

INITIAL ENVIRONMENT ASSESSMENT REPORT(IEAR) FOR TRANSMISSION NETWORK IN GUMTI & SOUTH TRIPURA DISTRICT UNDER NERPSIP TRANCHE-1, TRIPURA



Prepared By

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(A GOVERNMENT OF INDIA ENTERPRISE)

For



TRIPURA STATE ELECTRICITY CORPORATION LIMITED
(A GOVERNMENT OF TRIPURA ENTERPRISE)

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SECTION – I : PROJECT DESCRIPTION

1.0 BACKGROUND:

The North Eastern Region (NER) in India is endowed with rich energy resources but faces significant bottlenecks in electricity access and availability levels. The per capita power consumption in NER is one-third of the national average. No significant generation capacity has been added between 2004 and 2011 as a result of which inadequate power supply remains a critical constraint to sustainable and inclusive growth, and to scaling up private investment and economic competitiveness in the NER.

The road-map for development of power sector specifying the need for strengthening of overall Transmission, Sub-transmission system of NER and Sikkim was brought out in the “Pasighat Proclamation on Power” released during the first Sectoral Summit of North Eastern Council at Pasighat in Arunachal Pradesh in January 2007.

Pursuant to recommendations of Pasighat summit, a Sub-Group was constituted under the Chairmanship of Member (Power System), Central Electricity Authority (CEA) on Transmission, Sub-transmission related issues in North Eastern Region. The sub-group submitted its report in December, 2007 wherein a comprehensive scheme for strengthening of transmission, sub-transmission system was evolved by CEA in consultation with POWERGRID and States of North Eastern Region and Sikkim.

Subsequently, a number of meetings took place regarding methodology for execution and funding of the scheme. In the meeting taken by Member, Planning Commission on February 24, 2009 and meeting of Committee of PIB chaired by Secretary, Department of Expenditure on March 24, 2009, it was decided that DPRs of the scheme comprising transmission, sub-transmission system should be prepared by POWERGRID. Accordingly, DPRs for strengthening of transmission, sub-transmission system in Tripura were prepared and submitted to Ministry of DONER / Ministry of Power / TSECL by POWERGRID.

Among the NER States and Sikkim, the project in Arunachal Pradesh and Sikkim is proposed to be funded by Govt. of India. Implementation of the scheme in other 6 States in NER viz. Assam, Meghalaya, Tripura, Mizoram, Manipur & Nagaland is proposed through funding from World Bank / Govt. of India. The scheme is proposed to be funded by World Bank in three tranches. Accordingly, priority transmission, distribution schemes to be taken up under tranche-1 of the World Bank fund has been finalized by CEA in consultation with the State and POWERGRID.

Ministry of Power (MoP), GoI has appointed POWERGRID as Design cum Implementation Supervision Consultant (i.e. Project Management Consultant-PMC) and now redesignated as Implementing Agency (IA) to six North Eastern States for the said project. However, the ownership of the assets shall be with the respective State government or State Utilities, which upon progressive commissioning shall be handed over to them for taking care of Operation and Maintenance of assets.

1.1 BENEFITS OF THE PROJECT:

The proposed transmission & distribution schemes not only improve overall power supply situation but also improve reliability, quality, security and enhancement of power supply in the State.

1.2 PROJECT JUSTIFICATION

The State of Tripura is spread over an area of about 10,492 sq. km with a population of more than 37 Lakhs. The State of Tripura is endowed with rich energy resources but faces significant bottlenecks in electricity access and availability levels. The present per capita energy consumption is of the order of 335 units (kWh) against the regional per capita consumption of about 258 units and national per capita consumption of about 779 units. The State meets its power requirement through about 164.5 MW of self-generation and about 105 MW of power allocation from various central sector generation projects of NHPC and NEEPCO. The present demand is of the order of 250 MW. As most of the generation projects in the north eastern region are hydro in nature, the State faces shortage of power during low-hydro generation condition.

Presently, the State draws its share of power from central sector generating stations through following inter-state transmission system (ISTS):

- Agartala GPP – Agartala(Tripura) 132kV D/C
- Agartala GPP – Kumarghat(POWERGRID) 132 S/C
- Kumarghat(POWERGRID) – Aizwal(POWERGRID) 132kV S/C
- Kumarghat(POWERGRID) – Badarpur(POWERGRID) 132kV S/C
- Dharamanagar(Tripura) – Dullavcherra(Assam) 132kV S/C
- Pallatana(OTPC) – Silchar (POWERGRID) 400kV D/C
- Pallatana(OTPC)-Surajmaninagar(Tripura) 400kV D/C (initially operated at 132kV)

As per the 18th Electric Power Survey of CEA, the future demand of the State is expected to grow to about 340 MW by year 2016-17 and 472 MW by year 2021-22. This shall be met through various hydro and thermal projects coming up in the north-eastern region in near future, which are as follows:

- Pallatana GBPP : 726 MW
- Bongaigaon TPS : 750 MW
- Kameng HEP : 600 MW
- Lower Subansiri HEP : 2000 MW

The State has a share of about 316 MW from these future generation schemes. With this, the total share of the State from central sector generating stations shall be about 421 MW. Following lines have been planned to transfer power from these future generation schemes to the state of Tripura:

- Surajmaninagar (Tripura) - Purba Kanchanbari (Tripura) 400kV D/C (to be initially operated at 132kV)

- Purba Kanchanbari (Tripura) – Silchar (POWERGRID) 400kV D/C (to be initially operated at 132kV)

The present intra-state transmission system of the State is quite old & weak and is unable to cater to the growing power requirements of the State. Although the present Transmission & Distribution (T&D) system covers many areas of the State, it is inadequate in its reach and due to non-availability of redundant T&D system, breakdown of any transmission system element results in long term power shortages making the system highly unreliable. Besides, some of the network elements have undergone long term outage due to break-down. Therefore, it has become essential to address the above situation through remedial measures in the transmission and distribution system. Accordingly, phase-wise strengthening of transmission & distribution system has been proposed.

The transmission schemes proposed under this report are priority schemes under Tranche-1 and are essential for improving the power supply situation in the State. Implementation of these schemes will improve quality, reliability, security and enhancement of the power supply in the State.

1.3 PROJECT HIGHLIGHTS

a)	Project Name	:	NER Power System Improvement Project (NERSPIP) – Tranche- I, Tripura
b)	Location	:	Different parts of Tripura State
c)	Beneficiary States	:	Tripura
d)	Project Cost	:	Rs.1372 Cr.
e)	Commissioning Schedule	:	2019

1.4 PROJECT SCOPE & PRESENT STUDY

The present Initial Environment Assessment Report (IEAR) is a document developed to identify possible environmental and social issues related to 132 KV transmission lines and associated 132/33 kV substations in Gumti & South Tripura Districts of Tripura State covered under “NER Power System Improvement Project”. The IEAR provides insight on possible environment & social issues and also describe management measures to minimize/mitigate it based on TSECL’s Environmental and Social Policy & Procedures (ESPP). The scope of IEAR covers the following subprojects;

SI. No	Transmission Line	Substation
1.	Udaipur - Bagafa 132 kV D/C line (32Km)	Establishment 2 x 50 MVA, 132/33 kV new substation at Bagafa.
2.	Bagafa – Belonia 132 kV D/C line (12.8 Km)	Establishment of 2 x 50 MVA, 132/33 kV new substation at Belonia.
3.	Belonia –Sabroom 132 kV D/C line (46.4 Km)	Establishment of 2x31.5 MVA,132/33 kV new substation at Sabroom.

4.	Bagafa – Satchand 132 kV S/C on D/C line (utilizing the corridor of existing Bagafa – Satchand 66 kV line) (31.2 Km)	Establishment of 2x31.5 MVA, 132/33 kV new substation at Satchand.
5.	Udaipur - Amarpur 132 kV D/C line (16.9 Km)	

The project activities include the survey for finalizing the route alignment and installation of transmission lines and construction of substations (civil and electrical installation). Lattice towers/ poles are then erected on designated places using normal excavation and foundations thereafter conductors are strung across these using manual/stringing machines. The construction of substations is regular civil works for small buildings. The electrical installations consist of the transformers, breakers, capacitors etc. and other protection/controlling devices to ensure required power flow.

A power map showing the transmission grid of Tripura highlighting the above lines and other new projects placed as **Exhibit-1**. Schematic map showing the various subprojects covered under the subject IEAR is placed in **Exhibit -2**.

SECTION – II: BASELINE DATA

2.0 The project is located in the States of Tripura and will pass through the districts of South Tripura & Gumti (part of undivided South Tripura district). The basic environmental settings of the State and subject project area is given below:

2.1 TRIPURA:

Tripura, is situated in the north eastern part of the country and shares international border with Bangladesh from three sides. The area of the State is 10,491 Sq km which forms 0.32% of country's geographical area. The State lies between latitude 22°57' N and 24°33' N and longitude 91°10' and 92°20' E in North Eastern Region physiographic zone. The general land use pattern of the State is given in **Table 2.1**.

Table-2.1 Land use Pattern

Land Use	Area in '000 ha	Percentage
Total geographical area	1,049	
Reporting area for land utilization	1,049	100.00
Forests	629	59.96
Not available for cultivation	141	13.44
Permanent pastures and other grazing lands	02	0.19
Land under misc. tree crops & groves	14	1.33
Culturable wasteland	04	0.38
Fallow lands other than current fallows	02	0.19
Current Fallows	02	0.19
Net area sown	256	24.40

Source: Land use statistics, Ministry of Agriculture, GOI, 2011-12

South Tripura district which also includes the recently created district of Gumti and South Tripura situated approximately between latitude 22°56' and 23°45' N and longitude 91°18' and 91°59' E. The South Tripura district is bounded on the North by Dhalai district and West Tripura district, while on the other sides by international border with Bangladesh. The total geographical area of South Tripura district is 1514.3 Sq.km.

Climate:

The State has a tropical savanna type climate, designated under the Köppen climate classification. The undulating topography leads to local variations, particularly in the hill ranges. The four main seasons are winter from December to February, pre-monsoon or summer from March to April, monsoon from May to September and post-monsoon from October to November. During the monsoon season the south west monsoon brings heavy rains, which cause frequent floods.

The climate of the South Tripura district is mostly warm and is characterized by a humid summer and a dry cool winter.

Rainfall:

The annual rainfall of the State varies between 2,250 mm to 2,500 mm. Average annual rainfall is South Tripura district is about 2000 mm.

Temperature:

The temperature in the State ranges from 21°C to 38°C in summer and 4°C and 33°C in the winter. The temperature of the South Tripura district varies between 8°C to 35°C.

Soils:

The soil in Tripura can be classified into five distinct categories i.e. 1) Red loamy soil and sandy soil (cover 43.07 percent of the total land area of the State). 2) Reddish yellow brown sandy soil (cover 33.06 percent of the land area of the State). The three other types of soil that prevail in the region are the 3) Lateritic soil 4) Younger Alluvial soil 5) Older alluvial soil. The factors influencing the prevalence of different types of soil in Tripura include topographical changes, climate changes, prevalent rock materials and the vegetation. Soil erosion caused by chemical weathering of the soil in the State of Tripura has led to the bed rock of the region being revealed

Water Resources:

The State of Tripura has rich water resources with the presence of as many as ten major rivers, including Gumti, Manu-Deo and Khowai. All rivers are rain-fed and ephemeral in nature. All major rivers originate from hill ranges and show a typical drainage pattern called trellis, except a few instances of dendrite pattern. A study of basin characteristics by CSME (1989) indicate that eight of the ten basins are within the territorial limit of Tripura while basin areas of river Fenni and Langai are shared by two Indian States viz. Tripura and Mizoram and Bangladesh. Collectively basin area of ten major rivers and other minor streams covers nearly 10,500 sq. km. In terms of percentage of the basin of individual rivers vis-a-vis, total basin Gumti (22.66%), is followed by Manu-Deo (18.36%) and Khowai.

The main rivers flowing through South Tripura district are Gumti, Muhuri and Feni. The river Feni forms natural boundary between the South Tripura district and Bangladesh. *However, the project activity is not going to impact these water bodies in any way as the route alignment of proposed transmission lines are quite far from these rivers.*

Ecological Resources:

The recorded forest area of the State is 6,294 sq km which constitutes 59.99% of its geographical area. Reserved forests constitute 66.33%, Protected forests 0.03% and Unclassed forests constitute 33.64%.

Forest Map of the State is enclosed as **Map-1**. The State has six forest types as per Champion & Seth Classification system (1968) which belongs to two forest type groups, viz. Tropical Semi Evergreen and Tropical Moist Deciduous Forests. The proposed transmission lines shall pass through following districts having forest cover of 80.93%. The details of forest resources available in the project area are as follows:

New District	Old District	Geographic area	2013 Assessment (Area in Sq. km)				% Forest cover
			Very Dense forest	Mod Dense forest	Open forest	Total	
Gumti	South Tripura	3057	73	1388	1013	2474	80.93
South Tripura							

Source : Indian State of Forest Report, 2013

Protected Areas:

Tripura has two National Parks and four Wildlife Sanctuaries covering an area of 603.64 sq.km constituting 5.75% of the total geographical area of the State. Details of protected area enclosed as **Annexure-I**. There is no notified elephant reserve/ corridor found in Tripura.

The proposed transmission lines are not passing through any protected area like national parks, sanctuaries, and biosphere reserves etc, as all such areas have been completely avoided through careful route selection. However, some portion of 132 kV D/C Udaipur - Bagafa line alignment is passing at a distance of 1km away from the Trishna Wildlife Sanctuary boundary.

Wetlands:

There are about 408 Wetlands in Tripura covering an area of 98.58 sq.km. Of the total Wetlands, 7 Wetlands are important from the point of view of biodiversity conservation and as centers of socio-economic values and potential sources for eco-tourism in the State. The Rudrasagar lake of State is also covered under International Convention (Ramsar Convention on wet land) by MoEF. **However, none of these wetlands are getting involved/impacted in routing/RoW of proposed lines and locating substations.**

Minerals:

Oil and natural gas are the most important mineral resources in Tripura. ONGC or oil and natural gas corporation has initiated massive exploration programme in the State. Other minerals of significance are glass sand, plastic clay, shale etc.

Human and Economic Development:

The population of Tripura as per census 2011 was 36,71,032. The Scheduled Tribes (STs) population consists nearly 31.13% of the total population in the State. There are 19 sub tribes among the ST population of the State with their own cultural identity. This project is being implemented in the tribal areas, governed by Tripura Tribal Autonomous District Council (TTADC) as per the provisions Sixth Schedule of the Indian Constitution. Since TTADC areas accounts for 70% of the total geographical area of the state and over 80% of the tribal population of the state the project benefit will largely accrue to tribal population

Tripura is an agrarian State with more than half of the population dependent on agriculture and allied activities. However, due to hilly terrain and forest cover, only 27 per cent of the land is available for cultivation. Rice, the major crop of the state, is

cultivated in 91 per cent of the cropped area. According to the Directorate of Economics & Statistics, Government of Tripura, in 2009–10 potato, sugarcane, pulses and jute were the other major crops cultivated in the State. Jackfruit and pineapple top the list of horticultural products. Traditionally, most of the indigenous population practiced jhum method (a type of slash-and-burn) of cultivation. The number of people dependent on jhum has declined over the years.

Pisciculture has made significant advances in the State. At the end of 2009–10, the State produced a surplus of 104.3 million fish seeds. Rubber and tea are the important cash crops of the State. Tripura ranks second only to Kerala in the production of natural rubber in the country. The State is known for its handicraft, particularly hand-woven cotton fabric, wood carvings, and bamboo products. High quality timber including sal, garjan, teak and gamar are found abundantly in the forests of Tripura. The industrial sector of the State continues to be highly underdeveloped – brickfields and tea industry are the only two organised sectors. Tripura has considerable reservoirs of natural gas. According to estimates by Oil and Natural Gas Corporation (ONGC), the State has 400 billion cu.m reserves of natural gas, with 16 billion cu.m is recoverable. ONGC produced 480 million cu.m natural gas in the State, in 2006–07. In 2011 and 2013, new large discoveries of natural gas were announced by ONGC.

The economy of Tripura can be characterized by rate of poverty, low capital formation in-adequate infrastructure facilities, Geographical isolation and communication bottleneck, in-adequate exploration and use of forest and mineral resources, slow industrialization and high unemployment. More than 50% of the population depends on agriculture for sustaining their livelihood. However, share of agriculture and allied activities in Gross State Domestic Production (GSDP) is only 23% primarily due to low capital base in the sector.

South Tripura District has total Geographic Area of 1514.3 sq km. As per 2011 census, the population of the district is 4,53,079 with a population density of 299 per sq km. **Around 91.5% population of the district resides in rural areas.** The district enjoys a high literacy rate of 85.09%. The sex ration of the district is 935 females per 1000 males, which is better than the corresponding National figure. Around 72% rural population of the district is below the poverty line, which indicates weak economic base and under-development.

Agriculture is the main profession/source of livelihood of the district, **with a net sown area of around 41,840 Ha.** Paddy is the main food crop. Potato, sugarcane, jute and mustard are also grown. Fisheries and Animal Husbandry are other prominent sources of employment; current fish productivity of the district is 2281 kg/Ha/year.

The district has not witnessed much industrial growth due to varied reasons, with presence of only two Industrial Areas located at Belonia and at Sabroom. There are about 132 nos. of reported registered factories in the district employing around 2250 workers. There are 5 nos. of Handloom units and around 18750 nos. of handloom weavers in the district. It has been informed that lack of reliable and uninterrupted power is considered to be major hurdle in the industrial development of the area.

Additional/detailed information regarding the environmental and social features along the alignment is provided in Section- IV

SECTION III: POLICY, LEGAL & REGULATORY FRAMEWORK

3.0 Power transmission project activities by their inherent nature and flexibility have negligible impacts on environmental and social attributes. Indian laws relating to environmental and social issues have strengthened in the last decade both due to local needs and international commitments. TSECL undertakes its activities within the purview of Indian and State specific laws keeping in mind appropriate international obligations and directives and guidelines with respect to environmental and social considerations of Funding Agencies.

3.1 ENVIRONMENTAL

3.1.1 CONSTITUTIONAL PROVISIONS

Subsequent to the first United Nations Conference on Human Environment at Stockholm in June, 1972, which emphasized the need to preserve and protect the natural environment, the Constitution of India was amended through the historical 42nd Amendment Act, 1976 by inserting Article 48-A and 51-A(g) for protection and promotion of the environment under the Directive Principles of State Policy and the Fundamental Duties respectively. The amendment, *inter alia* provide:

"The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country". (New Article 48A)

"It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures". (New Article 51 A (g))

Article 21 of the constitution provides, "no person shall be deprived of his life or personal liberty except according to procedure established by law".

Article 21 is the heart of the fundamental rights and has received expanded meaning from time to time after the decision of the Supreme Court in 1978. The Article 21 guarantee fundamental right to life – a life of dignity to be lived in a proper environment, free of danger of disease and infection. The right to live in a healthy environment is part of Article 21 of the Constitution. Recently, Supreme Court has broadly and liberally interpreted the Article 21, transgressed into the area of protection of environment, and held that the protection of environment and citizen's right to live in eco-friendly atmosphere interpreted as the basic right guaranteed under Article 21.

Thus the Indian Constitution has now two fold provision:

- (a) On the one hand, it gives directive to the State for the protection and improvement of environment.
- (b) On the other hand the citizens owe a constitutional duty to protect and improve natural environment.

Sixth Schedule

In Tripura, special provisions have been extended to the Tribal Areas under the 6th Schedule [Articles 244(2) and 275(1)] in addition to basic fundamental rights. Besides, the Tripura Panchayats (Second Amendment) Act, 1998 of Principal Act, 1993 includes ADC in Government functioning. The Sixth Schedule is entirely focused at protection of tribal areas and interests by allowing self-governance through constitutional institutions at the district or regional level. These institutions are entrusted with the twin task of protecting tribal cultures and customs and undertaking development tasks.

The Sixth Schedule of the Constitution applies to a large part of the state, which is under the jurisdiction of the “Tripura Tribal Areas Autonomous District Council” (TTAADC). Out of the total geographical area of 10,491 sq. km, 7,133 sq. km (about 68%) is under the TTAADC. The Sixth Schedule areas are governed through “Autonomous District Councils” (ADC) that has wide-ranging legislative and executive powers. The purpose of establishing the Autonomous District Council (ADC) is to provide for internal autonomy to the tribal people inhabiting these areas, and protect their social, cultural and economic interests, through granting them administrative and legal authority as per constitution of India.

3.1.2 MANDATORY REQUIREMENTS (NATIONAL)

- **GoT order/sanction under The Electricity Act, 2003:**

Sanction of GoT is a mandatory requirement for taking up any new transmission project under the section 68(1) of The Electricity Act, 2003. The sanction authorize TSECL to plan and coordinate activities to commission the new project. Electricity Act does not explicitly deal with environmental implications of activities related to power transmission and construction of substation. However, TSECL integrates environmental protection within its project activities.

- **Forest Clearance under the Forest (Conservation) Act, 1980:**

When transmission projects pass through forest land, clearance has to be obtained from relevant authorities under the Forest (Conservation) Act, 1980. This Act was enacted to prevent rapid deforestation and environmental degradation. State governments cannot de-reserve any forest land or authorize its use for any non-forest purposes without approval from the Central government. TSECL projects, when involving forest areas, undergo detailed review and approval procedures to obtain a Forest Clearance certificate from MoEF, Government of India before starting any construction activity in designated forest area.

- **Environmental Clearances under Environment (Protection) Act, 1986:**

Since transmission line projects are environmentally clean and do not involve any disposal of solid waste, effluents and hazardous substances in land, air and water they are kept out of the purview of Environment (Protection) Act, 1986. However, amendment in the Environment (Protection) Act, 1986 on 7th May’ 1992 made it necessary to obtain clearance from MoEF for power transmission projects in two districts in the Aravalis (*viz.*, Alwar in Rajasthan and Gurgaon in Haryana). The Aravali

range, in these two areas, is heavily degraded, hence, any industrial activity there becomes critical. Environment Impact Notification, 1994 & 2006 lays down specific project categories that require clearance from MoEF Power transmission projects are not included in this list.

- **Ozone Depleting Substances (Regulation and Control) Rules, 2000 :**

MoEF vide its notification dtd. 17th July, 2000 under the section of 6, 8 and 25 of the Environment (Protection) Act, 1986 has notified rules for regulation /control of Ozone Depleting Substances under Montreal Protocol adopted on 16th September 1987. As per the notification certain control and regulation has been imposed on manufacturing, import, export and use of these compound. TSECL shall follow provisions of notification and phase out all equipments which uses these substances and planning to achieve CFC free organization in near future.

- **Batteries (Management and Handling) Rules, 2001:**

MoEF vide its notification dtd. 16th May, 2001 under the section of 6, 8 and 25 of the Environment (Protection) Act, 1986 has put certain restriction on disposal of used batteries and its handling. As per the notification it is the responsibility of bulk consumer (TSECL) to ensure that used batteries are not disposed of, in any manner, other than by depositing with the dealer/manufacturer/registered recycler/importer/reconditioner or at the designated collection centres and to file half yearly return in prescribed form to the concerned State Pollution Control Board.

- **Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 :**

Vide notification dated 24th September, 2008 under the EPA, 1986, MoEF notified rules for environmentally sound management of hazardous wastes to ensure that the hazardous wastes are managed in a manner which shall protect health and the environment against the adverse affects that may result from such waste. The used transformer oil has been declared as hazardous wastes vide this notification.

TSECL, being a bulk user of transformer oil shall comply with the provisions of the said rules (MoEF notification dated 24th September 2008) if the practice of storing of used oil is maintained. In case it is decided to outsource the process of recycle of used oil to registered recycler as per the provisions of notification then TSECL shall submit the desired return in prescribed form to concerned State Pollution Control Board at the time of disposal of used oil.

- **E-waste (Management and Handling) Rules, 2011:**

Vide notification dated 12th May 2011 under the EPA, 1986, MoEF notified rules for environmentally sound management of e-waste to ensure that e-waste are managed in a manner which shall protect health and the environment against the adverse affects that may result from hazardous substance contained in such wastes. Thus, it is the

responsibility of the bulk consumer (TSECL) to ensure that e-waste generated is channelized to authorized collection center(s) or registered dismantler(s) or recycler(s) or is return to the pick-up of take back services provided by the producer. TSECL, being a bulk consumer of electrical and electronics equipments shall maintain the record as per Form-2 for scrutiny by State Pollution Control Board.

- **The Biological Diversity Act, 2002 :**

Under the United Nations Convention on Biological Diversity signed at Rio de Janeiro on the 5th June, 1992 of which India is also a party, Gol has enacted the Biological Diversity Act, 2002 to provide for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith. As per the provision of act certain area which are rich in biodiversity and encompasses unique and representative ecosystems are identified and designated as Biosphere Reserve to facilitate its conservation. All restrictions applicable to protected areas like National Park & Sanctuaries are also applicable to these reserves TSECL will abide by the provision of act wherever applicable, and will try to totally avoid these biosphere reserves while finalizing the route alignment.

- **The Scheduled Tribes & Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006**

This act recognizes and vests the forest rights and occupation in forest land to forest dwelling. Scheduled Tribes and other traditional forest dwellers who have been residing in such forests for generations but whose rights could not be recognized.

The definitions of forest dwelling schedule tribes, forestland, forest rights, forest villages, etc. have been included in Section 2 of the Act. The Union Ministry of Tribal Affairs (MoTA) is the nodal agency for implementation of the Act while field implementation is the responsibility of the respective State government agencies. Its implementation has also been linked with forest clearance process under Forest (Conservation) Act, 1980 w.e.f. August 2009 by MoEF. TSECL shall abide by the provisions of the act if any portion of the transmission line is passing through forest land, in occupation of the forest dwelling scheduled tribes and other traditional forest dwellers for laying of transmission lines. However, for linear projects including transmission lines obtaining of NoC from the gram sabha has been exempted for the requirement of FRA compliance as per MoEF circular dated 5th February 2013 and 15th January 2014.

3.1.3 FUNDING AGENCY:

For TSECL, mandatory environment requirements with respect to WB Operational Policies are as follows:

- **World Bank (WB) Operational Policies (OP) 4.01: Environmental Assessment**

The policy objective is to ensure the environmental and social soundness and sustainability of investment projects and support integration of environmental and social aspects of projects in the decision-making process.

TSECL takes remedial measures to prevent, minimize, mitigate, or compensate for adverse impact and improve environmental performance. Environment Assessment will take into account the natural environment, human health and safety, and social aspects and trans-boundary and global environmental aspects. During EA process public is also informed at every stage of project execution and their views are considered during decision-making process.

- **World Bank OP 4.04: Natural Habitats**

The policy objective is to promote sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions.

- **World Bank OP 4.11: Physical Cultural Resources**

The policy objective is to preserve PCR and in avoiding their destruction or damage. PCR includes resources of archeological, paleontological, historical, architectural, and religious (including graveyards and burial sites), aesthetic, or other cultural significance.

- **World Bank OP 4.36: Forests**

The objective of this policy is to realize the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests.

3.2. SOCIAL

3.2.1 CONSTITUTIONAL PROVISIONS

Constitutional provisions in regard to social safeguards are well enshrined in the preamble such as **JUSTICE**, social, economic and political; **LIBERTY** of thought, expression, belief, faith and worship; **EQUALITY** of status and of opportunity; **FRATERNITY** assuring the dignity of the individual and the unity and integrity of the Nation. Fundamental Rights and Directive Principles guarantee the right to life and liberty. Health, safety and livelihood have been interpreted as part of this larger right. Social safeguards provisions are dealt in detail in different Article such as Article-14, 15, 17, 23, 24, 25, 46, 330, 332 etc. TSECL shall implement the said constitutional provision in true spirit to fulfill its environmental and social obligations and responsibilities.

3.2.2 MANDATORY REQUIREMENTS (NATIONAL)

- **The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (RFCTLARRA) :**

Govt. of India replaced the old Land Acquisition Act, 1894 and notified the new RFCTLARRA, 2013 which came into force from 1st January 2014. This act ensures appropriate identification of the affected families/households, fair compensation and rehabilitation of titleholders and non-titleholders. However, the new act i.e. RFCTLARRA, 2013 authorizes State Govt. (i.e. GoT) or its authorized Government agency to complete the whole process of acquisition of private land including Social Impact Assessment (SIA), Action Plan for R&R (i.e. Rehabilitation and Resettlement) &

its implementation and the TSECL responsibility is limited to identification and selection of suitable land based on technical requirement and ensuring budget allocation.

- **Rights of Way and Compensation under Electricity Act, 2003 :**

The Electricity Act, 2003 has a provision for notifying transmission company under section 164 (B) to avail benefits of eminent domain provided under the Indian Telegraph Act, 1885. Under this section TSECL may seek for GoT authorization to exercise all the powers that the Telegraph authority possesses and can spot, construct and erect towers without acquiring the land. Moreover, all damages due to its activity shall be compensated at market rate. In case of agricultural or private land the provisions of section- 67 and/or section-68 (5 & 6) of the Electricity Act, 2003 and section-10 of the Indian Telegraph Act, 1885 are followed for assessment and payment of compensation towards such damages

3.2.3 FUNDING AGENCY

For TSECL, mandatory social requirements with respect to WB Operational Policies are as follows:

- **World Bank OP 4.12: Involuntary Resettlement**

This policy covers direct economic and social impacts both resulting from Bank-assisted investment projects, and are caused by the involuntary taking of land. To avoid or minimize involuntary resettlement and, where this is not feasible, assist displaced persons in improving or at least restoring their livelihoods and standards of living in real terms relative to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

- **World Bank OP 4.10: Indigenous People (IP)**

This policy contributes to the Bank's mission of poverty reduction and sustainable development by ensuring that the development process fully respects the dignity, human rights, economies, and cultures of Indigenous Peoples. The objective is to design and implement projects in a way that fosters full respect for indigenous peoples" so that they receive culturally compatible social and economic benefits, and do not suffer adverse effects during the development process. The project shall ascertain broad community support for the project based on social assessment and free prior and informed consultation with the affected Tribal community, if any.

SECTION IV :

APPROACH FOR ROUTE/SITE SELECTION

4.0 ROUTE SELECTION - (ASSESSMENT & MANAGEMENT PROCESS)

At the system planning stage itself one of the factors that govern the evolution of system is the possible infringement with the forest. Wherever such infringements are substantial, different alternative options are considered. The route/ site selection criteria followed is detailed below:

While identifying the transmission system, preliminary route selection is done by TSECL based on the Survey of India Topo sheets, Forest Atlas (Govt. of India's Publication) and Google Maps etc. During route alignment all possible efforts are made to avoid the forest area involvement completely or to keep it to the barest minimum, whenever it becomes unavoidable due to the geography of terrain or heavy cost involved in avoiding it. *Presence of important/protected natural habitats (IUCN category I - IV) is verified by superimposing the proposed alternative alignment on the Integrated Biodiversity Assessment Tool (IBAT) map. IBAT is a very informative decision-making tool to address possible infringement with potential biodiversity important areas and has been developed through a partnership of global conservation leaders including Bird Life International, Conservation International (CI), the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) and the International Union for Conservation of Nature (IUCN) for conservation/protection of such areas.*

4.1.1 STUDY OF ALTERNATIVES

Environmental Criteria for Route selection

For selection of optimum route, the following points are taken into consideration:

- (i) The route of the proposed transmission lines does not involve any human rehabilitation
- (ii) Any monument of cultural or historical importance is not affected by the route of the transmission line.
- (iii) The proposed route of transmission line does not create any threat to the survival of any community with special reference to Tribal Community.
- (iv) The proposed route of transmission line does not affect any public utility services like playgrounds, schools, other establishments etc.
- (v) The line route does not pass through any National Parks, Sanctuaries etc.
- (vi) The line route does not infringe with area of natural resources.

In order to achieve this, TSECL undertakes route selection for individual transmission lines in close consultation with representatives of concerned Forest Department and the Department of Revenue. Although under the law, TSECL has right of eminent domain yet alternative alignments are considered keeping in mind the above-mentioned factors

during site selection, *with minor alterations often added to avoid environmentally sensitive areas and settlements at execution stage.*

- As a rule, alignments are generally cited away from major towns, whenever possible, to account for future urban expansion.
- Similarly, forests are avoided to the extent possible, and when it is not possible, a route is selected in consultation with the local Divisional Forest Officer, that causes minimum damage to existing forest resources.
- Alignments are selected to avoid wetlands and unstable areas for both financial and environmental reasons.

In addition, care is also taken to avoid National parks, Sanctuaries, Eco-sensitive zones, Tiger reserves, Biosphere reserves, Elephant corridors and IBA sites etc. Keeping above in mind the routes of proposed lines under the project have been so aligned that it takes care of above factors. As such different alternatives for transmission lines were studied with the help of Govt. published data like Forest atlas, Survey of India etc. and Google Maps to arrive at most optimum route which can be taken up for detailed survey and assessment of environmental & social impacts for their proper management.

A. TRANSMISSION LINE

1. EVALUATION OF ALTERNATIVES ROUTE ALIGNMENT FOR 132 KV D/C UDAIPUR –BAGAFI TRANSMISSION LINE

Three (3) different alignments (**Map-2** in KML format attached) were studied with the help Google Maps and walkover survey to arrive at most optimum route for detailed survey. This was then verified on web-based IBAT Database and an image for the same is provided in **Map - 3**. The comparative details of these three alternatives in respect of the proposed line are as follows:

S.N	Description	Alternative-I	Alternative-II	Alternative-III
1.	Route particulars (Bee Line Length - 24.5 km)			
i.	Route Length (km)	32	27	34.8
ii.	Terrain			
	Hilly (Gentle slope)	40%	70%	80%
	Plain	60%	30%	20%
2.	Environmental impact			
i.	Name of District through which the line passes	Gumti & South Tripura	Gumti & South Tripura	Gumti & South Tripura.
ii.	Towns in alignment	Udaipur, Bagafa & Santirbazaar.	Udaipur, Bagafa & Santirbazaar	Udaipur, Bagafa & Santirbazaar
iii.	House within RoW	Shall be ascertained after detailed survey	Shall be ascertained after detailed survey	Shall be ascertained after detailed survey
iv.	Forest involvement in Ha/km	59.4 ha/ 22 km	70.2ha / 26 km	81ha /30 km

S.N	Description	Alternative-I	Alternative-II	Alternative-III
v.	Type of Forest (RF/PF/Mangrove/ Wildlife Area/ Elephant corridor/ Biodiversity Hotspots/Biosphere Reserve/Wetlands or any other environmentally sensitive area.	Reserved Forest & Trishna wildlife sanctuary is approx. 1 km from the line	Reserved Forest & Trishna wildlife sanctuary is coming across the route.	Reserved Forest & Trishna wildlife sanctuary is approx.5 km from the line
vi.	Density of Forests	Low	Moderate	Dense
vii.	Type of flora	Mainly Sal, Teak, Rubber etc.	Mainly Sal, Teak, Rubber etc.	Mainly Sal, Teak, Rubber etc.
viii.	Type of fauna	Crow, Sparrow, Pigeon, Lizard, Fox, Monkey, Cat, Snake etc.	Crow, Sparrow, Pigeon, Lizard, Fox, Monkey, Cat, Snake etc.	Crow, Sparrow, Pigeon, Lizard, Fox, Monkey, Cat, Snake etc.
ix.	Endangered species, if any	Nil	Nil	Nil
x.	Historical/cultural monuments	Nil	Nil	Nil
3.	Compensation Cost			
i.	Crop (Non Forest)	Rs 50.00 lakhs (Approx.)	Rs. 5.00 lakhs (Approx.)	Rs. 24.00 lakhs (Approx.)
ii.	Forest (CA, NPV etc.)	Rs. 11.88 Crores (Approx.)	Rs. 14.04 Crores (Approx.)	Rs. 16.20 Crores (Approx.)
4.	Major Crossings			
i.	Highway (National/State)	1 (NH)	1 (NH)	1 (NH)
ii.	Power line	Nil	Nil	Nil
iii.	Railway line	1	1	1
iv.	River crossing	Nil	Nil	Nil
5.	Construction problems	Less due to involvement of more plain area and better approaches	Moderate	High
6.	O&M problems	O&M shall be easier due to less hilly & forest area and better approaches	Moderate	High

From the comparative analysis it is evident that complete avoidance of reserved forest area is not possible as reserved forest invariably intercepts with all the three alternatives studied around the bee line. However, Alternative Route-I is shorter in length as compared to Alternative-II and Alternative-III and pass through mostly plain area with minimum stretch of reserved forest area and avoiding the Trishna Wildlife Sanctuary which is approx. 1 km away from line. Therefore, Alternative-I found to be the most optimum and recommended for detailed survey.

2. EVALUATION OF ALTERNATIVES ROUTE ALIGNMENT FOR 132 KV D/C UDAIPUR – AMARPUR TRANSMISSION LINE

Three (3) different alignments (**Map- 4** in KML format attached) were studied with the help of Google Maps and walkover survey to arrive at most optimum route for detailed survey. The comparative details of these three alternatives in respect of the proposed line are as below:

S.N	Description	Alternative-I	Alternative-II	Alternative-III
1.	Route particulars (Bee Line Length - 15 km)			
i	Route Length (km)	16.9	19	18.6
ii.	Terrain			
	Hilly (Gentle slope)	80%	80%	80%
	Plain	20%	20%	20%
2.	Environmental impact			
i	Name of District through which the line passes	Gumti	Gumti	Gumti
ii	Towns in alignment	Udaipur & Amarpur	Udaipur & Amarpur	Udaipur & Amarpur
iii	House within RoW	Shall be ascertained after detailed survey	Shall be ascertained after detailed survey	Shall be ascertained after detailed survey
iv	Forest involvement in Ha/km	21.33Ha./ 7.9 km	24.3 Ha./ 9 km	32.4 Ha./12 km
v	Type of Forest (RF/PF/Mangrove/ Wildlife Area/ Elephant corridor/ Biodiversity Hotspots/Biosphere Reserve/Wetlands or any other environmentally sensitive area.	Reserved Forest (Deotamura Barmura RF)	Reserved Forest (Deotamura Barmura RF)	Reserved Forest (Deotamura Barmura RF)
vi	Density of Forests	Moderate	Moderate	Dense
vii	Type of flora	Mainly Sal, Teak and Rubber etc.	Mainly Sal, Teak and Rubber etc.	Mainly Sal, Teak and Rubber etc.
viii	Type of fauna	Crow, Sparrow, Fox, Pigeon, Lizard, Cat, Monkey, Snake etc.	Crow, Sparrow, Fox, Pigeon, Lizard, Cat, Monkey, Snake etc.	Crow, Sparrow, Fox, Pigeon, Lizard, Cat, Monkey, Snake etc.
ix	Endangered species, if any	Nil	Nil	Nil
x	Historical/cultural monuments	Nil	Nil	Nil
3	Compensation Cost			
i	Crop (Non Forest)	Rs 45.00 lakhs (Approx.)	Rs 50.00 lakhs (Approx.)	Rs 33.00 lakhs (Approx.)
ii	Forest (CA, NPV etc.)	Rs 4.26 Crore (Approx)	Rs 4.86 Crore (Approx)	Rs 6.48 Crore (Approx)

S.N	Description	Alternative-I	Alternative-II	Alternative-III
4.	Major Crossings			
i	Highway (National/State)	1 (SH)	1 (SH)	1 (SH)
ii	Power line	Nil	Nil	Nil
iii	Railway line	Nil	Nil	Nil
iv	River crossing	Nil	Nil	Nil
5.	Construction problems	Less due to easy approaches and less involvement of forest area	Comparatively more due to difficult approaches and involvement of more forest area	Most difficult due to non existing approach path and involvement of more forest area
6.	O&M problems	O&M shall be easier due to less forest involvement and better approaches	Moderate	High

From the above comparative analysis, Alternative-I is shortest in length than Alternative-II and Alternative-III. It is also observed that complete avoidance of reserved forest is not possible in any of the route alignments studied around bee line. However, it is evident that Alternative-I involve minimum stretch of reserved forest and also tree felling will be minimum. Therefore, Alternative-I is found more optimum and recommended for detailed survey.

3. EVALUATION OF ALTERNATIVES ROUTE ALIGNMENT FOR 132 KV D/C BAGAF A – SATCHAND TRANSMISSION LINE

Three (3) different alignments (**Map- 5** in KML format attached) were studied with the help Google Maps and walkover survey to arrive at most optimum route for detailed survey. The comparative details of these three alternatives in respect of the proposed transmission line are as below:

S.N	Description	Alternative-I	Alternative-II	Alternative-III
1.	Route particulars (Bee Line Length -26.2 km)			
i	Route Length (km)	31.2	29.4	40.3
ii.	Terrain			
	Hilly (Gentle slope)	40%	70%	80%
	Plain	60%	30%	20%
2.	Environmental impact			
i	Name of District through which the line passes	South Tripura	South Tripura	South Tripura
ii	Towns in alignment	Bagafa, Satchand, Santirbazaar & Sabroom	Bagafa, Satchand , Santirbazaar & Sabroom	Bagafa, Satchand , Santirbazaar & Sabroom
iii	House within ROW	Shall be ascertained after detailed survey	Shall be ascertained after detailed survey	Shall be ascertained after detailed survey
iv	Forest involvement in Ha./km	13.5 Ha./5 km	43.2 Ha/ 16 km	48.6 Ha./18 km

S.N	Description	Alternative-I	Alternative-II	Alternative-III
v	Type of Forest (RF/PF/Mangrove/ Wildlife Area/ Elephant corridor/Biodiversity Hotspots/Biosphere Reserve/Wetlands or any other environmentally sensitive area.	Reserved Forest (Proposed)	Reserved Forest (Tekka Tulsi RF)	Reserved Forest (Muhuripur and Deotamura Barmura RF)
vi	Density of Forests	Moderate	Dense	Dense
vii	Type of flora	Mainly Sal, Teak and Rubber etc.	Mainly Sal, Teak and Rubber etc.	Mainly Sal, Teak and Rubber etc.
viii	Type of fauna	Crow, Sparrow, Pigeon, Lizard, Fox, Monkey, Cat, Snake etc.	Crow, Sparrow, Pigeon, Lizard, Fox, Monkey, Cat, Snake etc.	Crow, Sparrow, Pigeon, Lizard, Fox, Monkey, Cat, Snake etc.
ix	Endangered species, if any	Nil	Nil	Nil
x	Historical/cultural monuments	Nil	Nil	Nil
3	Compensation Cost			
i	Crop (Non Forest)	Rs. 1.31 Crore (Approx.)	Rs. 67. 00 Lakh (Approx.)	Rs. 1.11 Crore (Approx.)
ii	Forest (CA, NPV etc)	Rs. 2.70 Crore (Approx.)	Rs. 8.64 Crore (Approx.)	Rs. 9.72 Crore (Approx.)
4.	Major Crossings			
i	Highway (National/State)	1 (NH)	1 (NH)	2 (NH)
ii	Power line	Nil	Nil	Nil
iii	Railway line	1	1	Nil
iv	River crossing	Nil	Nil	Nil
5.	Construction problems	Less due to involvement of more plain area and better approaches	Comparatively more due to involvement more hilly and forest area	Most difficult due to involvement more hilly and forest area
6.	O&M problems	O&M shall be easier due to less hilly & forest area and better approaches	Moderate	High

From the above comparison of the three different alternatives, it is observed that complete avoidance of reserved forest is not possible in any of the route alignments studied around bee line. Although Alternative-I is not the shortest route length and little higher in length than Alternate –II but it involves minimum stretch of reserved forest and also tree felling will be minimum. Alternative-I is least affecting the environment as compared to other alternatives. Therefore, Alternative-I is found to be most optimum alignment and recommended for detailed survey

4. EVALUATION OF ALTERNATIVES ROUTE ALIGNMENT FOR 132 KV D/C BAGAF A –BELONIA TRANSMISSION LINE

Three (3) different alignments (**Map- 6** in KML format attached) were studied with the help of published data Google Maps and walkover survey to arrive at most optimum route for detailed survey. The comparative details of these three alternatives in respect of the proposed transmission Line are as follows:

S.N	Description	Alternative-I	Alternative-II	Alternative-III
1.	Route particulars (Bee Line Length – 10.6 km)			
i	Route Length (km)	12.8	13.5	12.2
ii.	Terrain			
	Hilly (Gentle slope)	40%	40%	40%
	Plain	60%	60%	60%
2.	Environmental Impact			
i	Name of District through which the line passes	South Tripura	South Tripura	South Tripura
ii	Town in alignment	Bagafa, Belonia. & Santirbazaar	Bagafa, Belonia. & Santirbazaar	Bagafa, Belonia. & Santirbazaar
iii	House within ROW	Shall be ascertained after detailed survey	Shall be ascertained after detailed survey	Shall be ascertained after detailed survey
iv	Forest involvement in Ha/km	16.55 Ha./6.13 km	24.3 Ha. / 9 km	20.25 Ha./7.5 km
v	Type of Forest (RF/PF/Mangrove/Wildlife Area/Elephant corridor/Biodiversity Hotspots/Biosphere Reserve/Wetlands or any other environmentally sensitive area.	Reserved Forest (proposed)	Reserved Forest (proposed)	Reserved Forest (proposed) and some portion of Bormura Deoutanmura RF
vi	Density of Forests	Low	Moderate	High
vii	Type of flora	Mainly Sal, Teak and Rubber etc.	Mainly Sal, Teak and Rubber etc.	Mainly Sal, Teak and Rubber etc.
viii	Type of fauna	Crow, Sparrow, Pigeon, Lizard, Fox, Monkey, Cat, Snake etc.	Crow, Sparrow, Pigeon, Lizard, Fox, Monkey, Cat, Snake etc.	Crow, Sparrow, Pigeon, Lizard, Fox, Monkey, Cat, Snake etc.
ix	Endangered species, if any	Nil	Nil	Nil
x	Historical/cultural monuments	Nil	Nil	Nil
3	Compensation Cost			
i	Crop (Non Forest)	Rs. 33.35 Lakh (Approx.)	Rs. 22.50 Lakh (Approx.)	Rs. 23.50 Lakh (Approx.)
ii	Forest (CA, NPV etc.)	Rs. 3.31 Crore (Approx)	Rs. 4.86 Crore (Approx)	Rs. 4.05 Crore (Approx)

S.N	Description	Alternative-I	Alternative-II	Alternative-III
4.	Major Crossings			
i	Highway (National/State)	1 (SH)	1 (SH)	1 (SH)
ii	Power line	Nil	Nil	Nil
iii	Railway line	1	1	1
iv	River crossing	Nil	Nil	Nil
5.	Construction problems	Less due to easy approaches and less involvement of forest area	Most difficult due less approachability and involvement of more forest area	Comparatively more due difficult approaches and involvement of more forest area
6.	O&M problems	O&M shall be easier due to less forest involvement and better approaches	High	Moderate

From the above comparison of the three different alternatives, it is observed that complete avoidance of reserved forest is not possible in any of the route alignments studied around bee line. Although Alternative-I is not the shortest in route length and little higher in length than Alternate –III but it involves minimum stretch of reserved forest and also tree felling will be minimum. Alternative-I is least affecting the environment as compared to other alternatives. Therefore, Alternative-I is found to be most optimum alignment and recommended for detailed survey

5. EVALUATION OF ALTERNATIVES ROUTE ALIGNMENT FOR 132 KV D/C BELONIA -SABROOM T/L

Three (3) different alignments (**Map-7** in KML format attached) were studied with the help of published data Google Maps and walkover survey to arrive at most optimum route for detailed survey. The comparative details of these three alternatives in respect of the proposed transmission Line are as follows:

S.N	Description	Alternative-I	Alternative-II	Alternative-III
1.	Route particulars (Bee Line Length – 34 KM)			
i	Route Length (km)	46.4	35	38
ii.	Terrain			
	Hilly (Gentle slope)	20%	80%	90%
	Plain	80%	20%	10%
2.	Environmental Impact			
i	Name of District through which the line passes	South Tripura	South Tripura	South Tripura
ii	Town in alignment	Belonia & Sabroom.	Belonia & Sabroom	Belonia & Sabroom
iii	House within ROW	Shall be ascertained after detailed survey	Shall be ascertained after detailed survey	Shall be ascertained after detailed survey

S.N	Description	Alternative-I	Alternative-II	Alternative-III
iv	Forest involvement in Ha/km	35.1 Ha./13 km.	54 Ha./ 20 km	83.7 Ha./31 km
v	Type of Forest (RF/PF/Mangrove/ Wildlife Area/ Elephant corridor/ Biodiversity Hotspots/Biosphere Reserve/Wetlands or any other environmentally sensitive area.	Reserved Forest (Tekka Tulsı R.F)	Reserved Forest (Tekka Tulsı R.F)	Reserved Forest (Tekka Tulsı R.F)
vi	Density of Forests	Moderate	High	High
vii	Type of flora	Mainly Sal, Teak and Rubber etc.	Mainly Sal, Teak and Rubber etc.	Mainly Sal, Teak and Rubber etc.
viii	Type of fauna	Crow, Sparrow, Pigeon, Lizard, Fox, Monkey, Cat, Snake etc.	Crow, Sparrow, Pigeon, Lizard, Fox, Monkey, Cat, Snake etc.	Crow, Sparrow, Pigeon, Lizard, Fox, Monkey, Cat, Snake etc.
ix	Endangered species, if any	Nil	Nil	Nil
x	Historical/cultural monuments	Nil	Nil	Nil
3	Compensation Cost			
i	Crop (Non Forest)	Rs. 1.67 Crore (Approx.)	Rs. 0.75 Crore (Approx.)	Rs. 0.35 Crore (Approx.)
ii	Forest (CA, NPV etc.)	Rs. 6.30 Crore (Approx)	Rs10.80 Crore (Approx)	Rs. 16.74 Crore (Approx)
4.	Major Crossings			
i	Highway (National/State)	Nil	Nil	Nil
ii	Power line	Nil	Nil	Nil
iii	Railway line	1	1	1
iv	River crossing	Nil	Nil	Nil
5.	Construction problems	Less due to easy approachability through plain area and less involvement of forest	Comparatively more due to involvement more hilly and forest area	Most difficult due to involvement more hilly and forest area
6.	O&M problems	O&M shall be easier due to less hilly & forest area and better approaches	Moderate	High

From the above comparison of the three different alternatives, it is observed that complete avoidance of reserved forest is not possible in any of the route alignments studied around bee line. Although Alternative-I route alignment is longer than Alternative – II & III, but involves minimum forest area and easily approachable due to plane terrain. Alternative-II & III are comparatively having high involvement of forest area and more

number of tree felling. Hence Alternative-I which is least affecting the environment is found to be most optimum alignment and recommended for detailed survey.

B. SUBSTATION:

For substation site selection also analysis of 2-3 alternatives sites is carried out based on environment and social aspects and technical requirement. Such analysis considers various site specific parameters that include availability of infrastructure facilities such as access roads, water, distance from railheads, type of land (Government/revenue/private land); social impacts such as number of families getting affected; Common Property Resources (CPR) including feasibility of acquisition. The finalization of substation land is done based on above analysis and site visit/verification. The social aspects are provided due weightage after technical requirement in decision making for selection/finalization of land for substation. Since the lands for all the substations in the instant case are already in possession of TSECL said exercise is not required/ needed for proposed project. Details about proposed substation land have been provided in Section –5.0 (i).

SECTION - V

POTENTIAL ENVIRONMENTAL IMPACTS, THEIR EVALUATION AND MANAGEMENT

5.0 IMPACT DUE TO PROJECT LOCATION AND DESIGN

Environmental impacts of Transmission & Distribution (T & D) projects are not far reaching and are mostly localized to RoW (refer **Table- 5.1**). *Actual 132 KV line including tower on ground along with RoW and extent of impact on land/vegetation is placed as Fig.-1 & 1a*. However, T & D projects have some effects on natural and socio-culture resources. These impacts can be minimized by careful route selection. In order to get latest information and further optimization of route, modern survey techniques/tools like GIS, GPS are also applied. Introduction of GIS and GPS in route selection result in access to updated/latest information, through satellite images and further optimization of route having minimal environmental impact. Moreover, availability of various details, constraints like topographical and geotechnical details, forest and environmental details etc. help in planning the effective mitigative measures including engineering variations depending upon the site situation/location. In the instant scheme also these techniques are used and detail survey using GIS/GPS is under progress. Although, all possible measures have been taken during the finalization of route alignment for the proposed transmission lines but due to peculiarity of terrain and demography of the area where subprojects are being implemented, some environmental impacts may be there. The explanations in brief with regard to specific environment review criteria based on preliminary survey are as follows:

Table- 5.1: RoW Width & Clearance between Conductors and Trees

Transmission Voltage	Max. RoW (In Meters)	Min. Clearance (in Meters) between conductor & Trees *
132 kV	27	4.0

As per IS:5613 and MoEF guidelines finalized in consultation with CEA

(i) Resettlement

Land is required for a) construction of substations and b) erection of transmission lines. In general requirement of land area for substation varies from 0.3 acres (for 33 kV) to 10 acres (132 kV) depending upon voltage levels and no. of bays.

In the instant scheme, TSECL does not need to acquire lands for (a) because TSECL already possess land for all four proposed substations and the same is available in their existing 66 kV substation at Bagafa, Belonia, Sabroom, & Satchand. As no fresh land is needed to be acquired for these substations, issue related to acquisition of land including possible R&R is not envisaged. A sample drawing and location of proposed substations are enclosed at **Annexure- 2**.

In respect of (b), no permanent acquisition is envisaged. Land for tower and right of way is not acquired as agricultural activities can continue. A Typical plan of transmission line tower footing indicating the above position and extent of damage is depicted in **Fig.-2**.

As described earlier all measures are undertaken by TSECL at the line routing stage itself to avoid settlements such as cities, villages etc. It may be seen from the above description of proposed route alignments and also keeping in mind that no permanent acquisition of land is involved for tower foundation as per existing law, these subprojects don't require any resettlement of villagers. However, some temporary damages/disturbances can happen. Same will be compensated by the project under Compensation Plan for Temporary Damage (CPTD) to minimize the damages and provide compensation plan for temporary damages in consultation with the state government and affected persons and/ or community.

The project is being implemented in the tribal areas governed by Tripura Tribal Autonomous District Council (TTADC) as per the provisions of Sixth Schedule of the Indian Constitution. Since TTADC areas accounts for 70% of the total geographical area of the state and over 80% of the tribal population of the state the project benefit will largely accrue to tribal population therefore a separate "Tribal Peoples Development Plan" is not required.

(ii) Land value depreciation

Based on past experience land prices are generally expected to rise in the areas receiving power. Generally transmission lines pass through uninhabited area, agriculture fields and forests, where the land use is not going to change in foreseeable future. Therefore, the value of land will not be adversely affected to a significant degree.

(iii) Historical/cultural monuments/value

As per the policy of route selection, only that route alignment is finalized which avoids all the historical and cultural monuments. As per the preliminary assessment carried out during finalization of route alignment in consultation with State revenue authorities and Archaeological Survey of India (ASI), no such monuments are coming in the proposed route alignments. Moreover, utmost care shall be taken during detailed survey to avoid such areas.

(iv) Lines into precious ecological areas

As already explained all precautions have been taken to avoid routing of line through forest and protected areas like national park/sanctuaries. In spite of taking due care during route selection, involvement of some forest area could not be avoided completely. However suitable management measures as specified in EMP¹ (refer clause- 9) like minimizing RoW requirement, use of existing tower, use of tall or extended tower etc wherever feasible shall be undertaken to minimize the loss of vegetation. Moreover, protected area like wildlife sanctuary, national parks, biosphere reserves etc. have been avoided completely. However, reference in EMP is maintained to address the issues in case of any eventuality and shall be appropriately addressed during Final Environment Assessment Report (FEAR). In the instant scheme one of the line i.e. Udaipur - Bagafa 132 KV D/C which was earlier passing through Trishna Wildlife Sanctuary has been realigned at a distance of 1km from the boundary to avoid any impact on wildlife. Details of forest involvement in different lines are presented below:

¹ *Environment Management Plan (EMP) is placed at Table -6.1*

Sl. No.	Name of Transmission Line	Forest Involvement (In ha.)
1	Udaipur - Bagafa 132 KV D/C line	59.40
2	Udaipur - Amarpur 132 KV D/C line	21.33
3	Bagafa - Satchand 132 KV D/C line	13.50
4	Bagafa - Belonia 132 KV D/C line	16.55
5	Belonia - Sabroom 132 KV D/C line	35.10

It may be seen from the above table that out of total transmission line length of 139.3 km about 54 km (145.88 ha.) shall pass through forest. Prior approval of Gol/MoEF shall be obtained under Forest (Conservation) Act, 1980 after detail survey and finalization of route through forest area in consultation with local forest authorities as per well established forest clearance process described in ESPP. As per the initial study/assessment most of the forests to be traversed by the subject lines are categorised as Reserve Forest (RF) & Un-classed forest and found to be in various degree of degradation and even the wildlife species present are those who have adapted to open or disturbed habitat. It has also been confirmed by forest department that the plantation of *Tectona grandis*, *Shorea robusta*, *Terminallia bellirica* species have been carried out during last decade to enhance the density and quality of forest. Nonetheless, to mitigate losses to existing forests, clearing of the transmission line Right-of-Way will be done under supervision of forest department, and some low canopy seed trees and shrubs may be kept intact if they do not interfere with tower erection and line installation. The extracted wood will be sold by the forest department, who will also retain the sale proceeds. Three-meter wide strips of land below each conductor will be cleared during construction and one such strip shall be kept free of vegetation for maintenance purpose and regeneration up to certain height in remaining width of RoW will be allowed after construction activity. Periodical lopping/pruning of trees to maintain line clearance will be done under the direction of forest department (for details refer **Fig. - 3** for tree falling pattern and **Fig.- 3a** for area of influence). Moreover, to prevent unauthorized tree felling in forest area. measures like providing construction crews with fuel wood or alternative fuels by Contractor has been specified in EMP (refer clause- 24)

Transmission lines can serve as new access routes into previously inaccessible or poorly accessible forests, thereby accelerating forest and wildlife loss. In such cases, TSECL cannot take action itself, but local Forest Department personnel will normally assess the dangers and take appropriate action, such as establishing guard stations at the entrance to the forest etc. cost of which is borne by TSECL. Given the already easy access and degraded conditions at the proposed subprojects sites, this problem is not expected to be encountered. Nonetheless, TSECL staff will report to the Forest Department any noticeable encroachment induced by the Projects.

(v) Lines into other valuable lands

Impacts on agricultural land will be restricted to the construction phase and when large-scale maintenance measures are required. The proposed transmission line will pass mostly through agricultural fields. As per existing law, land for tower/pole and right of way is not acquired and agricultural activities are allowed to continue after construction activity and TSECL pays compensation for all damages including cost of land below tower to its owner.

In areas where transmission lines will traverse agricultural land, compensation will be paid to owners for any crop damage incurred as a result of construction activities. TSECL field staff will consult affected villagers and local revenue dept. and apprise him about the project and likely tower locations, which shall be erected in the agricultural land, for compensation. Revenue dept. after evaluating the land loss due to construction activity and crop damages based on productivity of land arrives at the compensation cost which is paid to farmer. Agricultural activities will be allowed to continue following the construction period. If bunds or other on-farm works are disturbed during construction or maintenance, they will be restored to the owner's satisfaction following cessation of construction or maintenance activities. In the event that private trees are felled during construction or maintenance operations, compensation will be paid to the owner in an amount determined by the estimated loss of products from the tree over an eight year period (for fruit bearing trees). Agricultural lands under private ownership will be identified, and in accordance with normal TSECL procedures compensation will be paid to the affected villagers (**Annexure-3**). Budgetary provision of **Rs. 461.16 lakhs** has been made in the cost estimate to meet these expenses.

(vi) **Interference with other utilities and traffic**

As per regulations enacted by Government of India, it is mandatory for TSECL to seek clearance prior to construction from department of Railways, Telecommunications and wherever necessary from aviation authorities that are likely to be affected by the construction of transmission lines. The transmission lines affect nearby telecommunication circuits by causing electrical interference. A standing committee -- Power Telecom Co-ordination Committee (P.T.C.C.) has been constituted by Government of India to plan and implement the mitigating measures for the induced voltage which may occur to nearby telecom circuit and suggest necessary protection measures to be adopted. The committee suggests measures like rerouting of the telecom circuits, conversion of overhead telecom circuits into cables etc. to minimize the interference.

The cost of such measures is determined by the Committee on the basis of prevailing norms and guidelines. Though the exact cost to mitigate the impacts of induction in neighboring telecom circuits would vary from case to case, the cost on an average works out to be Rs.50000/- per km. Provision to meet these expenses has been made in the cost estimate for the same for transmission line proposed under the instant scheme.

The main approach road for accessing the construction sites including four proposed substations is National Highway (NH) - 44 (Tripura). The volume of traffic on the NH-44 is quite low. It may be judged from the fact that this Tripura portion of NH-44 from Churaibari to Sabroom near Bangladesh border was decided to be upgraded to 4 lanes by National Highway Authority of India (NHAI) in 2007. However, due to low density of traffic, it has now been taken up for 2 laning instead of 4 laning as decided earlier. Two substations i.e. Sabroom & Satchand are situated on the main NH whereas Bagafa & Belonia substations are situated between 2-15 km from NH. Volume on these inter connected road is quite negligible as it comprises of mostly small vehicles. Therefore, we don't foresee any steep rise in volume of traffic due to mobilization for said projects.

Wherever transmission line crosses the railways, clearance is taken from that department. In general, the system is planned and executed in such a way that

adequate clearance is maintained between transmission lines on the one hand, and railways, civil aviation and defense installations on the other. Wherever the transmission lines pass by the airports the towers beyond specified height are painted in alternate orange and white stripes for easy visibility and warning lights are placed atop these towers.

(vii) Interference with drainage pattern

As the transmission lines are constructed aerially and the blockage of ground surface is limited to area of tower footings, which is very small, there is little possibility of affecting drainage pattern. Moreover, the transmission lines proposed under the subject don't not involve any tower to be placed in river beds for river crossing. However, management measures as specified in EMP (refer clause - 5 & 12) like appropriate siting of towers shall be undertaken during detailed alignment survey and design to avoid any incidence of flooding hazards of loss of agricultural production due to interference with drainage patterns or irrigation channels. In the infrequent instances where the natural flow/drainage is affected, flow will be trained and guided to safe zones. Since all proposed substations are located in plane terrain no affect on drainage of the area is envisaged particularly with adequate arrangement of drainage built in all substation design.

5.1 ENVIRONMENTAL PROBLEMS DUE TO DESIGN

(i) Escape of polluting materials

The equipments installed on lines and substations are static in nature and do not generate any fumes or waste materials. However, detailed specification with respect to equipment design and substation sewage design has been included in tender document to avoid any incidence of land and water contamination. Apart from this, solid waste like packing materials, cables, aluminium conductor, sand, aggregate material, cements and steel generated during construction is carefully handled and removed from site.

(ii) Explosion/fire hazards

During the survey and site selection for transmission lines, and substations, it has been ensured that these are kept away from oil/gas pipelines and other sites with potential for creating explosions or fires. Fires due to flashover from lines can be a more serious problem in forest. However, adequate safety measures shall be taken to avoid such incidence and has been included in EMP (refer clause - 15, 23 & 51). Besides this forest authorities also incorporate measures like making fire lines to prevent spreading of fire in the affected forest area. Apart from this, state of art safety instruments are installed in the substations on both the ends so that line gets tripped within milliseconds in case of any fault.

(iii) Erosion hazards due to inadequate provision for resurfacing of exposed area

Construction of 132kV line involves only small scale excavation of area i.e. 3m L x 3m W x 3m H for tower footing that may result in generation of 108 m³ of excavated material from each tower. In case of 132/33 kV substation foundation, excavation of soil to the tune of 7500 m³ is required depending on site condition. *It is estimated that a total*

of approx. 45360 m³ (420 X 108) and 37500 m³ (7500 x 5) of excavated materials will be generated for construction of 420 nos of tower and 5 nos. of substation respectively proposed under present scheme. However, most of these excavated materials (about 80-90%) will be used for re-filling after construction work is over and remaining materials will be disposed properly as detailed out in EMP(refer clause - 25, 26 & 28). Moreover, the topsoil disturbed during the development of sites will be stored properly and used to restore the top surface of the platform. Left over infertile and rocky material will be dumped at carefully selected dumping areas and used as fill for foundations and leveling. Hence, possibility of erosion of exposed area due to construction activity is negligible.

(iv) Environmental aesthetics

Since spacing between the towers/poles in case of 132 kV D/C transmission line is approx. 300 meters, these will not affect the visual aesthetics of the localities particularly when it is ensured to route the lines as far away from the localities as possible. TSECL takes up plantation of trees to buffer the visual effect around its substations and to provide better living conditions. Wherever TSECL feels it appropriate, discussions will be held with local Forest Department officials to determine feasibility of planting trees along roads running parallel to transmission lines to buffer visual effect in these areas. In addition, towers may be painted grey or green to merge with the background.

(v) Noise/vibration nuisances

The equipment installed at substation are mostly static and are so designed that the noise level always remains within permissible limits i.e. 85 dB as per Indian standards. The noise levels reported during normal operating conditions are about 60 to 70 dB at 2 m. distance from the equipment. To contain the noise level within the permissible limits whenever noise level increases beyond permissible limits, measures like providing sound and vibration dampers and rectification of equipment are undertaken. In addition, plantations of sound absorbing species like Casuarinas, Tamarind, and Neem are raised at the substations that reduce the sound level appreciably.

(vi) Blockage of Wildlife passage

The proposed transmission lines don't pass through any protected area and no migration paths of wildlife like elephant corridor exist near to subproject project locations hence possibility of any disturbance to wild life is not anticipated. In the instant scheme portion of 132 KV D/C Udaipur - Bagafa line passing at a distance of 1 km from the boundary of Trishna Wildlife Sanctuary will not cause any adverse impact on wildlife. The said sanctuary is situated between 23° 26.137' N and 91° 28.184' E and has an altitudinal gradient of 51–82 m. The total sanctuary area is 194.71 km² and is delimited on the east and west sides by the international boundary with Bangladesh. The forest cover of the sanctuary consists of dense primary forest (62%) dominated by *Shorea robusta*, *Dipterocarpus turbinatus*, and *Terminalia bellirica* trees, degraded forest (18%) dominated by *Toona ciliata*, *Albizia procera*, large number of shrubs, herbs and climbers, and the remaining 20% is bushy forest of bamboos (*Bambusa tulda*, *B. balcooa* and *Melocana baccifera*), sedges, long grasses (*Pennisetum purpureum* Schumach), and shrubs like *Microcos paniculata*, *Chromolaena odorata*, and *Lantana camara* among others. The sanctuary has a number of perennial water rivulets and patches of grasslands. The climatic condition is tropical, with a minimum

rainfall of 3.58 mm in December and a maximum of 508.20 mm in July. The average minimum and maximum temperature recorded in the region is 6.8° C in January and 37.70° C in June, respectively. The major fauna of this sanctuary comprises of Indian Bison (*Bos gaurus*), Wild Boar (*Sus scrofa*), Spectacle Monkey (*Trachypithecus phayrie*), Phayre's Leaf Monkey (*Presbytis phayrei*), Capped Langur (*Trachypithecus pileatus*), Slow loris (*Nycticebus coucang*), Wild Cat (*Felis chaus*), King Cobra (*Ophiophagus hannah*), Hoolock Gibbon (*Hylobates hoolock*), Leopard (*Panthera pardus*), Marbled Cat (*Felis marmorata*), Leopard Cat (*Felis bengalensis*), Golden Cat (*Felis temmincki*), Common Otter (*Lutra lutra*), Chinese Pangolin (*Manis pentadactyla*). Common bird found in Trishna include species like Pheasant tailed Jacana (*Hydrophasianus chirurgus*), Red Jungle Fowl (*Gallus gallus*), White Breasted Kingfisher (*Halcyon smyrnensis*), Indian Black drongo (*Dicrurus macrocercus*), Tailer bird (*Orthotomus sutorius*), Jungle Myna (*Acridotheres fuscus*), Parrot (*Psittacine sp*), Eagle (*Hieraatus Spilogaster*), Hornbill (*Bucerotidae sp*), Dove (*Columbidae sp*). The Sanctuary is also home for about 59 butterfly species belonging to 48 genera and 5 families. These includes species like *Papilio polytes*, *Papilio demoleus*, *Castalius rosimon*, *Eurema hecabe*, *Letha europa*, *Cepora nerissa*, *Castalius rosimon*, *Narathura selta*, *Baoris farri*, *Troides helena* and *Labadea martha*. Although such species are not going to be impacted as the proposed line is routed away from their habitat. However, for actual comprehension, the conservation status as per IUCN categorization of major species is placed as **Annexure- 4**.

The Trishna Sanctuary's important & heaviest mammal **Bison (*Bos gaurus*)** is mostly confined to its core area which is also known as Bison Reserve notified in 2007 having an area of 31.63 sq km. The proposed Udaipur-Bagafa line is 24 km approx. from this Bison Reserve in respect to its closest point to Trishna sanctuary boundary and 19 km approx from its nearest point in respect of line route (near Bagafa).). Wildlife Institute of India's geospatial map of area showing sanctuary boundary and Bison Reserve vis-à-vis line route is placed at **Map-3a**. As confirmed by Wildlife Warden of Trishna Sanctuary Bison migration/ movement is confined to Trishna core which is quite far from proposed route alignment of Bagafa line and no Bison has ever been reported from project area. Moreover, location of 3-4 towers coming at adequately safe distance from the said sanctuary shall not cause any hindrance to free passage/movement/electrocution of birds as the species reported from the sanctuary are predominantly small bird having wingspan ranging from 19-155 cm (*Pheasant tailed Jacana-19-24 cm*, *White breasted king Fisher 35-42 cm*, *Indian Eagle & Hornbill 120-155 cm*) whereas distance between two conductor is 4.6 m (460 cm) **Fig.-4** and distance between 2 tower is 300-350 m (30000-35000 cm) hence additional measures like bird guards/ diverter etc. may not be needed for proposed portion of transmission line. Further, bird hit is normally reported during landing and takeoff near the water bodies and these measures are more effective if installed in the towers coming in fly path of birds which is not in the instant case.

5.2 ENVIRONMENTAL PROBLEMS DURING CONSTRUCTION PHASE

(i) Uncontrolled silt runoff

As already explained, during construction maximum 108 m³ from each tower foundation and 7500m³ of excavated materials for each substation foundation will be generated. However, adequate measures shall be taken to store excavated materials properly for

refilling after construction is over. Further, excavation in the hilly areas is avoided in rainy days. Hence, uncontrolled silt run off is not anticipated.

(ii) Nuisance to nearby properties

As already described in preceding paras, during site selection due care is taken to keep the transmission lines and substations away from settlements. Further, all the construction activities will be undertaken through the use of small mechanical devices e.g. tractors and manual labour, therefore nuisance to the nearby properties if any, is not expected. Since all construction related activities for new substations shall be confined to existing substations which are already inaccessible for general public due to its separation/demarcation by the boundary wall. Moreover, such areas are declared as prohibited for general public as per the provisions of Electricity Act. Hence, any adverse impact arising during the construction of these substations will be temporary and limited to the boundaries of existing substations only and will neither impact nearby habitat/property nor health & safety of neighboring community.

(iii) Interference with utilities and traffic and blockage of access way

Since all the locations of subprojects are not well connected through rail link, transportation of construction materials will be mostly through road network. However, in environmental sensitive area like forest national parks, wildlife sanctuary etc. (if involved), transportation will be mostly through head load. Access to the remote sites will be along existing roads or village paths; minor improvements to paths may be made where necessary, but no major construction of roads will be necessary either during construction or as a part of maintenance procedures. In case access road/path is not available than existing field/bund may be utilized after paying due compensation for any damage to crop or field. However, in case requirement of new access road through forest area including tree felling the same will be included in forest proposal in consultation with forest department as per provisions of Forest (Conservation) Act, 1980. However, in case tree felling is not required in access road in forest area, the permission for the same will be obtained from concerned DFO in accordance with MoEF circular dt. 7th October, 2014.

As and when a transmission line crosses any road/ railways line, adequate care/caution is taken so as not to cause any hindrance to the movement of traffic. Stringing at the construction stage is carried out during lean traffic period in consultation with the concerned authorities and angle towers are planted to facilitate execution of work in different stages. Apart from this, safety precaution like barricading of work area and placement of visible signage shall be undertaken to avoid any unforeseen incident.

(iv) Inadequate resurfacing for erosion control

Since, the towers for the proposed transmission lines are to be constructed in plain area as well as hilly area due care will be taken to control erosion. If due to terrain at some points towers may be placed on slopes and erosion prone soils, internationally accepted engineering practices including bio-engineering techniques wherever feasible shall be undertaken to prevent soil erosion. This will include cutting and filling slopes wherever necessary. The back cut slopes and downhill slopes will be treated with revetments. As explained above adequate steps shall be taken to resurface the area after construction.

Wherever sites are affected by active erosion or landslides, both biological and engineering treatment will be carried out, e.g. provision of breast walls and retaining walls, and sowing soil binding grasses around the site. Further, construction is generally undertaken in dry/non-monsoon period.

(v) **Inadequate disposition of borrow area**

As mentioned earlier the transmission tower foundations involve excavations on small scale basis and the excavated soil is utilized for back filling. In case of substations generally the sites are selected in such a manner that the volume of cutting is equal to volume of filling avoiding borrowing of the area. As such acquisition/opening of borrow area is not needed.

(vi) **Protection of Worker's health/safety**

All health and safety issues and its management aspects are integral part of project/contract specific safety plan (**Annexure - 5**) which is also part of contract condition. Various aspects such as work and safety regulations, workmen's compensation, insurance are adequately covered under the General Conditions of Contract (GCC), a part of bidding documents. Project is executed as per the approved plan and is regularly monitored by dedicated Safety personnel. Moreover, for strict compliance of safety standard/plan a special provision as a deterrent has been added in the contract which provides for a heavy penalty of Rs.10 lakhs for each accidental death and Rs1.0 lakh/each for any injury and is deducted from the contractor's payment and paid to the deceased/affected family (**Annexure – 6**).

TSECL maintains safety as a top priority and has framed guidelines/checklist for workers' safety as its personnel are exposed to live EHV apparatus and transmission lines. These guidelines/checklists include work permits and safety precautions for work on the transmission lines both during construction and operation (**Annexure - 7**) and is regularly monitored by site in-charge. In addition training is imparted to the workers in fire fighting and safety measures. Standard safety tools like helmet, safety belt, gloves etc. are provided to them in accordance to the provisions of Safety Rules. First aid facilities will be made available with the labour gangs, and doctors called in from nearby towns when necessary. The number of outside (skilled) labourers will be quite small, of the order of 25-30 people per group and remaining workforce of unskilled labourers will be comprised of mostly local people. As per policy/norms preference shall be given to the eligible local labor having required skills a specific clause has been incorporated in contract conditions (refer clause- 22.2.1 of GCC) for compliance of same by Contractor. Workers are also covered by the statutory Workmen (Compensation) Act. Regular health checkups are conducted for construction workers. The construction sites and construction workers' houses will be disinfected regularly if required. In order to minimize/checking of spread of socially transmitted diseases e.g. HIV/AIDS etc. TSECL will conduct awareness building programs on such issues for the construction workers.

5.3 ENVIRONMENTAL PROBLEMS RESULTING FROM OPERATION

(i) **O&M Staff/Skills less than acceptable resulting in variety of adverse effects**

The O & M program is normally implemented by substation personnel for both the lines as well as substations. Monitoring measures employed include patrolling and thermovision scanning.

The supervisors and managers entrusted with O&M responsibilities are intensively trained for necessary skills and expertise for handling these aspects. A monthly preventive maintenance program will be carried out to disclose problems related to cooling oil, gaskets, circuit breakers, vibration measurements, contact resistance, condensers, air handling units, electrical panels and compressors. Any sign of soil erosion is also reported and rectified. Monitoring results are published monthly, including a report of corrective action taken and a schedule for future action.

TSECL follows the best international practices while designing its system to maintain acceptable prescribed EMF level. The approved international standards and design, which The ICNIRP guideline for the general public (up to 24 hours a day) is a maximum exposure level of 1,000 mG or 100 μ T. Further, because of issues relating to need to ensure health and safety relating to the line such as fire safety, safe voltages on metallic parts of buildings, and safety clearances to avoid flashover, the transmission lines will not pass directly over any residential properties and as such the potential for EMF effects to occur will be further diminished.

Poly Chlorinated Biphenyls (PCBs) due to their high heat capacity, low flammability and low electrical conductivity were extensively used as insulating material in capacitors and transformers. But after the finding that these PCBs are non-biodegradable and have carcinogenic tendency, its use in electrical equipments as insulating medium has been banned all over the world long back. However, it has been reported in some studies that chances of contamination of oil with PCB is possible. Keeping that in mind, TSECL has discontinued procurement electrical equipments containing PCB more than 2 mg/kg and specification (as per IEC 61619 or ASTM D4059) is being stated in the tender document. Moreover, the subject scheme doesn't involve replacement of any PCB containing equipment, hence no disposal of such equipment is anticipated.

5.4 CRITICAL ENVIRONMENTAL REVIEW CRITERIA

(i) Loss of irreplaceable resources

The transmission and distribution projects do not involve any large scale excavation. In transmission line land is affected to the extent 144 sq. m below the tower base for which compensation is paid to land owner. However, the subject transmission lines are passing through 54 km of forest area out of total line length 139 km. However, as per regulation, afforestation will be undertaken on double the area diverted will help in increase the forest cover.

(ii) Accelerated use of resources for short-term gains

The subprojects will not be making use of any natural resources occurring in the area during construction as well as maintenance phases. The construction material such as tower members, cement etc shall come from factories while the excavated soil shall be used for backfilling to restore the surface. During construction of transmission line very small quantity of water is required which is met from nearby existing source or through

tanker. However, for substation mostly ground water is used by installing a bore well during construction as well as for Operational stage. Moreover, provision of rain water harvesting in all proposed substations under the present scheme has been made to conserve precious water resource and enhance the ground water level. Hence it may be seen that the activities associated with implementation of subject project shall not cause any accelerated use of resources for short term gains.

(iii) **Endangering of species**

As described earlier, no endangered species of flora and fauna exist in the subprojects area is getting affected thus there is no possibility of endangering/ causing extinction of any species.

(iv) **Promoting undesirable rural-to urban migration**

The subprojects will not cause any submergence or loss of land holdings that normally trigger migration. It also does not involve acquisition of any private land holdings. Hence, there is no possibility of any migration.

5.5 PUBLIC CONSULTATION:

Public consultation/information is an integral part of the project implementation. Public is informed about the project at every stage of execution. During survey also TSECL site officials meet people and inform them about the routing of transmission lines. During the construction, every individual, on whose land tower is erected and people affected by RoW, are consulted. Apart from this, Public consultation using different technique like Public Meeting, Small Group Meeting, Informal Meeting shall also be carried out during different activities of project cycle. During such consultation the public are informed about the project in general and in particular about the following:

- Complete project plan (i.e. its route and terminating point and substations, if any, in between);
- Design standards in relation to approved international standards;
- Health impacts in relation to EMF;
- Measures taken to avoid public utilities such as school, hospitals, etc.;
- Other impacts associated with transmission lines and TSECL approach to minimizing and solving them;
- Compensation process for trees and crop damages.

Apart from organizing many informal group meetings in different villages, public meeting are organized on 15th Sep.' 2014 at Bagafa, 20th Sep.'2014 at Matabari (Udaipur) & 26th Sep.' 2014 at Satchand en-route of transmission lines covered under subject scheme. Some photographs of above consultation programmes are placed at **Plate-1**. During the public consultation programme a brochure explaining the need for implementation of subprojects also distributed among participants (**Annexure-8**). The detail of lines and its importance also explained to the villagers by the officials of TSECL and POWERGRID. The programme was arranged in interactive way and queries/concern raised by public like routing of line avoiding heavily populated area/houses, engagement of local people in construction activity etc. were replied. The Minutes of Meeting of various public consultation programmes enclosed as **Annexure- 9**. The programme was appreciated by the villagers and they assured to extend their cooperation for construction of the said

subprojects. The process of such consultation shall continue during project implementation and even during O&M stage.

5.6 CONCLUSIONS:

From the above discussion, it seems that the area is rich in natural forest resources. But careful route selection following the principle of avoidance, ecologically sensitive areas like National Park / Wildlife Sanctuaries have been avoided completely but complete avoidance of forest could not be achieved due to terrain limitations. However, all possible efforts have been taken that line route is aligned in such a way that it involves minimum forest stretch. In the instant case there is only 146 Ha forest involvement on transmission line for which adequate mitigation measure like providing funds for raising compensatory afforestation on double the area of degraded forest land shall be done by State forest department at IA's/owner cost. Moreover, to reduce the impact on forest area bare minimum felling of trees shall be done in ROW in the forest. The infrastructural constraints are very real and pose a limiting factor on the development of the area. The above facts while on the one hand underline the need for implementation of the subject scheme for overall development of the area and on another hand suggests that a detailed EIA may not be necessary as per the provisions of existing regulations.

Further, a detailed Final Environmental Assessment Report (FEAR) listing action/measures adopted for mitigation of possible environmental impact, details of environment/forest clearance, EMP implementation, monitoring details etc. after the environment/forest clearances are obtained from MoEF shall be compiled and submitted to Bank (refer **Annexure- 10** for content of FEAR).

SECTION – VI :

PROJECT IMPLEMENTATION ARRANGEMENT & MONITORING

6.0 ADMINISTRATIVE ARRANGEMENT FOR PROJECT IMPLEMENTATION:

Ministry of Power (MoP), Gol has appointed POWERGRID as Design cum Implementation Supervision Consultant (i.e. Project Management Consultant-PMC) and now redesignated as Implementing Agency (IA). However, the ownership of the assets shall be with respective State government or State Utilities, which upon progressive commissioning shall be handed over to them for taking care of Operation and Maintenance of assets. The arrangement for monitoring and reviewing of project from the perspective of environment and social management will form part of overall arrangements for project management and implementation environment. Following implementation arrangement has been proposed at different levels for smooth implementation of this project;

Central Project Implementation Unit (CPIU) - A body responsible for coordinating the preparation and implementation of the project and shall be housed within the IA's offices at Guwahati. The "Project-In-Charge" of IA & Head of each of the SPCU shall be a member of CPIU.

State Project Coordination Unit (SPCU) – A body formed by the Utility and responsible for coordinating with IA in preparing and implementing the project at the State level. It consist of experts across different areas from the Utility and shall be headed by an officer of the rank not below Chief Engineer, from the Utility.

Project Implementation Unit (PIU) – A body formed by the IA, including members of Utility on deputation, and responsible for implementing the Project across the State, with its personnel being distributed over work site & working in close association with the SPCU/ CPIU. PIU report to State level "Project Manager" nominated by the Project-in-Charge of IA. The IA will have a Core team stationed at the CPIU on permanent basis and other IA officers (with required skills) will visit as and when required by this core team. This team shall represent IA and shall be responsible for all coordination with SPCU, PIU, within IA and MoP, Gol. CPIU shall also assist MoP, Gol in monitoring project progress and in its coordination with The Bank.

6.1 REVIEW OF PROJECT IMPLEMENTATION PROGRESS:

To enable timely implementation of the project/subprojects, following committee has been setup to review the progress;

A. Joint Co-ordination Committee (JCC): IA and SPCU nominate their representatives in a body called JCC to review the project. IA shall specify quarterly milestones or targets, which shall be reviewed by JCC through a formal monthly review meeting. This meeting forum shall be called as Joint Co-ordination Committee Meeting (JCCM).The IA shall convene & keep a record of every

meeting. MoP, Gol and The Bank may join as and when needed. Minutes of the meeting will be shared with all concerned and if required, with Gol and The Bank.

- B. High Power Committee (HPC):** The Utility in consultation with its State Government shall arrange to constitute a High Power Committee (HPC) consisting of high level officials from the Utility, State/ District Administration, Law enforcement agencies, Forest Department. etc. so that various permission/ approvals/ consents/ clearances etc. are processed expeditiously so as to reach the benefits of the Project to the end consumers. HPC shall meet on bimonthly basis or earlier, as per requirement. This forum shall be called as High Power Committee Meeting (HPCM) and the SPCU shall keep a record of every meeting. Minutes of the meeting will be shared with all concerned and if required, with Gol and The Bank.
- C. Contractor's Review Meeting (CRM):** Periodic Review Meeting will be held by officials of PIU with Contractors at field offices, State Head Quarters (PIU location) and if required with core team of IA at Guwahati. These shall be called "Contractor's Review Meeting" (CRM). PIU shall keep a record of all CRMs, which shall be shared with all concerned and if required, with Gol and The Bank.
- D.** A review will be held among MoP, Gol, The Bank, State Government., Utility and IA, at four (4) months interval or earlier if needed, primarily to maintain oversight at the top level and also to debottleneck issues that require intervention at Gol/ State Government level. Minutes of the meeting shall be prepared by IA and shared with all concerned.

6.2 ENVIRONMENTAL MONITORING IN UTILITY:

Monitoring is a continuous process for TSECL projects at all the stages, be it the site selection, construction or maintenance.

The success of TSECL lies in its strong monitoring systems. Apart from the Field In-Charge reviewing the progress on daily basis regular project review meetings are held at least on monthly basis at corporate level wherein apart from construction issues the environmental aspects of the projects are discussed and remedial measures taken wherever required. The exceptions of these meetings are submitted to the Directors and Chairman and Managing Director of the Corporation. The progress of various on-going projects is also informed to the Board of Directors.

TSECL has formed a separate cell at the Circle office level namely Environment and Social Management Cell (ESMC) headed by AGM (Transmission) for proper implementation and monitoring of environmental & social management measures. TSECL organization support structure is depicted in **Exhibit - 3**. Key responsibilities of the ESMC are follows:

- Coordinating environmental and social commitments and initiatives with various multilateral agencies, GoT and MoEF.
- Coordination of all environmental activities related to a project from conceptualization to operation and maintenance stage.
- Advising and coordinating /Site office to carry out environmental and social surveys and route alignment for new projects.

- Advising site offices to follow-up with the state forest offices and other state departments for expediting forest clearances and other E & S issues of various projects.
- Providing a focal point for interaction with the MoEF for expediting forest clearances
- Training of Circle and Site officials on E & S issues arising out of Transmission/ Distribution projects and their management plan.
- Training of other departments to familiarize them with the ESPP document.

As regards monitoring of impacts on ecological resources particularly in Forest, Sanctuary or National Park, it is generally done by the concerned Divisional Forest Officer, Chief Wildlife Warden and their staff as a part of their normal duties. A detailed Environment Management Plan (EMP) including monitoring plan for all possible environmental and social impact and its proper management has been drawn (**Table-6.1**) and will be implemented during various stage of project execution. Since many provisions of EMP are to be implemented by contractor hence for proper monitoring EMP has included in the contract document. A budget estimate towards tree/crop/tower base compensation and EMP implementation is prepared and is placed at **Annexure-11**. A summary of the same is presented below:

Sr. No.	Budgetary Head	Amount (Rs. Lakhs)
1	Forest compensation	2845.00
2	Tree & Crop Compensation	426.35
3	Land Compensation for Tower Footing	34.81
4	Implementation Monitoring & Audit	34.00
	Total	3340.16

Any other measures like provision of bird guards, spike guards, barbed wire fencing or any other arrangement shall be finalized only after detailed/ check survey and finalization route alignment. Since the detailed/ check survey is part of main package such measures, its extent and estimated cost shall be incorporated in the revised cost estimate proposal which is normally prepared for all projects as there is a considerable time gap between planning and actual implementation. However, provision of additional measures like bird guards/diverter and its cost estimation need not be required in the instant scheme as no such impact are envisaged due to lines route being far away from such sensitive areas.

6.3 GRIEVANCE REDRESSAL MECHANISM (GRM)

Grievance Redress Mechanism (GRM) is an integral and important mechanism for addressing/resolving the concern and grievances in a transparent and swift manner. Many minor concerns of peoples are addressed during public consultation process initiated at the beginning of the project and broadly outlined in Annexure-23 of ESPPF. For handling grievance, TSECL has already a framework in place. To ensure its implementation, Grievance Redress Committee (GRC) will be established at two places, one at the project/scheme level and another at Corporate/HQ level. The GRCs shall include members from TSECL, Local Administration, Village Panchayat Members, Affected Persons representative and reputed persons from the society and representative from the autonomous districts council in case of tribal districts

selected/decided on nomination basis under the chairmanship of project head. The composition of GRC shall be disclosed in Panchayat office and concerned district headquarter for wider coverage.

The complainant will also be allowed to submit its complaint to local project official who will pass it to GRC immediately but not more than 5 days of receiving such complaint. The first meeting of GRC will be organized within 15 days of its constitution/disclosure to formulate procedure and frequency of meeting. However, GRC meeting shall be convened within 15 days of receiving a grievance for its solution. GRC endeavor will be to pronounce its decision/ may also refer it to corporate GRC for solution within 30-45 days of receiving grievances. In case complainant/appellant is not satisfied with the decision of GRC they can approach TSECL Corporate level Committee /District Collector or Court of law for solution.

The corporate level GRC shall function under the chairmanship of Director (Technical) who will nominate other members of GRC including one representative from corporate ESMC who is conversant with the environment & social issues. The meeting of Corporate GRC shall be convened within 7-10 days of receiving the reference from project GRC or complainant directly and pronounce its decision within next 15 days.

6.4 ENVIRONMENTAL REVIEW :

Periodic review by higher management including review by Heads of SPCU and CPIU for all environmental and social issues will be undertaken to ensure that EMP and other measures are implemented at site for compliance of agreed policy and management plan.

Table- 6.1: ENVIRONMENT MANAGEMENT PLAN²

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
Pre-construction							
1	Location of overhead line towers/ poles/ underground distribution lines and alignment & design	Exposure to safety related risks	Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites.	Tower location and overhead/underground alignment selection with respect to nearest dwellings	Setback distances to nearest houses – once	Implementing Agency (IA)	Part of overhead lines tower/poles/ laying of underground cable sitting survey and detailed alignment survey and design
2	Equipment specifications and design parameters	Release of chemicals and gases in receptors (air, water, land)	PCBs not used in substation transformers or other project facilities or equipment.	Transformer design	Exclusion of PCBs in transformers stated in tender specification - once	IA	Part of tender specifications for the equipment
			Processes, equipment and systems not to use chlorofluorocarbons (CFCs), including halon, and their use, if any, in existing processes and systems should be phased out and to be disposed of in a manner consistent with the requirements of the Government	Process, equipment and system design	Exclusion of CFCs stated in tender specification – once Phase out schedule to be prepared in case still in use – once	IA	Part of tender specifications for the equipment Part of equipment and process design
3	Transmission/ Distribution line design	Exposure to electromagnetic interference	Line design to comply with the limits of electromagnetic interference from overhead power lines	Electromagnetic field strength for proposed line design	Line design compliance with relevant standards – once	IA	Part of design parameters

² *Compliance of these measures with quantity etc. shall be provided in the Final Environment Assessment Report (FEAR) to be prepared after obtaining all statutory clearances and execution of project”*

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
4	Substation location and design	Exposure to noise	Design of plant enclosures to comply with noise regulations.	Expected noise emissions based on substation design	Compliance with regulations - once	IA	Part of detailed siting survey and design
		Social inequities	Careful selection of site to avoid encroachment of socially, culturally and archaeological sensitive areas (i. g. sacred groves, graveyard, religious worship place, monuments etc.)	Selection of substation location (distance to sensitive area).	Consultation with local authorities/ autonomous councils -once		Part of detailed siting survey and design
5	Location of overhead line towers/poles/ laying of underground distribution line & alignment and design	Impact on water bodies	Avoidance of such water bodies to the extent possible. Avoidance of placement of tower inside water bodies to the extent of possible	Tower/pole location and overhead/ underground line alignment selection (distance to water bodies)	Consultation with local authorities– once	IA	Part of tower/pole sitting survey and detailed underground /overhead line alignment survey and design
		Social inequities	Careful route selection to avoid existing settlements and sensitive locations	Tower/pole location and overhead/ underground line alignment selection	Consultation with local authorities/ autonomous councils and land owners – once	IA	Part of detailed tower/pole sitting and overhead/ underground alignment survey and design
			Minimise impact on agricultural land	Tower location and overhead/underground line alignment selection (distance to agricultural land)	Consultation with local authorities/ autonomous councils and land owners – once		
			Careful selection of site and route alignment to avoid encroachment of socially, culturally and archaeological sensitive areas (i. g. sacred groves, graveyard, religious worship place, monuments etc.)	Tower/pole location and overhead/ underground line alignment selection (distance to sensitive area)	Consultation with local authorities/ autonomous councils -once		

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
6	Involuntary acquisition or permanent land acquisition for substation.	Social inequities	Compensation and R&R measures as per provision of RFCTLARRA,2013 ³	Compensation and monetary R&R measures implementation before possession.	As per provisions of Act.	State Govt.	Prior to award/start of substation construction.
7	Line through protected area/ precious ecological area	Loss of precious ecological values/ damage to precious species	Avoid siting into such areas by careful site and alignment selection (National Parks, Wildlife Sanctuary, Biosphere Reserves/ Biodiversity Hotspots)	Tower/pole location and overhead/ underground line alignment selection (distance to nearest designated ecological protected/ sensitive areas)	Consultation with local forest authorities - once	IA	Part of detailed siting and alignment survey /design
			Minimize the need by using RoW wherever possible	Tower/pole location and overhead/ underground line alignment selection	Consultation with local authorities and design engineers - once	IA	Part of detailed siting and alignment survey /design
8	Line through identified Elephant corridor / Migratory bird	Damage to the Wildlife/ Birds and also to line	Study of earmarked elephant corridors to avoid such corridors, Adequate ground clearance, Fault clearing by Circuit Breaker, Barbed wire wrapping on towers, reduced spans etc., if applicable	Tower/pole location and overhead/ underground line alignment selection. Minimum/maximum ground clearance	Consultation with local forest authorities – once. Monitoring – quarterly basis	IA	Part of detailed siting and alignment survey /design and Operation

³ In the instant subproject no fresh land acquisition (permanent) is involved hence this clause shall not be applicable..

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
			Avoidance of established/ identified migration path (Birds & Bats). Provision of flight diverter/reflectors, Bird guard, elevated perches, insulating jumper loops, obstructive perch deterrents, raptor hoods etc. ⁴ , if applicable	Tower/pole location and overhead/ underground line alignment selection	Consultation with local forest authorities - once	IA	Part of detailed sitting and alignment survey /design and Operation
9	Line through forestland	Deforestation and loss of biodiversity, edge effect	Avoid siting of line by careful site and alignment selection	Tower/pole location and overhead/ underground line alignment selection (distance to nearest protected or reserved forest)	Consultation with local authorities – once	IA	Part of detailed sitting and alignment survey/design
			Minimise the need by using existing towers, tall towers and RoW, wherever possible		Consultation with local authorities and design engineers – once		
			Measures to avoid invasion of alien species	Intrusion of invasive species	Consultation with local forest authorities - once		
			Obtain statutory clearances from the Government	Statutory approvals from Government	Compliance with regulations – once for each subproject		
			Consultation with autonomous councils wherever required	Permission/ NOC from autonomous councils	Consultation with autonomous councils – once during tower placement		

⁴ As per International/National best practices and in consultation with concerned forest/wildlife Authority

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
10	Lines through farmland	Loss of agricultural production/change in cropping pattern	Use existing tower or footings wherever possible	Tower/pole location and overhead/ underground line alignment selection	Consultation with local authorities and design engineers – once	IA	Part of detailed alignment survey and design
			Avoid sitting new towers on farmland wherever feasible	Tower/pole location and overhead/ underground line alignment selection	Consultation with local authorities and design engineers – once		Part of detailed sitting and alignment survey /design
11	Noise related	Nuisance to neighbouring properties	Substations sited and designed to ensure noise will not be a nuisance	Noise levels	Noise levels to be specified in tender documents – once	IA	Part of detailed equipment design
12	Interference with drainage patterns/Irrigation channels	Flooding hazards/ loss of agricultural production	Appropriate sitting of towers to avoid channel interference	Tower/pole location and overhead/ underground line alignment selection (distance to nearest flood zone)	Consultation with local authorities and design engineers – once	IA	Part of detailed alignment survey and design
13	Escape of polluting materials	Environmental pollution	Transformers designed with oil spill containment systems, and purpose-built oil, lubricant and fuel storage system, complete with spill cleanup equipment.	Equipment specifications with respect to potential pollutants	Tender document to mention specifications – once	IA	Part of detailed equipment design /drawings
			Substations to include drainage and sewage disposal systems to avoid offsite land and water pollution.	Substation sewage design	Tender document to mention detailed specifications – once	IA	Part of detailed substation layout and design /drawings
14	Equipments submerged under flood	Contamination of receptors	Substations constructed above the high flood level(HFL) by raising the foundation pad	Substation design to account for HFL (elevation with respect to HFL elevation)	Base height as per flood design- once	IA	Part of detailed substation layout and design /drawings

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
15	Explosions /Fire	Hazards to life	Design of substations to include modern fire fighting equipment	Substation design compliance with fire prevention and control codes	Tender document to mention detailed specifications – once	IA	Part of detailed substation layout and design /drawings
			Provision of fire fighting equipment to be located close to transformers				
Construction							
16	Equipment layout and installation	Noise and vibrations	Construction techniques and machinery selection seeking to minimize ground disturbance.	Construction techniques and machinery	Construction techniques and machinery creating minimal ground disturbance- once at the start of each construction phase	IA (Contractor through contract provisions)	Construction period
17	Physical construction	Disturbed farming activity	Construction activities on cropping land timed to avoid disturbance of field crops (within one month of harvest wherever possible).	Timing of start of construction	Crop disturbance – Post harvest as soon as possible but before next crop – once per site	IA (Contractor through contract provisions)	Construction period
18	Mechanized construction	Noise, vibration and operator safety, efficient operation	Construction equipment to be well maintained.	Construction equipment – estimated noise emissions	Complaints received by local authorities – every 2 weeks	IA (Contractor through contract provisions)	Construction period
		Noise, vibration, equipment wear and tear	Turning off plant not in use.	Construction equipment – estimated noise emissions and operating schedules	Complaints received by local authorities – every 2 weeks	IA (Contractor through contract provisions)	Construction period

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
19	Construction of roads for accessibility	Increase in airborne dust particles	Existing roads and tracks used for construction and maintenance access to the line wherever possible.	Access roads, routes (length and width of new access roads to be constructed)	Use of established roads wherever possible – every 2 weeks	IA (Contractor through contract provisions)	Construction period
		Increased land requirement for temporary accessibility	New access ways restricted to a single carriageway width within the RoW.	Access width (meters)	Access restricted to single carriage –way width within RoW – every 2 weeks	IA (Contractor through contract provisions)	Construction period
20	Construction activities	Safety of local villagers	Coordination with local communities for construction schedules, Barricading the construction area and spreading awareness among locals	Periodic and regular reporting /supervision of safety arrangement	No. of incidents- once every week	IA (Contractor through contract provisions)	Construction period
		Local traffic obstruction	Coordination with local authority/ requisite permission for smooth flow of traffic	Traffic flow (Interruption of traffic)	Frequency (time span)- on daily basis	IA (Contractor through contract provisions)	Construction period
21	Temporary blockage of utilities	Overflows, reduced discharge	Measure in place to avoid dumping of fill materials in sensitive drainage area	Temporary fill placement (m ³)	Absence of fill in sensitive drainage areas – every 4 weeks	IA (Contractor through contract provisions)	Construction period
22	Site clearance	Vegetation	Marking of vegetation to be removed prior to clearance, and strict control on clearing activities to ensure minimal clearance.	Vegetation marking and clearance control (area in m ²)	Clearance strictly limited to target vegetation – every 2 weeks	IA (Contractor through contract provisions)	Construction period
			No use of herbicides and pesticides				

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
23	Trimming /cutting of trees within RoW	Fire hazards	Trees allowed growing up to a height within the RoW by maintaining adequate clearance between the top of tree and the conductor as per the regulations.	Species-specific tree retention as approved by statutory authorities (average and max. tree height at maturity, in meters)	Presence of target species in RoW following vegetation clearance – once per site	IA (Contractor through contract provisions)	Construction period
		Loss of vegetation and deforestation	Trees that can survive pruning to comply should be pruned instead of cleared.	Species-specific tree retention as approved by statutory authorities	Presence of target species in RoW following vegetation clearance - once per site	IA (Contractor through contract provisions)	Construction period
			Felled trees and other cleared or pruned vegetation to be disposed of as authorized by the statutory bodies.	Disposal of cleared vegetation as approved by the statutory authorities (area cleared in m ²)	Use or intended use of vegetation as approved by the statutory authorities – once per site	IA (Contractor through contract provisions)	Construction period
24	Wood/ vegetation harvesting	Loss of vegetation and deforestation	Construction workers prohibited from harvesting wood in the project area during their employment, (apart from locally employed staff continuing current legal activities)	Illegal wood /vegetation harvesting (area in m ² , number of incidents reported)	Complaints by local people or other evidence of illegal harvesting – every 2 weeks	IA (Contractor through contract provisions)	Construction period
25	Surplus earthwork/soil	Runoff to cause water pollution, solid waste disposal	Soil excavated from tower footings/ substation foundation disposed of by placement along roadsides, or at nearby house blocks if requested by landowners	Soil disposal locations and volume (m ³)	Acceptable soil disposal sites – every 2 weeks	IA (Contractor through contract provisions)	Construction period

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
26	Substation construction	Loss of soil	Loss of soil is not a major issue as excavated soil will be mostly reused for filling. However, in case of requirement of excess soil the same will be met from existing quarry or through deep excavation of existing pond or other nearby barren land with agreement of local communities	Borrow area sitting (area of site in m ² and estimated volume in m ³)	Acceptable soil borrow areas that provide a benefit - every 2 weeks	IA (Contractor through contract provisions)	Construction period
		Water pollution	Construction activities involving significant ground disturbance (i.e. substation land forming) not undertaken during the monsoon season	Seasonal start and finish of major earthworks(P ^H , BOD/ COD, Suspended solids, others)	Timing of major disturbance activities –prior to start of construction activities	IA (Contractor through contract provisions)	Construction period
27	Site clearance	Vegetation	Tree clearances for easement establishment to only involve cutting trees off at ground level or pruning as appropriate, with tree stumps and roots left in place and ground cover left undisturbed	Ground disturbance during vegetation clearance (area, m ²)	Amount of ground disturbance – every 2 weeks	IA (Contractor through contract provisions)	Construction period
				Statutory approvals	Statutory approvals for tree clearances – once for each site		
28	Substation foundation/ Tower erection disposal of surplus earthwork/fill	Waste disposal	Excess fill from substation/tower foundation excavation disposed of next to roads or around houses, in agreement with the local community or landowner	Location and amount (m ³)of fill disposal	Appropriate fill disposal locations – every 2 weeks	IA (Contractor through contract provisions)	Construction period

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
29	Storage of chemicals and materials	Contamination of receptors (land, water, air)	Fuel and other hazardous materials securely stored above high flood level.	Location of hazardous material storage; spill reports (type of material spilled, amount (kg or m ³) and action taken to control and clean up spill)	Fuel storage in appropriate locations and receptacles – every 2 weeks	IA (Contractor through contract provisions)	Construction period
30	Construction schedules	Noise nuisance to neighbouring properties	Construction activities only undertaken during the day and local communities informed of the construction schedule.	Timing of construction (noise emissions, [dB(A)])	Daytime construction only – every 2 weeks	IA (Contractor through contract provisions)	Construction period
31	Provision of facilities for construction workers	Contamination of receptors (land, water, air)	Construction workforce facilities to include proper sanitation, water supply and waste disposal facilities.	Amenities for Workforce facilities	Presence of proper sanitation, water supply and waste disposal facilities – once each new facility	IA (Contractor through contract provisions)	Construction period
32	Influx of migratory workers	Conflict with local population to share local resources	Using local workers for appropriate asks	Avoidance/reduction of conflict through enhancement/ augmentation of resource requirements	Observation & supervision–on weekly basis	IA (Contractor through contract provisions)	Construction period
33	Lines through farmland	Loss of agricultural productivity	Use existing access roads wherever possible	Usage of existing utilities	Complaints received by local people /authorities - every 4 weeks	IA (Contractor through contract provisions)	Construction period
			Ensure existing irrigation facilities are maintained in working condition	Status of existing facilities			
			Protect /preserve topsoil and reinstate after construction completed	Status of facilities (earthwork in m ³)			

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
			Repair /reinstate damaged bunds etc after construction completed	Status of facilities (earthwork in m ³)			
		Social inequities	Land owners/ Farmers compensated for any temporary loss of productive land as per existing regulation.	Process of Crop/tree compensation in consultation with forest dept.(for timber yielding tree) and Horticulture deptt.(for fruit bearing tree)	Consultation with affected land owner prior to implementation and during execution.	IA	During construction
34	Uncontrolled erosion/silt runoff	Soil loss, downstream siltation	Need for access tracks minimised, use of existing roads. Limit site clearing to work areas Regeneration of vegetation to stabilise works areas on completion (where applicable) Avoidance of excavation in wet season Water courses protected from siltation through use of bunds and sediment ponds	Design basis and construction procedures (suspended solids in receiving waters; area re-vegetated in m ² ; amount of bunds constructed [length in meter, area in m ² , or volume in m ³])	Incorporating good design and construction management practices – once for each site	IA (Contractor through contract provisions)	Construction period
35	Nuisance to nearby properties	Losses to neighbouring land uses/ values	Contract clauses specifying careful construction practices. As much as possible existing access ways will be used	Contract clauses Design basis and layout	Incorporating good construction management practices – once for each site Incorporating good design engineering practices– once for each site	IA (Contractor through contract provisions)	Construction period

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
			Productive land will be reinstated following completion of construction	Reinstatement of land status (area affected, m ²)	Consultation with affected parties – twice – immediately after completion of construction and after the first		
		Social inequities	Compensation will be paid for loss of production, if any.	Implementation of Tree/Crop compensation (amount paid)	Consultation with affected parties – once in a quarter	IA	Prior to construction
36	Flooding hazards due to construction impediments of natural drainage	Flooding and loss of soils, contamination of receptors (land, water)	Avoid natural drainage pattern/ facilities being disturbed/blocked/ diverted by ongoing construction activities	Contract clauses (e.g. suspended solids and BOD/COD in receiving water)	Incorporating good construction management practices-once for each site	IA (Contractor through contract provisions)	Construction period
37	Equipment submerged under flood	Contamination of receptors (land, water)	Equipment stored at secure place above the high flood level(HFL)	Store room level to be above HFL (elevation difference in meters)	Store room level as per flood design-once	IA	Construction period
38	Inadequate siting of borrow areas (quarry areas)	Loss of land values	Existing borrow sites will be used to source aggregates, therefore, no need to develop new sources of aggregates	Contract clauses	Incorporating good construction management practices – once for each site	IA (Contractor through contract provisions)	Construction period
39	Health and safety	Injury and sickness of workers and members of the public	Safety equipment's (PPEs) for construction workers Contract provisions specifying minimum requirements for construction camps Contractor to prepare and implement a health and safety plan.	Contract clauses (number of incidents and total lost-work days caused by injuries and sickness)	Contract clauses compliance – once every quarter	IA (Contractor through contract provisions)	Construction period

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
			Contractor to arrange for health and safety training sessions				
40	Inadequate construction stage monitoring	Likely to maximise damages	Training of environmental monitoring personnel	Training schedules	Number of programs attended by each person – once a year	IA	Routinely throughout construction period
			Implementation of effective environmental monitoring and reporting system using checklist of all contractual environmental requirements	Respective contract checklists and remedial actions taken thereof.	Submission of duly completed checklists of all contracts for each site - once		
			Appropriate contract clauses to ensure satisfactory implementation of contractual environmental mitigation measures.	Compliance report related to environmental aspects for the contract	Submission of duly completed compliance report for each contract – once		
Operation and Maintenance							
41	Location of line towers/poles and overhead/ underground line alignment & design	Exposure to safety related risks	Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites.	Compliance with setback distances (“as-built” diagrams)	Setback distances to nearest houses – once in quarter	TSECL	During operations
42	Line through identified bird flyways, migratory path	Injury/ mortality to birds, bats etc due to collision and electrocution	Avoidance of established/ identified migration path (Birds & Bats). Provision of flight diverter/reflectors, elevated perches, insulating jumper loops, obstructive perch deterrents, raptor hoods etc., if applicable	Regular monitoring for any incident of injury/mortality	No. of incidents- once every month	TSECL	Part of detailed siting and alignment survey /design and Operation
43	Equipment submerged under flood	Contamination of receptors (land, water)	Equipment installed above the high flood level (HFL) by raising the foundation pad.	Substation design to account for HFL (“as-built”	Base height as per flood design – once	TSECL	During operations

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
				diagrams)			
44	Oil spillage	Contamination of land/nearby water bodies	Substation transformers located within secure and impervious sump areas with a storage capacity of at least 100% of the capacity of oil in transformers and associated reserve tanks.	Substation bunding (Oil sump) ("as-built" diagrams)	Bunding (Oil sump) capacity and permeability - once	TSECL	During operations
45	SF6 management	Emission of most potent GHG causing climate change	Reduction of SF6 emission through awareness, replacement of old seals, proper handling & storage by controlled inventory and use, enhance recovery and applying new technologies to reduce leakage	Leakage and gas density/level	Continuous monitoring	TSECL	During Operations
46	Inadequate provision of staff/workers health and safety during operations	Injury and sickness of staff /workers	Careful design using appropriate technologies to minimise hazards	Usage of appropriate technologies (lost work days due to illness and injuries)	Preparedness level for using these technologies in crisis – once each year	TSECL	Design and operation
			Safety awareness raising for staff.	Training/awareness programs and mock drills	Number of programs and percent of staff /workers covered – once each year		
			Preparation of fire emergency action plan and training given to staff on implementing emergency action plan	Provision of facilities	Complaints received from staff /workers every 2 weeks		
47	Electric Shock Hazards	Injury/ mortality to staff and public	Careful design using appropriate technologies to minimise hazards	Usage of appropriate technologies (no. of injury incidents, lost work days)	Preparedness level for using these technology in crisis – once a month	TSECL	Design and Operation

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
			Security fences around substations	Maintenance of fences	Report on maintenance – every 2 weeks		
			Barriers to prevent climbing on/dismantling of transmission	Maintenance of barriers			
			Appropriate warning signs on facilities	Maintenance of warning signs	Number of programs and percent of total persons covered – once each year		
			Electricity safety awareness raising in project areas	Training /awareness programs and mock drills for all concerned parties			
48	Operations and maintenance staff skills less than acceptable	Unnecessary environmental losses of various types	Adequate training in O&M to all relevant staff of substations & transmission/distribution line maintenance crews. Preparation and training in the use of O&M manuals and standard operating practices	Training/awareness programs and mock drills for all relevant staff	Number of programs and percent of staff covered – once each year	TSECL	Operation
49	Inadequate periodic environmental monitoring.	Diminished ecological and social values.	Staff to receive training in environmental monitoring of project operations and maintenance activities.	Training/awareness programs and mock drills for all relevant staff	Number of programs and percent of staff covered – once each year	TSECL	Operation
50	Equipment specifications and design parameters	Release of chemicals and gases in receptors (air, water, land)	Processes, equipment and systems using cholofluorocarbons (CFCs), including halon, should be phased out and to be disposed of in a manner consistent with the requirements of the Govt.	Process, equipment and system design	Phase out schedule to be prepared in case still in use – once in a quarter	TSECL	Operations
51	Transmission/ distribution line maintenance	Exposure to electromagnetic interference	Transmission/ distribution line design to comply with the limits of electromagnetic interference from overhead power lines	Required ground clearance (meters)	Ground clearance - once	TSECL	Operations

Clause No.	Project activity/ stage	Potential impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
52	Uncontrolled growth of vegetation	Fire hazard due to growth of tree/shrub /bamboo along RoW	Periodic pruning of vegetation to maintain requisite electrical clearance. No use of herbicides/pesticides	Requisite clearance (meters)	Assessment in consultation with forest authorities - once a year(pre-monsoon/post-monsoon)	TSECL	Operations
53	Noise related	Nuisance to neighbouring properties	Substations sited and designed to ensure noise will not be a nuisance.	Noise levels {dB(A)}	Noise levels at boundary nearest to properties and consultation with affected parties if any - once	TSECL	Operations