park:

- Employees of tenants should be encouraged to use car pooling options.
- The tenants will be encouraged to establish a shuttle service between the IT Park and Thimphu City.
- Bhutan Post can be requested to consider improving the frequency of its buses to the area and extend the bus service to the main gate of the IT Park to encourage public transportation use.

8.2. Environmental Management Plan

The EMP consists of a set of mitigation, monitoring and institutional measures to eliminate the adverse impacts, offset them, or reduce them to acceptable levels. The mitigation measures, during the construction phase, suggested by this EA study would be incorporated in the tender document as part of the technical specification, so that the contractor would be obliged to execute the

mitigation measures. The contract for work would be awarded by ensuring that all mitigation measures covering physical, social, biological, occupational health and safety, etc., are met.

The EMP is provided in **Table 9**.

Table 9: Environment Management Plan

Mitigation Aspects	Mitigation measures	Monitoring Indicators	Monitoring Methods	Implementing Agency	Monitoring Agency	Monitoring Frequency	Indicative Budget (Nu)
Erosion Control	<p>Construction phase</p> <ul style="list-style-type: none"> An area within 15m from the site boundary will not be cleared of vegetation. In addition, a combination of silt traps and basins shall be located along the northern portion of the site to prevent sedimentation in receiving streams or storm water drains (refer to Appendix 7). Prior to any earthwork excavation, the topsoil shall be removed and stock-piled in a safe location for reuse covering over cut slopes and for planting of native plant species. The topsoil shall be covered with tarpaulins (refer to Appendix 1). A balanced cut and fill process will be maintained at the construction site by ensuring a slope gradient not exceeding 1:0.8 – 1:1 (V:H). This process will be followed by proper compaction of backfill. Identifying an onsite location for storage of excavated topsoil, construction waste as well as material storage (See Appendix 8) <p>Operational phase</p> <ul style="list-style-type: none"> Immediate re-vegetation of cut and fill slopes or exposed area following all construction activity by using suitable native species. Local plants such as Gawangshing (<i>Alnus nepalensis</i>), Kharshing (<i>Erythrina arborescens</i>), Weeping Willow (<i>Salix babylonica</i>), Deshing (<i>Daphne bholua</i>), Small bamboos (<i>Yushania microphylla</i>, or similar native species, will be used for bio-engineering to bind soil and prevent erosion. Vegetated swales and bio-retention basins will be appropriately located around the site and integrated into the landscaping scheme to reduce runoff as well as sedimentation. A green belt with appropriate groundcover, shrubs and trees, will be developed at the site periphery to prevent soil erosion and washing away of topsoil. It will also aid the stabilization of the functional ecosystem and restore water balance. 	<ul style="list-style-type: none"> Volume of vegetation and species of plant removed Area of re-plantation, bioengineering application Silt collection in bioretention basins Visual monitoring would be carried out at sensitive locations on a daily basis 	<ul style="list-style-type: none"> Review of design, tender and contractor bid documents Field observation Interaction with contractors and local community 	Contractor during construction; PMU during operations	PMU / compliance monitoring by NEC/TCC	Every week during construction	20,00,000

Mitigation Aspects	Mitigation measures	Monitoring Indicators	Monitoring Methods	Implementing Agency	Monitoring Agency	Monitoring Frequency	Indicative Budget (Nu)
Dust and Noise Suppression	<p>Construction Phase:</p> <ul style="list-style-type: none"> Spraying of water on compacted areas Covering of waste disposal trucks with tarpaulins Limits specified by the National Standards for Ambient Air Quality will be adhered to during construction. Vehicles employed by the contractor to comply with NEC emission norms. Construction activity maintained below following noise levels: Day - 65 dB (A); Night – 55 dB (A) Regular maintenance of machinery and provision of personnel protective equipments/ aids to laborers <p>Operation Phase:</p> <ul style="list-style-type: none"> The D.G. Set will be provided with a stack height of 6m above building height. Fugitive emissions shall also be controlled through good housekeeping. A closed yard area will be designated for storing diesel fuel and other hazardous material. The generator set shall be installed as per NEC guidelines in an acoustic chamber to control noise. The D.G. set shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB (A) to attenuate the noise level to desired standards. A proper routine and preventive maintenance procedure for the D.G set would be set and followed in consultation with the manufacturer which would help prevent noise levels of the DG set from deteriorating with use. The effects of the vibrations coming out of the base of the body over the surrounding civil structures will be minimized by providing damping pads or resilient mounting. In addition to the above-mentioned measures, the green belt developed will serve as a barrier between the source and the surrounding areas. The green belt will help capture the fugitive 	<ul style="list-style-type: none"> Complaints from public Dust on road surface, leaves of plants along access road 	<ul style="list-style-type: none"> Review of tender and contractor bid documents Field observation Maintenance records of D.G sets 	Contractor during construction; PMU during operations	PMU / compliance monitoring by NEC/TCC	Daily / weekly	9,00,000

Mitigation Aspects	Mitigation measures	Monitoring Indicators	Monitoring Methods	Implementing Agency	Monitoring Agency	Monitoring Frequency	Indicative Budget (Nu)
	<p>emission and to attenuate the noise generated apart from improving the aesthetics.</p> <ul style="list-style-type: none"> Workplace emissions standards will be maintained within the IT Park. 						
Safeguarding Protected Areas	<ul style="list-style-type: none"> A low hard green hedge with railings is proposed around the project site. In order to mitigate impacts on the Environmental Conservation Precinct adjoining the site, this will be erected before the major construction of the project commences. This hedge will act as a barrier that will prevent construction waste and other solid wastes from the site from being disposed in this Precinct. The hedge will also prevent laborers from using the stream. During operational phase, the hedge will prevent any disturbance to the environment of the ECP. 	<ul style="list-style-type: none"> Visual monitoring would be carried out at sensitive locations on a daily basis Water quality of stream Complaints from public 	<ul style="list-style-type: none"> Field observation 	Contractor during construction; PMU during operations	PMU / compliance monitoring by NEC/TCC	Fortnightly / Monthly	12,00,000
Labor Management	<ul style="list-style-type: none"> In selecting the contractor to execute the work, preference shall be given to those that are able to provide housing and other facilities for labor in offsite locations and arranging for local transportation for the laborers to the site. In the event that suitable offsite locations are unavailable and the labor camp is located onsite, the measures listed below are required to mitigate anticipated impacts during the construction. The onsite labor camps will be designed to incorporate the measures listed below. The contractor will be responsible for the implementation of these measures, which will be incorporated within the tender document. Labor camps will be established and located appropriately onsite. Housing for the laborers shall be secure and be able to protect the inhabitants from rain, excessive sunshine and other extreme conditions. Laborers will be provided with cooking gas or kerosene to discourage use of firewood. Proper waste disposal facilities such as dustbins and garbage 	<ul style="list-style-type: none"> Status of labor camps - availability of cooking fuel (gas/kerosene), water and other basic facilities Illegal entry to neighborhood Complaints from public 	<ul style="list-style-type: none"> Review of tender and contractor bid documents Site and camp inspection Interaction with laborers, local community and other stakeholders 	Contractor	PMU / compliance monitoring by NEC/TCC	Every month during construction	7,50,000

Mitigation Aspects	Mitigation measures	Monitoring Indicators	Monitoring Methods	Implementing Agency	Monitoring Agency	Monitoring Frequency	Indicative Budget (Nu)
	<p>pits shall be made available at the camp sites.</p> <ul style="list-style-type: none"> • Portable toilets / pit latrines will be constructed onsite with appropriate septic tank and soak pit provision; drinking water will be supplied. • Migrant laborers will be briefed on local culture, laws and rules on illegal activities such as felling of trees, hunting, fishing and other prohibited activities. • Once construction is complete, camp areas shall be cleaned and bare surfaces re-vegetated to restore the area. • Other measures as required by the national and local laws will be implemented wherever appropriate. 						
Occupational Health and Safety	<ul style="list-style-type: none"> • Compliance with General Rules and Regulations on Occupational Health and Safety 2006. • Erect signs and signal hazardous areas onsite, which will be visible from a distance. • Laborers will be provided with helmets, boots, gloves, masks, and earplugs depending upon the nature of work. • There will be provision of first aid health facility at work sites and necessary information on rescue during emergency. • No underage workers, or children, shall be present on the construction site, either as employees, guests, or as dependents of legal employees. <p>All these OHS requirements will be included within the tender document (Refer to Appendix 1).</p> <p><i>Operation phase</i></p> <ul style="list-style-type: none"> • Compliance with General Rules and Regulations on Occupational Health and Safety 2006 • Fire extinguishers and first-aid kits shall be provided in common areas of the facility. • An operational manual will also be developed for the building facilities management. 	<ul style="list-style-type: none"> • Adoption level of OHS • Number of accidents / incidents • Complaints from laborers, occupants and public 	<ul style="list-style-type: none"> • Review of tender and contractor bid documents • Site & facility inspection • Interaction with employees and public • Review of incidents record 	Contractor	PMU / compliance monitoring by NEC/TCC	Every three months	2,00,000

Mitigation Aspects	Mitigation measures	Monitoring Indicators	Monitoring Methods	Implementing Agency	Monitoring Agency	Monitoring Frequency	Indicative Budget (Nu)
Solid Waste Management	<p><i>Construction phase</i> Construction waste will be managed as per TCC’s norms. A suitable location will be identified for safe and easy storage of waste on site. This will be carted away by the contractor to a location identified by TCC for filling purposes. Solid waste from the labor camp will be stored in bins provided, which will be collected by TCC as part of the area’s solid waste management disposal plan.</p> <p><i>Operation Phase</i> Solid waste generated by the IT Park during operation will be managed as per the Rules and Regulations for Thimphu Municipal Solid Waste Management 2007. The IT Park will adhere to the following minimum standards and requirements for segregation and storage of solid waste:</p> <ul style="list-style-type: none"> • Waste will be segregated into biodegradable, recyclable and non-recyclable materials; stored in separate containers. • The solid waste container depending on its use will be properly marked or identified for on-site collection as “compostable”, “non-recyclable” and “recyclable” or any other classification as determined by the Thimphu City Corporation. • Appropriate storage and handling of waste at the premises will be ensured until safe transportation and disposal by TCC. • Sludge from the treatment plant will be de-watered, dried and used for soil conditioning. 	<ul style="list-style-type: none"> • Complaints from public • Public complaints 	<ul style="list-style-type: none"> • Field observation 	Contractor during construction; PMU during operations	PMU / compliance monitoring by NEC/TCC	Fortnightly / monthly	1,50,000
E-waste Management	<p>The following Operating Procedure shall be implemented with the support of DIT to mitigate the e-waste generated at the IT Park:</p> <ul style="list-style-type: none"> • Include e-waste management under the agency responsible for facilities management. • This agency will be responsible for inventory and tracking e-waste onsite using appropriate software that records the details of the status of each item and identifies material which reaches its end of life. 	<ul style="list-style-type: none"> • Disposal problems 	<ul style="list-style-type: none"> • Review of inventory 	PMU / occupiers	Compliance monitoring by NEC/TCC	Every six months	1,00,000

Mitigation Aspects	Mitigation measures	Monitoring Indicators	Monitoring Methods	Implementing Agency	Monitoring Agency	Monitoring Frequency	Indicative Budget (Nu)
	<ul style="list-style-type: none"> Allocation of adequate storage – fragile items like CFLs and fluorescent lamps should be stored in drums, a dedicated bin for cartridges, etc. This should be separate from other solid waste like paper waste and organic waste which would be carted away at more frequent intervals by TCC. Identify a registered e-waste recycler or ensure that the e-waste is sent back to the supplier. If the e-waste is recycled, it is necessary to ensure that this e-waste returns to the clean e-waste channel for safe disposal after re-use/re-cycling. An alternative option for disposal is to donate equipment (bonded and non-bonded) to charitable institutions and schools. Documentation of all e-waste leaving the facility for recycling or treatment. 						
Traffic Management	<p><i>Construction phase</i></p> <ul style="list-style-type: none"> Ensuring that no construction vehicle servicing the construction site will be parked on the access roads. Dedicated parking spaces will be provided on site. <p><i>Operation phase</i></p> <ul style="list-style-type: none"> Employees of tenants should be encouraged to use car pooling options. The tenants will be encouraged to establish a shuttle service between the IT Park and Thimphu City. Bhutan Post can be requested to consider improving the frequency of its buses to the area and extend the bus service to the main gate of the IT Park to encourage public transportation use. 	<ul style="list-style-type: none"> Public and employee complaints Incidents (traffic accidents on access road) 	<ul style="list-style-type: none"> Field observation 	Contractor during construction; PMU during operations	PMU	Every week during construction / 6 monthly review during operation	-
Waste water treatment	<i>Included in the project design</i>	-	-	-	-	-	24,00,000

8.2.1. EMP Implementation and Monitoring

Construction Phase

The Project Monitoring Unit (PMU) established for overseeing regular construction activities will also be entrusted with the task of ensuring that the environmental mitigation measures and conditions related to environmental compliance are followed by the contractor. The PMU will work closely with environmental consultants or an environmental engineer assigned for this task to supervise and document the environmental aspects of the construction.

The PMU will specifically undertake regular monitoring / inspection of the construction site, activities and mitigation measures implementation plans specified in the EMP. Monitoring indicators indicated in the EMP would be used to establish progress. All construction and installation activities including those carried out by subcontractors and suppliers would be supervised, or regularly checked by the PMU to ensure that requirements identified in impact assessments have been implemented. The frequency and extent of this supervision would vary according to the nature of the construction activity and the level of risk to the environment. Tasks required to be carried out by the PMU supervisors include:

- Inspections of the construction areas, to verify that housekeeping or supporting controls are being implemented effectively. These inspections would utilize the site environmental standards as the minimum standards that should be achieved, with necessary actions being recorded and raised at weekly progress meetings.
- Inspections of the environmental deliverables required by the EMP. These inspections would be used to confirm that:
 - Construction works are progressing in accordance with the agreed mitigation measures.
 - Agreed protection or mitigation measures are in place, prior to or during the implementation of construction activities.
 - Construction works have been completed in accordance with the design and commitments made during the statutory process.
- An assessment of the Project's environmental performance, based upon the information gathered from the supervisors / contractors / supervisor's site inspections during the period.

The monitoring during the construction stage of the project is primarily focused on construction and management practices. This stage of monitoring is to check compliance with the best practices, norms and standards and on implementation of the mitigation measures prescribed by the EA vis-a-vis the impact or changes that are occurring on environmental receptors. During this stage, the focus will be on the following parameters:

- Disposal of excavated material / construction wastes and its consequences.

- Disruption of natural water courses, drainage work, and its consequences.
- Loss or degradation of forest and vegetation.
- Sensitivity to disruption of community infrastructures.
- Slope protection measures.
- Consultation and cooperation with the local community on environmental matters.

Operational Phase

Environmental awareness is viewed as a crucial element in the planning, appreciation and implementation of the EMP. As a consequence, facility managers and tenants will be provided with an 'Operations Manual' detailing the environmental features of the IT Park and required monitoring and maintenance procedures. The Manual would also contain detailed procedures for emergency response and other unforeseen risks as provided in **Appendix 9**. A copy of the Environmental Clearance certificate issued by the NEC will be framed and displayed at the new premises. The developer will ensure that the certificate is renewed one month prior to expiry.

The monitoring during operation period will be mainly related with main focus on building design and their impacts on the receiving environment. During this phase, the following parameters would be monitored:

- Drainage structures, their outfall and damage to private properties, community properties, and natural resources,
- Effectiveness of the provided slope protection and soil erosion measures,
- Status of waste disposal measures and management (including e-waste)
- Activities of the IT Park and its effect on the community (traffic congestion, noise from the DG set, etc).

8.2.2. Communications with the Public

A Project Community Liaison Plan would be established to provide a framework for managing communications with local residents and interested parties.

The objectives of the Plan would include:

- Implementing effective communication to ensure that local residents and community groups are informed of the project proceedings
- Local employment promotion

A nodal Community Relations Officer (CRO) will be appointed by the PMU during construction and by the facility managers during the operational phase.

The CRO will be responsible for involving public, recording complaints & grievance redressal and coordinating public information sessions. Communication material will include newspaper notifications/articles and information displayed at selected places. Interaction sessions with the community will be conducted monthly during the construction phase and quarterly / half-yearly during the operational phase. An approximate amount of Nu 50,000 to 100,000 per annum will be budgeted under overall Project Management for implementation of the Community Liaison Plan.

Appendices

Appendix 1: Relevant Rules and Regulations on Occupational Health and Safety (OHS) in Construction

Management of Occupational Health and Safety⁵⁹

Health and Safety Program

An employer of an enterprise on which these Rules and applicable shall prepare and implement an occupational health and safety program that ensures that each workplace of the enterprise is safe and healthy by:

- Addressing the hazards and risks at the workplace;
- Outlining the procedures and responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks;
- Identifying the emergency management plans for the workplace or workplaces; and
- Specifying how consultation, training and information is to be provided to employees at workplaces.

The employer shall prepare and implement the policy in consultation with the health and safety representative (if any) at each workplace of the enterprise or, if there is no such representative the employees at each of the workplaces.

The employer shall display the program in a prominent place at each permanently sited workplace of the enterprise.

Appointment of Health and Safety Representative

The employees at a workplace may elect one of its members to be their health and safety representative at that workplace to:

- Act on behalf of the employees in relation to health and safety matters;
- Raise issues which are of concern to the employees about occupational health and safety;
- Consult with the employer's representative or if there is no such representative, the employer, on health and safety matters; and
- Provide a focal contact for a labor inspector and for the employer in relation to occupational health and safety.

The employer shall not discriminate or take disciplinary action if any kind on the OHS for acting or having acted in accordance with these Rules.

Self Inspection and Reporting Procedures⁶⁰

Self Inspections by Employers

Every employer shall ensure that regular inspections are made of all workplaces, including buildings, structures, scaffoldings, grounds, excavations, tools, equipment, machinery and work methods and practices, at intervals that will prevent the development of unsafe working conditions.

An inspection required by these Rules, where feasible, includes the participation of members of the committee (if any) or the workers' health and safety representative (if any). If there is no committee or workers' health and safety representative, the employer must designate an employee as workers' representative.

Reporting Procedures

An employer shall submit a report on self-inspection carried out under subsection (14.1) to the Department of Labour on quarterly basis.

⁵⁹ Source: Chapter 2 - General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries, 2006

⁶⁰ Source: Chapter 4 - General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries, 2006

A separate report on self-inspection carried out under subsection (14.1) shall be submitted to the Department of Labour by the workers' health and safety representative.

An employer shall immediately notify the Department of Labor of an accident or an incident that:

- Resulted or could have resulted in death, loss or impairment of bodily function, loss of consciousness, electrical shock, acute or chronic symptoms of exposure to any substance at the workplace, any other serious bodily injury or any injury or disease requiring medical treatment; or
- Caused a loss of production or working time at the workplace.
- In case of a death of a worker, the employer must inform the nearest Police Station and submit a copy of the incident investigation report to the Department of Labor.
- An employer shall ensure that an incident investigation report contain the following information:
 - The place, date and time of the incident;
 - The names and job titles of persons injured or dead in the incident;
 - The names of witnesses;
 - A brief description of the incident;
 - A statement of the sequence of events which preceded the incident;
 - Identification of any unsafe conditions, acts or procedures which contributed in any manner to the incident;
 - Recommended corrective actions to prevent similar incidents; and
 - The names of the persons who investigated the incident.

Correction of Unsafe Conditions

Remedy without delay – any unsafe or harmful conditions found in the course of an inspection must be remedied without delay.

Reporting unsafe conditions – whenever a worker or any person observes what appears to be an unsafe or harmful condition or act, the worker or the person must report it as soon as possible to a supervisor or to the employer, and the person receiving the report must investigate the reported unsafe condition or act and must ensure that any necessary corrective action is taken without delay.

Minimum Safety Standards for the Construction Industry⁶¹

For any construction, renovation/alteration, painting (including traditional painting) of structures, the employer is responsible for health and safety of the employees. The employer shall initiate and maintain this standard to provide good working environments in their construction site.

The Standards contained in this part shall apply with respect to employments performed in a workplace/construction site in Bhutan.

Personal protective and life saving equipments:

The employer shall be responsible for providing suitable personal protective equipment or clothing, based on the type of work and risk, without cost to workers.

- (a) Helmet shall be provided to all workers, or visitors visiting the site for protection of head against impact or penetration of falling or flying objects.
- (b) Safety belt shall be provided to workers working in heights (more than 20ft) such as roofing, painting and plastering.
- (c) Safety boots shall be provided to all workers for protection of feet from impact or penetration of falling objects on feet.
- (d) Ear protecting devices shall be provided to all workers and to be used during the occurrence of extensive noise.
- (e) Eye and face protection equipments shall be provided to all welders to protect against sparks of fire.

⁶¹ Source: Appendix 2 - General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries, 2006

- (f) Respiratory protection devices shall be provided to all workers during occurrence of fumes, dusts, or toxin gas/vapor.
- (g) Safety nets shall be provided when workplaces are more than 25 feet (7.5m) above the ground or other surfaces where the uses of ladders, scaffolds, catch platforms, temporary floor or safety belts is impractical.
- (h) First aid kits shall be made available at all times throughout the entire construction period. Arrangement shall be made to ensure medical attention for workers who have met with an accident or sudden illness at any time during the construction period.

Fire protection: the employer shall be responsible for a fire protection and prevention through out all phases of the construction or demolishing works.

Hand and power tools: Conditions of all hand and power tools like belts, gears, shafts, pulleys, sprockets, spindles, chains or other reciprocating, rotating or moving parts of equipments shall be maintained by the employer in a safe condition to prevent any accidents.

Signs, signals and barricades: Appropriate signs and symbols shall be required to be put up at work places. Barricades shall be put up all around the construction site at all times during construction or demolishing period to deter the passage of vehicles or persons to the construction site.

Material handling, storage, use and disposal:

- (a) All materials stored in shall be stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling or collapse.
- (b) Aisles and passageways shall be kept clear to provide for free and safe movement of material handling equipment and workers. Material if stored/stacked at roadside must not hinder free movement of vehicles and persons.
- (c) The areas used for construction shall be kept in good repair to ensure safe movement of vehicle or person.
- (d) Maximum safe load limits of floors within buildings and structures shall be conspicuously posted in all storage areas.
- (e) Materials shall not be stored on scaffold.
- (f) Brick stacks shall not be more than 7 feet in height and for concrete blocks they shall not be more than 6 feet high.
- (g) All scrap timber, waste material, and rubbish must be removed from the immediate work area as the work progresses.

Scaffolds:

- (a) Each scaffold or its components shall be capable of supporting its own weight and at least 4 times the maximum intended load applied or transmitted to it.
- (b) In case of direct connection of adjustable suspended scaffolds to roof or floor for balance, it shall be capable of resisting at least 4 times the tipping movement imposed. The rope should be capable of supporting at least 6 times the maximum intended load applied or transmitted to that rope.
- (c) Pole scaffolds over 60feet (5.6m) in height shall be designed by a registered professional engineer and shall be constructed and loaded in accordance with that design.
- (d) The platform/scaffold plank shall be at least 15 inches (46cm) wide and 1.5 inches thick.
- (e) The ends of platform, unless wedged, shall extend over the centerline of its supports at least 6 inches (15cm) for fully decked platform. For 10 feet or less platforms the extension should be designed and installed so that the cantilevered portion of the platform is able to support workers without tripping. Guardrails must be constructed to block the access to cantilever ends.
- (f) The front edge of all platforms shall not be more than 14 inch (36cm) from the face of the work.
- (g) For fully decked platform the lapped (minimum of 12inch and nailed) or abutted should be supported with separate support surface.
- (h) Platform should not deflect more than 1/60 of the span when loaded.
- (i) Ramp or walkway should be at least 6feet (1.8m) wide having slip resistance threads and must not be inclined more than a slope of 1 vertical and 3 horizontal.
- (j) A rail consisting of a top and middle bar shall be provided on open sides of the ramp scaffolds and should provide adequate handhold for employees grasping them to avoid falling.
- (k) Workers should not be made to work on scaffolds covered with snow, ice or other slippery materials except as necessary for removal of such materials.

- (l) Workers should not be made to work on the scaffolds during storm or high wind.
- (m) Makeshifts devices and ladders shall not be used on top of scaffolds to increase the working level height for workers.
- (n) While working on roof, roofing brackets shall be constructed to fit the pitch of a roof. A catch platform shall be installed below the working area of roof where the height is more than 16 feet above the ground level and the roof slope is more than 4/12. The worker shall wear the safety belt all the time while working on truss/roof.
- (o) The rope used to securing brackets and scaffolds or as an anchorage shall be damage free and strong.

Excavations:

- (a) Excavated earth must be stacked away (at least 2 feet) from the pit to avoid from falling back or rolling into the excavation and burring the workers or injuring the workers from rolling loose rock unless a protective barricades/retaining devices is provided to prevent falling earth.
- (b) When the adjoining building/structure is endangered by excavation operation, support systems such as shoring, bracing or underpinning shall be provided to ensure the stability of such structures.

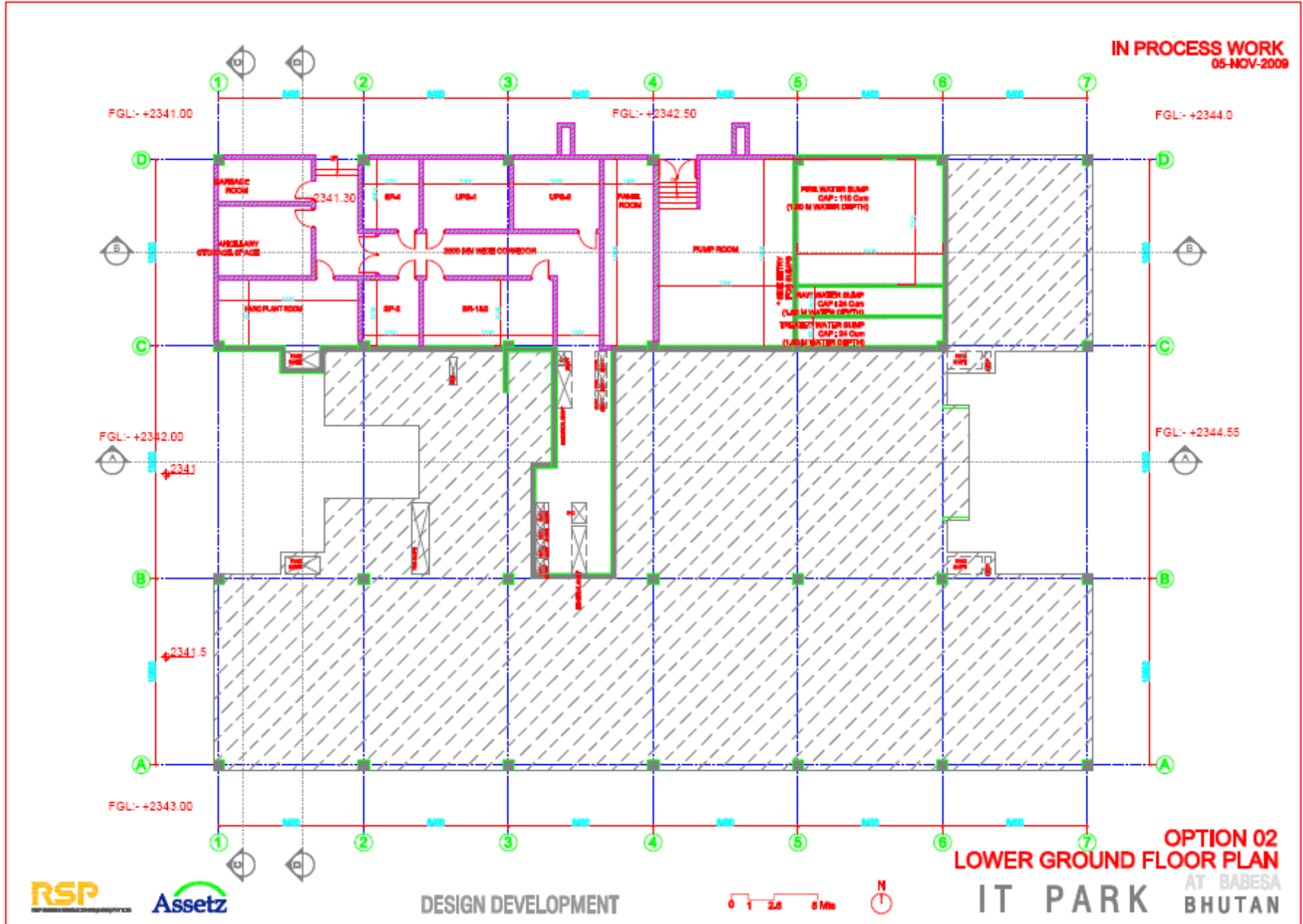
8. Electrical works:

- (a) All Electrical equipment and installation shall be constructed, installed and maintained by a competent person, and so used as to guard against risk of electrical shocks and electrocution.
- (b) Adequate steps shall be taken to ascertain the present of and to guard against dangers to workers from any live electrical cable, which may be under, on or above the construction site.

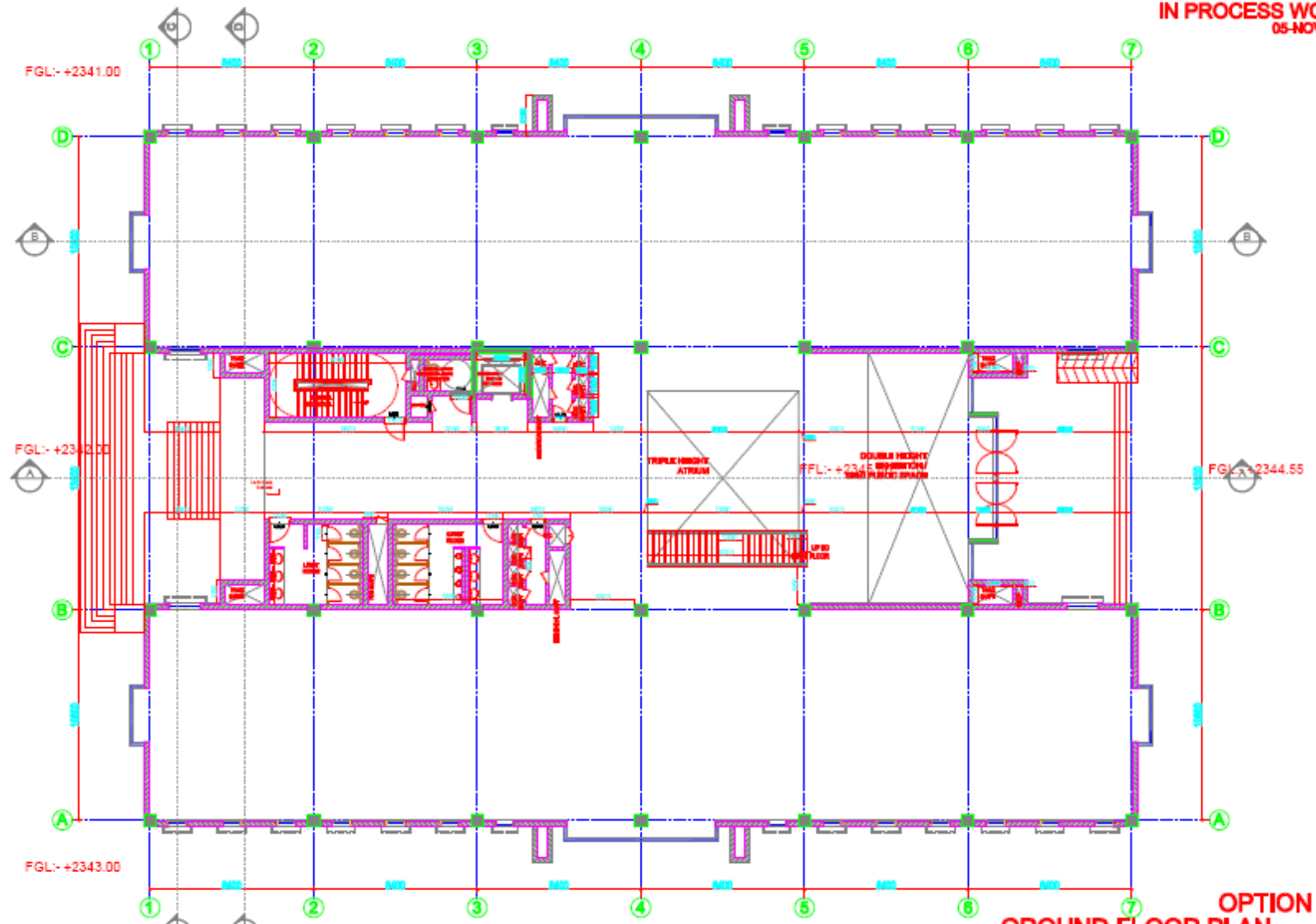
Sanitation and Hygiene:

- (a) Facilities such as toilets, drinking water, and waste bins shall be adequately installed at the workplace.

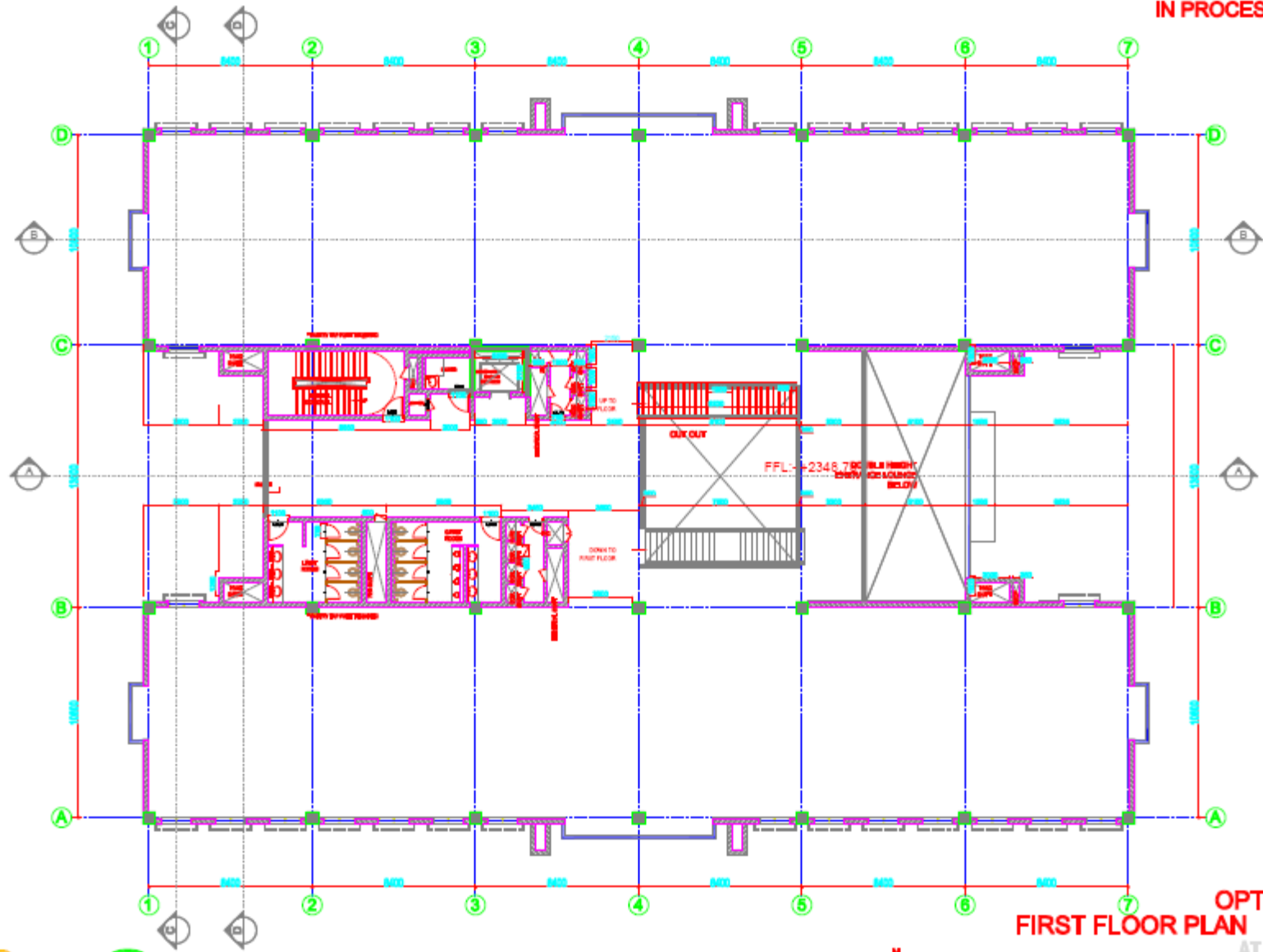
Appendix 2: Floor plans, section and views of the Thimphu Tech Park



IN PROCESS WORK
05-NOV-2009



IN PROCESS WORK
05-NOV-2009



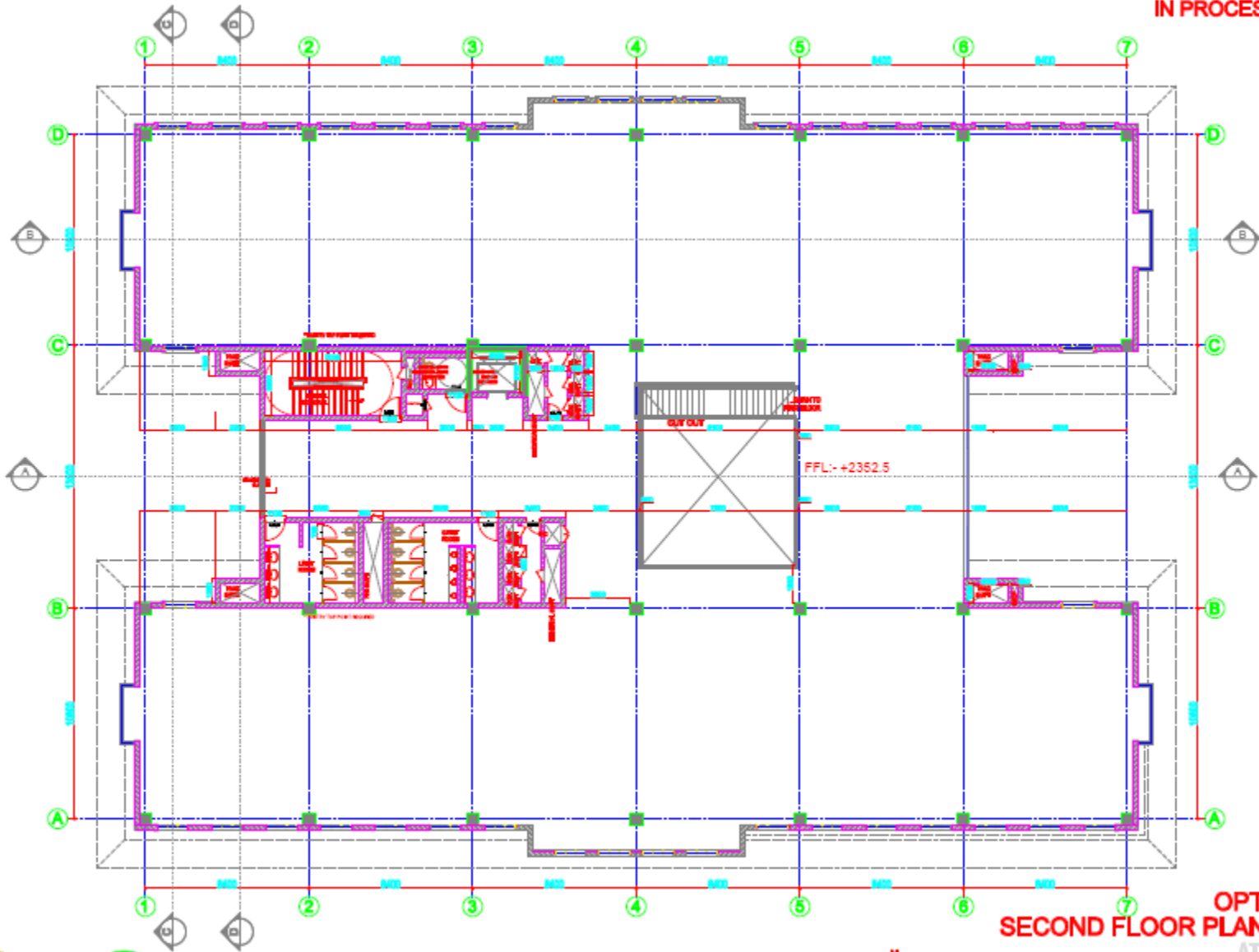
OPTION 02
FIRST FLOOR PLAN
IT PARK AT BABESA
BHUTAN



DESIGN DEVELOPMENT



IN PROCESS WORK
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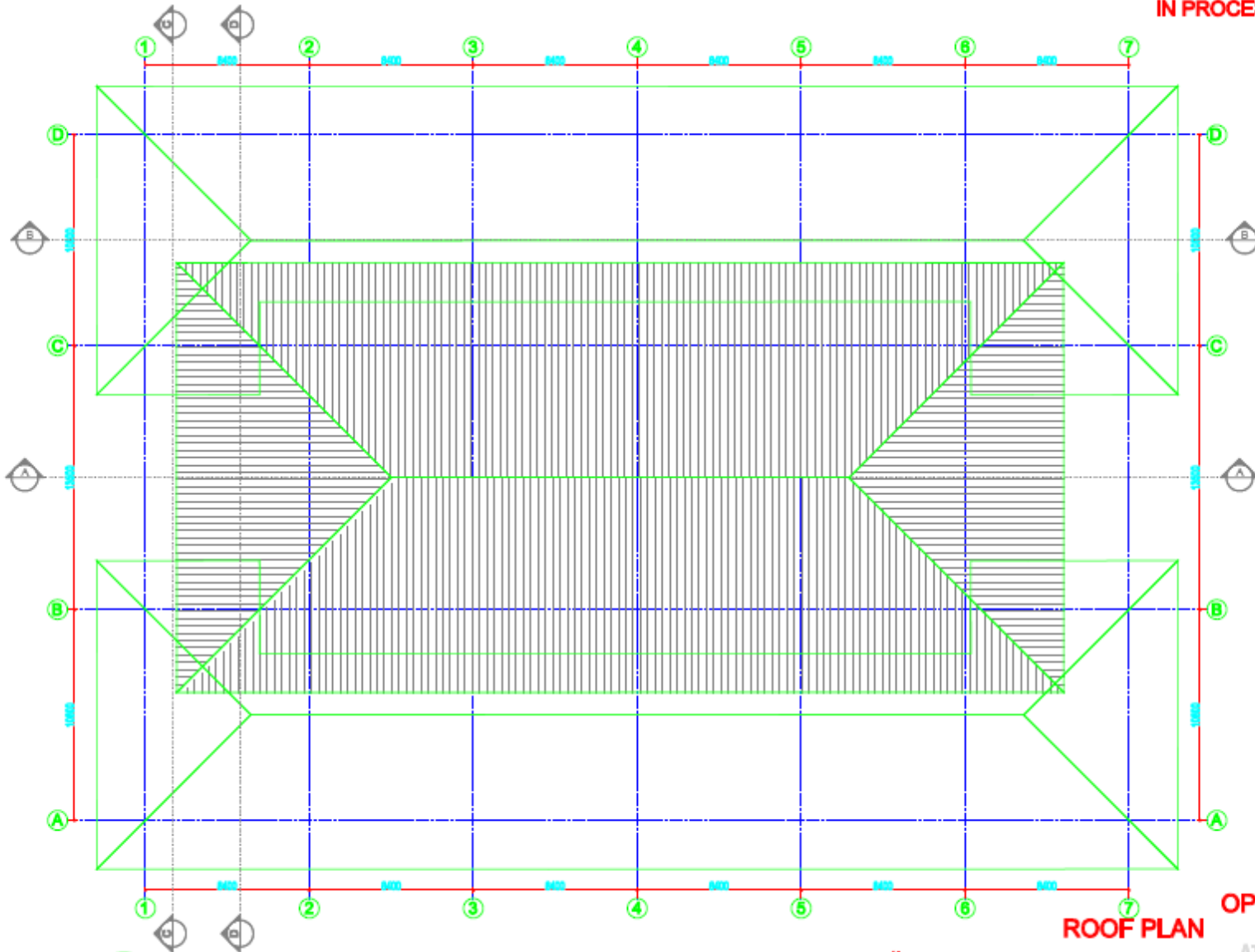


DESIGN DEVELOPMENT



OPTION 02
SECOND FLOOR PLAN
IT PARK AT BABESA
BHUTAN

IN PROCESS WORK
05-NOV-2009



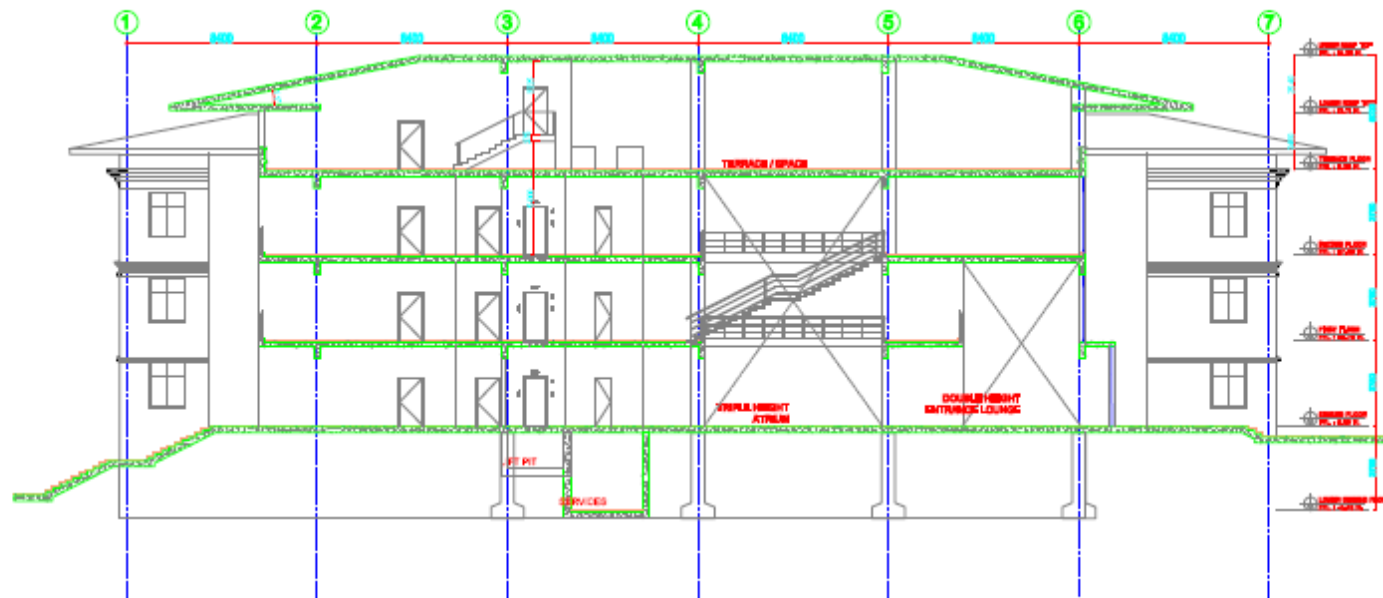
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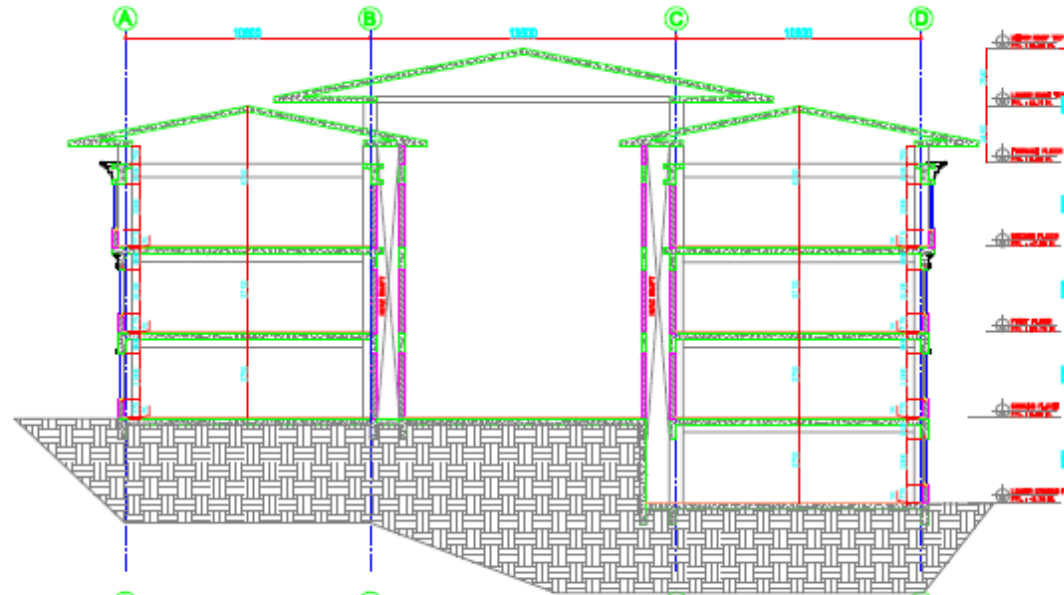


OPTION 02
ROOF PLAN
IT PARK
AT BABESA
BHUTAN

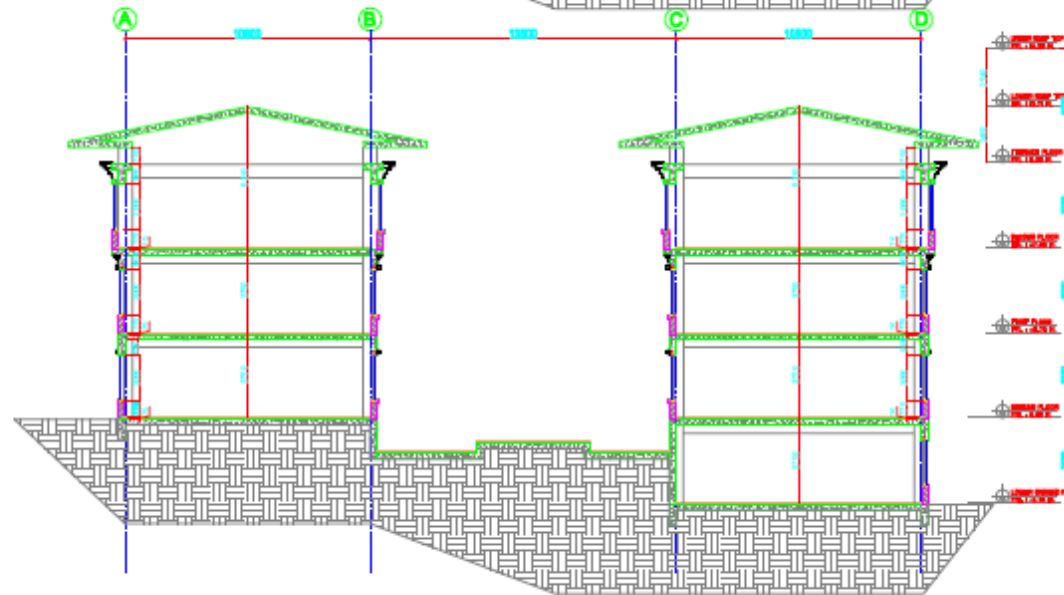


SECTION:- A-A

SECTION :- D-D



SECTION :- C-C



DESIGN DEVELOPMENT

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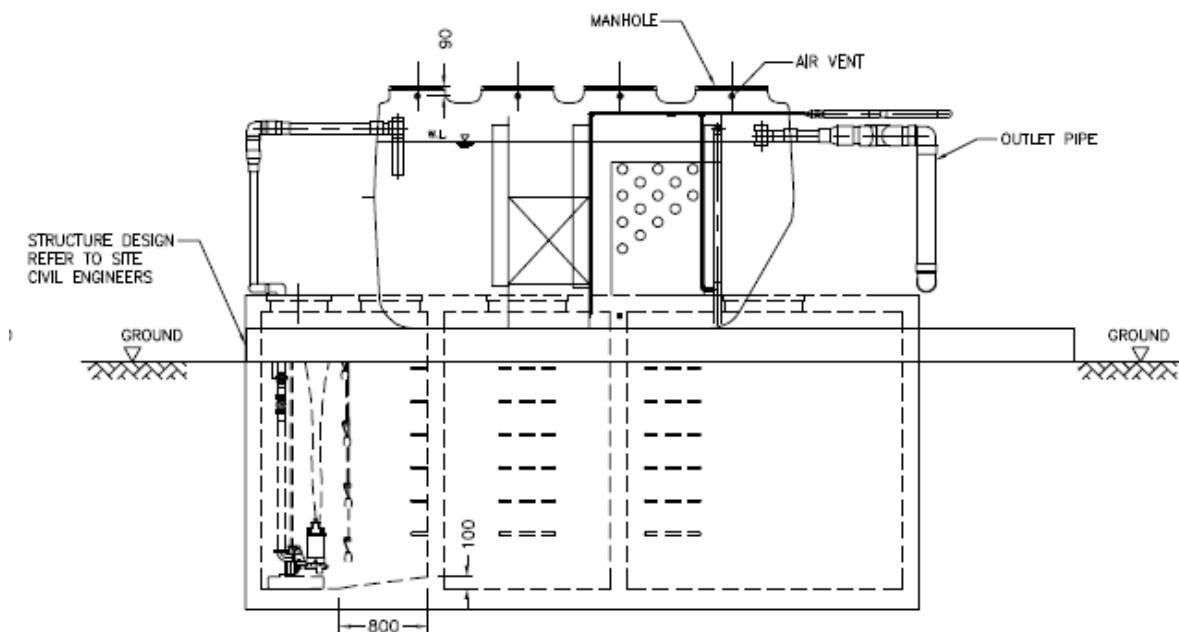
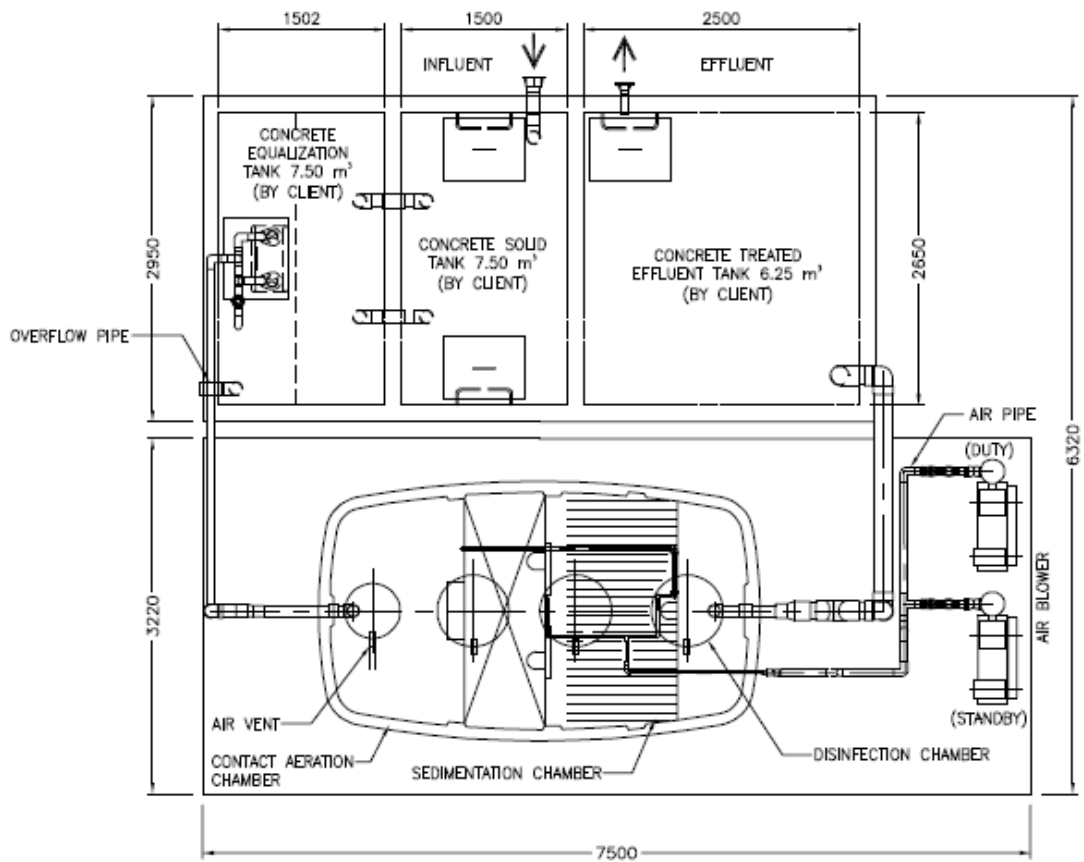
IT PARK

AT BABESA
BHUTAN

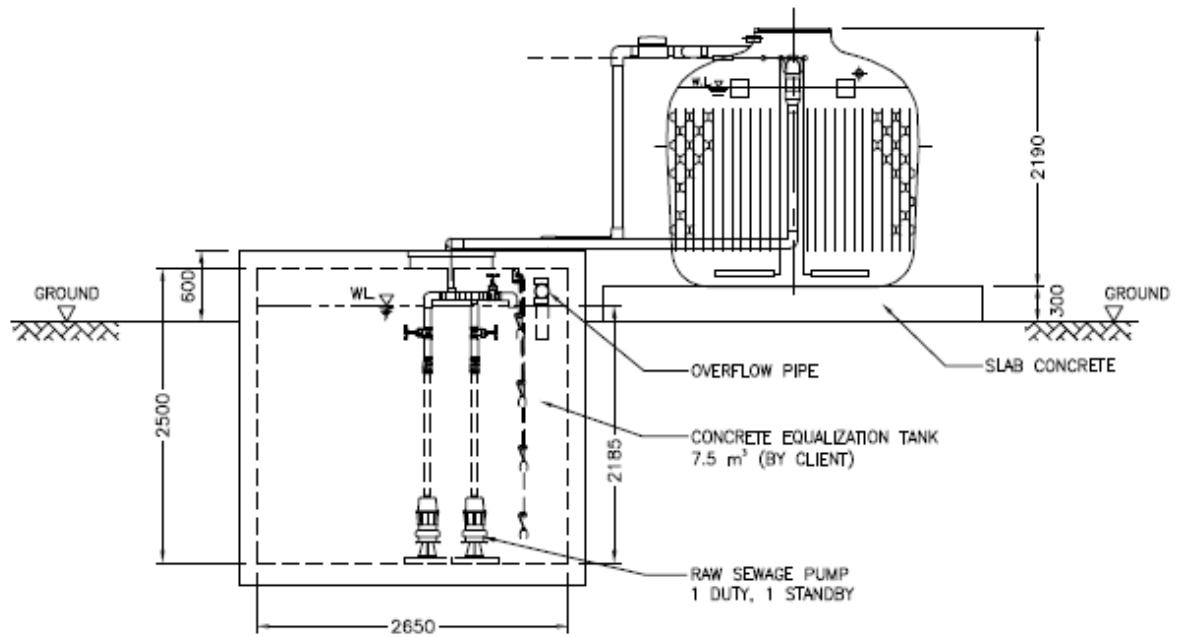


IT PARK AT BABESA
BHUTAN
29 June 2009

Appendix 3: Details of the STP design



Details of the STP design (contd.)



Appendix 4: Protected Species of Bhutan and their Globally Threatened Status

Species Name	Globally Threatened Status
<i>Bird Species</i>	
Black-necked Crane, <i>Grus nigrocollis</i>	Vulnerable
Monal Pheasant, <i>Lophophorus impejanus</i>	-
Peacock Pheasant, <i>Polyplectron bicalcaratum</i>	-
Raven, <i>Corvus corax</i>	National bird
Rufous-necked Hornbill, <i>Aceros nipalensis</i>	Vulnerable
<i>Fish Species</i>	
Golden Mahseer, <i>Tor tor</i>	-
<i>Mammal Species</i>	
Asian Elephant, <i>Elephas maximus</i>	Endangered
Clouded Leopard, <i>Neofelis nebulosa</i>	Vulnerable
Golden Langur, <i>Trachypithecus geei</i>	Endangered
Musk Deer, <i>Moschus chrysogaster</i>	In Bhutan it is one of the most targeted species for poaching
Pangolin, <i>Manis crassicaudata</i>	-
Pygmy Hog, <i>Sus salvanius</i>	Critically Endangered
Snow Leopard, <i>Uncia uncia</i>	Endangered
Takin, <i>Budorcas taxicolor</i>	Vulnerable
Tiger, <i>Panthera tigris</i>	Endangered
Wild Buffalo, <i>Bubalus bubalis</i>	Endangered
Spotted Deer, <i>Axis axis</i>	-
Gaur, <i>Bos gaurus</i>	Vulnerable
Leopard, <i>Panthera pardus</i>	-
Leopard Cat, <i>Prionailurus bengalensis</i>	-
Himalayan Black Bear, <i>Ursus thibetanus</i>	Vulnerable
Red Panda, <i>Ailurus fulgens</i>	Endangered
<i>Plant Species</i>	
Agar wood, <i>Aquilaria malaccensis</i>	Vulnerable
Chinese Caterpillar fungus, <i>Cordecyps sinensis</i>	Is highly targeted by illegal collectors for its medicinal value
Gentiana, <i>Gentiana crassuloides</i>	Not known
Snow-down Lily, <i>Lloydia yunnanensis</i>	Not known
Blue Poppy, <i>Meconopsis grandis</i>	National flower of Bhutan
Himalayan Yew, <i>Taxus baccata</i>	Not known
Ginseng, <i>Panax pseudoginseng</i>	Not known

Source: Bhutan Environment Outlook, 2008 - Forest and Nature Conservation Act of Bhutan 1995, Red List of Globally Threatened Species, IUCN, 2006

Appendix 5: Public Consultation Questionnaire

Thimphu IT Technology Park – Public Consultation Questionnaire

The Royal Government of Bhutan (RGoB), with financial assistance from the World Bank, is implementing a project that aims to increase productive employment in Bhutan through promotion of enterprise development in the Information Technology/Information Technology Enabled Services (IT/ITES) sector. One component of the project includes the establishment of an IT Park and related infrastructure. Thimphu TechPark Pvt Ltd., a joint venture company of Assetz Property Group Pte Ltd of Singapore and Druk Holding & Investments Ltd of Bhutan, has been selected through an international competitive bidding process to design, build, finance, own, operate, and transfer the IT Park facility.

This interview is being undertaken in order to assist Assetz to identify and address the social impacts of constructing and operating the IT Park. The questionnaire has been designed to understand the perceptions and attitudes of local people towards the construction and operation of Thimphu TechPark.

1. Location and distance with respect to site:

Interviewee details	
Name	
Age	
Gender (M/F)	
Education level	
Occupation / Designation	

2. Respondent Type (tick appropriate box):

- Household
 Business / Organisation

3. Background Information (*fill table appropriate to respondent type*):

Household (HH)				
Ethnic group				
No. of people in HH				
No. of females in HH				
No. of children (school going)				
Average annual HH income (BTN/year)	< 100,000			
	100,001 to 500,000			
	> 500,000			
Property ownership	Owned / Rented			
No. of years living at this location				
No. of vehicles owned by HH	Car	2-wheeler	Cycle	Other

Business / Organisation						
Organisation Name						
Description						
No. of employees						
No. of female employees						
No. of years at this location						
Proportion of employees commuting by mode of transport	Company bus / van	Car	2-wheeler	Public bus	Cycle	Walk

4. Have you in the past lived or worked close to a large construction site or large facility such as an IT Park?
 If yes, please provide details:

5. How would you describe your attitude to the potential **construction** of an IT Technology Park in the area?

-2	-1	0	+1	+2
Highly Negative	Slightly Negative	Neutral	Slightly Positive	Highly Positive

Why?

6. How would you describe your attitude to the potential **operation** of an IT Technology Park in the area?

-2	-1	0	+1	+2
Highly Negative	Slightly Negative	Neutral	Slightly Positive	Highly Positive

Why?

7. How would you describe your **overall attitude** to the development of an IT Technology Park in the area?

-2	-1	0	+1	+2
Highly Negative	Slightly Negative	Neutral	Slightly Positive	Highly Positive

Why?

8. What do you think would be the significant impacts of the Technology Park for your area **during construction**? (please tick all that apply under 'impact' column, and rank top three significant impacts)

		Impact	Rank
1	Increase employment		
2	Improve infrastructure / services		
	2.1 Transport		
	2.2 Communications		
	2.3 Water supplies		
	2.4 Access to electricity		
	2.5 Other (specify)		
3	Would affect accessibility to your site		
4	Would encourage informal development		
5	Would increase land value		
6	Would affect safety of people living in the area		
7	Would disturb land / soil (including erosion and landslides)		
8	Would cause dust		
9	Would create noise		
10	Waste disposal from labor camps would create sanitation problems		
11	Would create construction waste disposal problems		
12	Would take jobs away from local people		
13	Would increase crime		
14	Would affect the flora and fauna in the area		
15	Would increase traffic		
16	Other (specify)		

9. What do you think would be the significant impacts of the technology park for your area **during operation**? (please tick all that apply under 'impact' column, and rank top three significant impacts)

		Impact	Rank
1	Increase employment		
2	Improve infrastructure / services		
	2.1 Transport		
	2.2 Communications		
	2.3 Water supplies		
	2.4 Access to energy		
	2.5 Other (specify)		
3	Would affect accessibility to your site		
4	Would encourage informal development / land use changes		
5	Would increase land value		
6	Would affect safety of people living in the area		
7	Would disturb land / soil (including erosion and landslides)		
8	Would cause dust		
9	Would create noise		
10	Waste disposal from labor camps would create sanitation problems		
11	Solid waste and e-waste would create problems		

12	Would take jobs away from local people		
13	Would increase crime		
14	Would affect the flora and fauna in the area		
15	Would increase traffic		
16	Other (specify)		

10. What do you think would be the **main positive benefits** of the technology park for your area? (list three)
During construction *During operation*

11. What do you think would be the **main negative impacts** of the technology park for your area? (list three)
During construction *During operation*

12. How could the **construction** of the technology park be improved?

13. How could the **operation** of the technology park be improved?

Thank you for your time.

Signature of respondent:

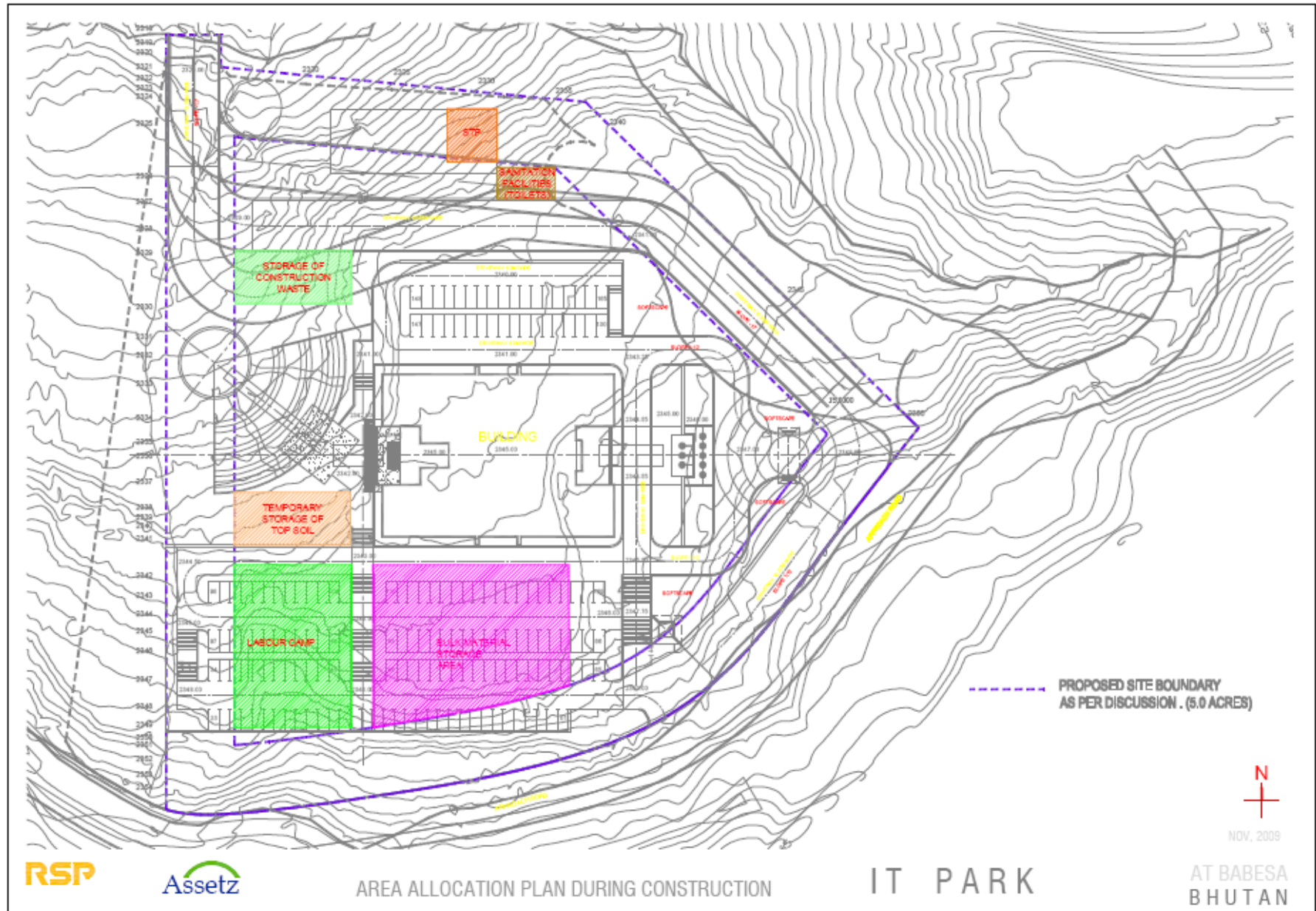
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Date:

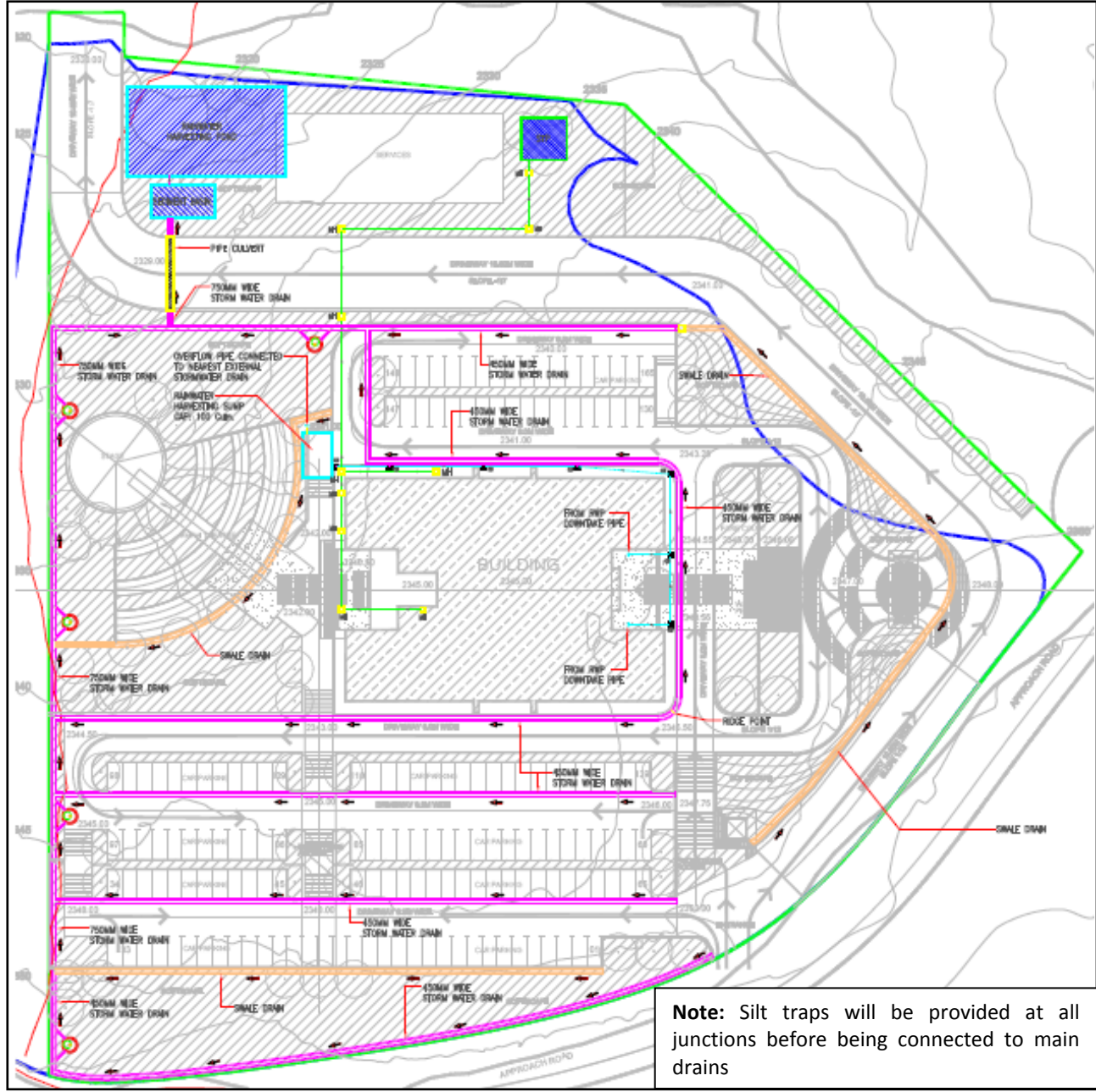
Appendix 6: List of participants - Public Consultation

Sl No.	Date of consultation	Name of respondent / head of HH	Age	Gender	Location
1	20/10/2009	Purna Bahadur Chuwan	35	Male	House next to project site (Livestock farm – Serbithang Road)
2	20/10/2009	Nim Tshomo	53	Female	House across project site (Serbithang Road)
3	20/10/2009	Maj. R K Pradhan	56	Male	Poultry farm across project site (Serbithang Road)
4	20/10/2009	Ati Man Suba	23	Male	House next to project site (Livestock farm – Serbithang Road)
5	20/10/2009	Sanguy Wangmo	40	Female	House next to site (Livestock farm – Serbithang Road)
6	20/10/2009	Doku Tshering	48	Male	House across site (Piggery farm – Serbithang Road)
7	21/10/2009	Sagay	50	Male	Along access road (Serbithang Road)
8	21/10/2009	Neten Wangmo	34	Female	Along access road (Serbithang Road)
9	21/10/2009	Namgay Dorji	30	Male	Along access road (Serbithang Road)
10	21/10/2009	Norpu Dema	39	Female	House next to project site, after proposed IT park entrance
11	21/10/2009	Gyeltsen	49	Male	Along access road (Serbithang Road)
12	21/10/2009	Tashi Wangmo	34	Female	Near Babesa school and access road (bus stop on Phuntsholing highway)
13	21/10/2009	Pemba Tshering	27	Male	Near entrance to access road (opp. Bus stand on Phuntsholing highway near Babesa school)
14	21/10/2009	Tandin	50	Female	House opposite to Babesa school (on Phuntsholing highway)
15	21/10/2009	Namgyel Dawa	25	Male	Along approach road (on Phuntsholing highway) below site
16	21/10/2009	Sonam	50	Female	Near Babesa school and access road (bus stop on Phuntsholing highway)
17	21/10/2009	Sonam Tenzin	47	Male	Opposite to Babesa school (on Phuntsholing highway)
18	21/10/2009	Kuenzang	30	Female	At entrance to approach road to site (on Phuntsholing highway)
19	21/10/2009	Bishnu Gurung	38	Female	Babesa school (Vice Principal)
20	21/10/2009	Kinley Zamgo	31	Female	Along approach road (on Phuntsholing highway)
21	21/10/2009	Tenzin	27	Male	Along approach road (on Phuntsholing highway)
	20-21/10/2009	Tshering Wangchuk	Environment Inspector, Thimphu City Council		
	20-21/10/2009	Dawa Zangmo	Office of the PIA/DIT, MoIC (IT-ITES Program Implementing Agency/Department of Information Technology, Ministry of Information & Communications)		

Appendix 7: Area allocation plan during construction



Appendix 8: Erosion control plan



Note: Silt traps will be provided at all junctions before being connected to main drains

Appendix 9: Procedure for managing unforeseen environmental risks, hazards & accidents

In order to ensure adequate level of preparedness to manage unforeseen environmental risks, hazards and emergencies, the following procedure would be followed:

1. Identification of a responsible person or team to manage unforeseen events or emergencies (during construction, it would be within the PMU, and during the operation, it would be from the agency managing the facilities). List of emergency contact numbers, names and information on hospitals, ambulance etc. is provided and displayed prominently.
2. Identification of potential emergency situations and risks.
3. Identification of emergency exits / evacuation routes and marking of the same to aid personnel during an emergency.
4. Display of evacuation plans at prominent locations and briefing on emergency preparedness and response during an emergency.
5. Fire and safety training and first aid training to employees and contract personnel
6. Conducting mock drills and maintaining records for the same.
7. Firefighting equipment and systems serviced periodically.
8. Accidents and incident reports are submitted to the notified authorities.

Such a plan would be detailed out in the Operations Manual for the facility.

Annexure: Response to NEC's Environmental Clearance Conditions

This Annexure provides the response to the terms and conditions of the Environmental Clearance issued by NEC for construction of the Thimphu Tech Park at Babesa under Thimphu Dzongkhag. The response to each of the 27 points is set out below:

1. *As per Section 28.3 of the Regulation for the Environmental Clearance of Projects 2002, any modification of proposal/application shall take place only with prior approval from the NECS;*

Response: The proposal for the Tech Park included within the application submitted to the NECS in September 2009 has not been modified in scope or scale. Minor changes to the design and specifications have been described in the Project Description chapter of the EA. Any modifications/expansion of the proposal in the future will be submitted to the NECS for approval prior to construction.

2. *The holder shall ensure that construction of Thimphu Tech Park is carried out in line with the National Environment Protection Act 2007, Land Act 2007, Labour and Employment Act 2007 and its General Rules and Regulation on Occupation Health and Safety 2006, Environmental Assessment Act 2000 and its Regulation 2002 and any other Acts and Regulations that have direct or indirect impact on its operations;*

Response: Acts and regulations listed above and any other relevant acts and regulations likely to have impacts on the construction and operation of Thimphu Tech Park have been reviewed under Chapter 2: Policy Context of the Environmental Assessment report. Clauses of relevance to the proposed development shall be included within the tender document for the contractor, as stated in the EMP. An Operations Manual will be prepared and provided to the agency managing the facilities to ensure that the provisions of these Acts and Rules are complied with during the operation phase.

3. *The holder shall ensure that construction of the Tech Park complies with the National Standards for Ambient Air Quality, Industrial Emission, Workplace Emission and Noise Levels for Bhutan, NEC 2007, Environmental Discharge Standards 2004;*

Response: The National Standards for Bhutan 2007 and Environmental Discharge Standards have been included under Chapter 8: Mitigation Measures and EMP. The standards will be specified within the tender document for the contractor entrusted with the task. An Operations Manual will be prepared and provided to the agency managing the facilities to ensure that the provisions of these Acts and Rules are complied with during the operation phase.

4. *The holder shall ensure that sectoral clearances as per the existing norms are sought prior to construction of Tech Park. The construction of Tech Park shall be confined within the 5 acres of land as mentioned in the project proposal submitted to the NECS;*

Response: The finalized drawings of the proposed development will be submitted to TCC for statutory approval. The current proposal for Thimphu Tech Park is for about 50,000 sq. ft, which is confined within the 5 acres of land as stated in the application.

5. *The holder shall ensure that import and use of secondhand equipment is strictly prohibited. The equipment procured shall be of state-of-the-art technology accompanied with proper supporting documents stating their authenticity;*

Response: The facility will be provided with new equipment for the HVAC, plumbing, electrical systems, fire fighting, etc. No secondhand equipment is proposed to be used. The contractor entrusted with the task of construction will provide procurement bills from suppliers in support of this. During the operation of the IT Park, the occupiers will be informed of Bhutan's rules that prohibit the import of secondhand equipment.

6. *The holder shall ensure that each consignment of raw materials is attached with certification documents from the authentic supplier, reflecting its characteristics (both physical and chemical);*

Response: The tender document for the construction of the IT Park will specify that the characteristics of raw materials such as sand, cement, steel, etc., will be certified by the supplier and if necessary by laboratory tests where required.

7. *The holder shall ensure that enclosed material handling systems are put in place for handling of raw materials, fuels and finished products;*

Response: Detailed procedures for handling construction materials and waste; and fuels such as diesel and oil for the D.G. sets – have been specified under Chapter 8: Mitigation Measures and EMP of the Environmental Assessment. The measures will be included within the tender document for contractors during construction and in the Operations Manual during operations.

8. *The holder shall ensure that excavated materials and any construction debris are managed as per the norms of Thimphu City Corporation;*

Response: Detailed procedures for handling excavated materials and construction waste have been specified under Chapter 8: Mitigation Measures and EMP of the Environmental Assessment. The measures will be included within the tender document for contractors.

9. *The holder shall be responsible for sending back the e-waste generated from the operation of Tech Park to the supplier (s);*

Response: Detailed Operating Procedure for handling e-waste has been specified under Chapter 8: Mitigation Measures and EMP of the Environmental Assessment. The Operating Procedure will be implemented with the support of DIT.

10. *The holder shall ensure that raw materials and fuels are stored in a closed yard;*

Response: Storage areas and methods for raw materials and fuels during construction and operation phases have been specified under Chapter 8: Mitigation Measures and EMP of the Environmental Assessment. The measures will be included within the tender document for contractors during construction and in the Operations Manual during operations.

11. *The holder shall ensure that general housekeeping, cleanliness and hygiene are maintained at all times in the plant;*

Response: Housekeeping, cleanliness and hygiene requirements of the General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries, 2006, have been specified under Chapter 8: Mitigation Measures and EMP of the Environmental Assessment. The requirements will be included within the tender document for contractors and also in the Operations Manual during operations.

12. *The holder shall ensure that the best available pollution abatement equipment is installed for controlling the particulate emissions and is operated at all times during operation of the facility;*

Response: Pollution abatement measures and compliance norms for all equipment used during construction and operation phase have been specified under Chapter 8: Mitigation Measures and EMP of the Environmental Assessment and will be included within the tender document for contractors.

13. *The holder shall ensure that fugitive emissions from the activities in and around the factory premises are effectively controlled and mitigated at all times;*

Response: Given that the proposed development is a IT Technology Park the only expected fugitive emissions are likely to be from the D.G. sets whenever used. Emission mitigation measures for the

equipment have been specified under Chapter 8: Mitigation Measures and EMP of the Environmental Assessment.

14. *The holder shall ensure that appropriate effluent treatment plant is installed for treating liquid wastes of the facility to the required standards before discharging into the environment;*

Response: The proposed development will have an on-site sewage treatment plant, where treatment would be up to tertiary levels. Details of treated effluent quality are provided in Table 2 under Chapter 3: Project Description of the Environmental Assessment.

15. *The holder shall ensure that Occupational Health and Safety measures are implemented at all times, particularly the use of gloves, earmuffs, helmets and breathing masks. To this effect, the holder shall be solely responsible if the health of employees deteriorate due to the working environment. The holder shall therefore ensure that proper health check up facilities are provided to all employees and individual employee health records are maintained and updated at regular intervals;*

Response: General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries, 2006, have been reviewed under Chapter 2: Policy Context of the Environmental Assessment. Specific OHS requirements of relevance to the proposed development have been provided in Appendix 1 of the report and incorporated within the EMP. These requirements will be included within the tender document for contractors.

16. *The holder shall ensure that adequate lighting and ventilation facilities are provided within the work zones;*

Response: The IT Park building is being designed to achieve 'Gold' rating under LEED accreditation; therefore appropriate lighting and ventilation systems meeting LEED requirements have been incorporated in the building specifications. Details are provided under Chapter 3: Project Description of the Environmental Assessment.

17. *The holder shall ensure that first aid-kit is available in the plant at all times;*

Response: As part of the OHS commitments stipulated within in the EMP, a first aid-kit will be provided onsite and in common areas during the construction and operation phases respectively. This is stated in Chapter 8: Mitigation Measures and EMP of the Environmental Assessment.

18. *The holder shall ensure that safety signs are posted at strategic locations within the work areas, including sign boards indicating the areas where specific safety gadgets are required to be used;*

Response: As part of the OHS commitments stipulated within the EMP, safety signs in work areas will be posted. This is stated under Chapter 8: Mitigation Measures and EMP of the Environmental Assessment.

19. *The holder shall ensure that adequate fire fighting facilities are installed and expiry dates / life of such facilities are checked at regular intervals;*

Response: As part of the OHS commitments stipulated within in the EMP, firefighting facilities will be provided during the construction phase. The facility will also be provided with life safety and security systems as described in Chapter 3: Project Description.

20. *The holder shall ensure at all times that underage workers are not employed;*

Response: As part of the OHS and Labor and Employment Act commitments stipulated within the EMP, the proposed development will not allow underage workers to be employed onsite. This clause will be included within the contract document.

21. *The holder shall ensure that trees/plants are planted within the premises upon consultation with department of forest to maintain greenery and improve visual impact;*

Response: The landscaping plans for the IT Park are being finalized and included with the Masterplan drawings. An indicative landscaping scheme is shown in the Masterplan figure under Chapter 3: Project Description of the Environmental Assessment. In addition, low-water intensive, native plant species are listed in the EMP. The green belt referred to in the EMP is a part of this plan.

22. *The holder shall develop detail implementation plans (DIP), focusing on how to comply with the environmental terms and conditions, and submit to NECS within three months from the date of issue of this environmental clearance;*

Response: Detailed Implementation Plans have been described in the EMP. These will be incorporated in the tender documents for construction.

23. *The holder shall develop contingency plan to deal with unforeseen environmental risks, hazards & accidents and submit to NECS within three months from the date of issue of this environmental clearance;*

Response: Plans to deal with unforeseen environmental risks, hazards and accidents have been incorporated within the EMP and provided in Appendix 9 of the report.

24. *The holder shall ensure that a copy of the environmental clearance is framed and displayed at the workplace;*

Response: As part of the EMP implementation procedures set out in the Environmental Assessment and EMP report, a copy of the environmental clearance will be framed and displayed at the workplace.

25. *The holder shall ensure that the environmental clearance is renewed at least one month prior to its expiry;*

Response: As part of the EMP implementation procedures set out in the Environmental Assessment and EMP report, a copy of the environmental clearance will be framed and displayed at the workplace. This clearance certificate will be renewed one month before expiry.

26. *The holder shall ensure that environmental unit is established for strict implementation of the environmental terms and conditions and the terms of reference (TOR) of the unit is submitted to the NEC within three months from the date of issue of this environmental clearance;*

Response: As part of the EMP implementation a PMU will be established to ensure the implementation of environmental terms and conditions. The responsibilities of the PMU are detailed under section EMP Implementation and Monitoring under Chapter 8: Mitigation Measures and EMP of the Environmental Assessment.

27. *Violation of any of the above terms and conditions constitute an offence under the National Environment Protection Act 2007, Environmental Assessment Act 2000 and its Regulations 2002, and shall result to the environmental clearance being revoked without liability on the part of the Royal Government.*

Response: The developer's commitment to the implementation of the mitigation measures and EMP will ensure there is no violation of the NEC Environmental Clearance terms and conditions.