

INITIAL ENVIRONMENT ASSESSMENT REPORT (IEAR) FOR RIHAND-DADRI HVDC REFURBISHMENT



ENVIRONMENT AND SOCIAL MANAGEMENT
POWER GRID CORPORATION OF INDIA LTD.
(A GOVERNMENT OF INDIA ENTERPRISE)

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ABBREVIATIONS

APs	–	Affected Persons
ADB	–	Asian Development Bank
CERC	–	Central Electricity Regulatory Commission
CGWB	–	Central Ground Water Board
CSS	–	Country Safeguard System
EIA	–	Environment Impact Assessment
EPA	–	Environment (Protection) Act, 1986
ESMC	–	Environment and Social Management Cell
ESMD	–	Environment and Social Management Department
ESMT	–	Environment and Social Management Team
ESPP	–	Environmental and Social Policy & Procedures
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
GoI	–	Government of India
HVDC	–	High Voltage Direct Current
IMD	–	Indian Meteorological Department
IEAR	–	Initial Environmental Assessment Report
MBGL	–	Meter Below Ground Level
MoEF&CC	–	Ministry of Environment, Forests and Climate Change
MoP	–	Ministry of Power
MW	–	Mega watt
NR	–	Northern Region
O & M	–	Operation & Maintenance
POWERGRID	–	Power Grid Corporation of India Ltd.
SPS	–	Safeguard Policy Statement
SF6	–	Sulphur Hexafluoride
SVC	–	Static VAR Compensator

SECTION - I: PROJECT DESCRIPTION

1.0 BACKGROUND

The Rihand-Dadri system is lifeline for Rihand/Singrauli complex running continuously at 1500MW to evacuate the power from Rihand generation having capacity of 3000 MW. The importance of Rihand-Dadri system has increased manifold after the commissioning of third stage of Generation project at Rihand Power Plant as sufficient evacuation capacity from the complex is not available resulting in more dependence on HVDC system.

The constraint of evacuation of power from Rihand complex through alternate AC system is so high that whenever one pole of HVDC is taken out, the backing down of power has to be done at Rihand. Therefore Rihand-Dadri HVDC system is still considered to be a lifeline for evacuation of Power from Rihand-Singrauli Generation complex. The salient features of Rihand-Dadri system is as follow;

- Capacity – 1500MW [2 X 750 MW] Rihand-Dadri HVDC Bipole Terminal
- DC System Voltage - ± 500 kV
- DC Line Length – 815 KM
- Type of Conductor – Quad Bersimis
- Converter – 12 Pulse Graetz Bridge (Total 1152 Thyristors)
- AC Filters – 3 banks of 230MVA each

1.1 PROJECT OBJECTIVE:

The objective of the project is to make Rihand – Dadri HVDC system completely reliable and to extend its life in line with Central Electricity Regulatory Commission (CERC) regulation.

1.2 PROJECT JUSTIFICATION

Rihand-Dadri HVDC system is an important link of Northern Region and is responsible for evacuation of major power out of 3000MW generated at Rihand Generating station. Reliable operation of Rihand-Dadri HVDC is of most importance for smooth operation of Northern Grid as power interruption in the link results in back down of generators in Rihand/Singrauli generating complex and also affects power supply to Delhi/Punjab.

Though the system was running satisfactorily till last 3-4 years, problems started arising in different areas of HVDC resulting in outage of HVDC system as well as interruption of power flow. These failures are due to ageing of the equipment as Rihand-Dadri HVDC system has already completed its useful life of 25 years.

M/s ABB AB Sweden, the OEM visited Rihand & Dadri HVDC Terminals and submitted detailed report on 11th April 2013 whereby ABB recommended replacement/up-gradation of some crucial component wherein failure on account of aging has already been experienced. The similar practice is followed worldwide for up-gradation of HVDC systems to enhance its life and to improve reliability.

1.3 PROJECT HIGHLIGHTS

a)	Project	:	Refurbishment of Rihand-Dadri HVDC System
b)	Location of the Project	:	Northern Region
c)	Project Cost	:	Rs. 681.80 Crores at August 2016 Price Level (including IDC of Rs. 35.10 Crores)
d)	Commissioning Schedule	:	March 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 associated with the proposed refurbishment of Rihand-Dadri HVDC system in State of Uttar Pradesh and Haryana. The IEAR provides insight on possible environment & social issues and enlist management measures to minimize/mitigate them based on POWERGRID's Environmental and Social Policy & Procedures (ESPP) and Action Plan for Safeguards developed for use of the Country Safeguard System (CSS) under the ADB Safeguard Policy Statement, 2009 (SPS). The following scopes of works are proposed to be implemented under the present scheme.

PART-A

1. Valve Hall Equipment Replacement;
2. Replacement of Converter Transformer & Smoothing Reactor Bushings;
3. Replacement of Valve Hall Ventilation System;
4. Refurbishment/Replacement of Yard Equipment (AC & DC side like AC/DC Breakers, Isolators, and Earth Switch etc.).

PART-B

1. Control & Protection Upgradation (Replacement of existing Control & Protection including SCADA System with latest new Control & Protection including SCADA System);
2. Valve Cooling Upgradation (Replacement of existing wet type Valve Cooling System with new Valve Cooling System).

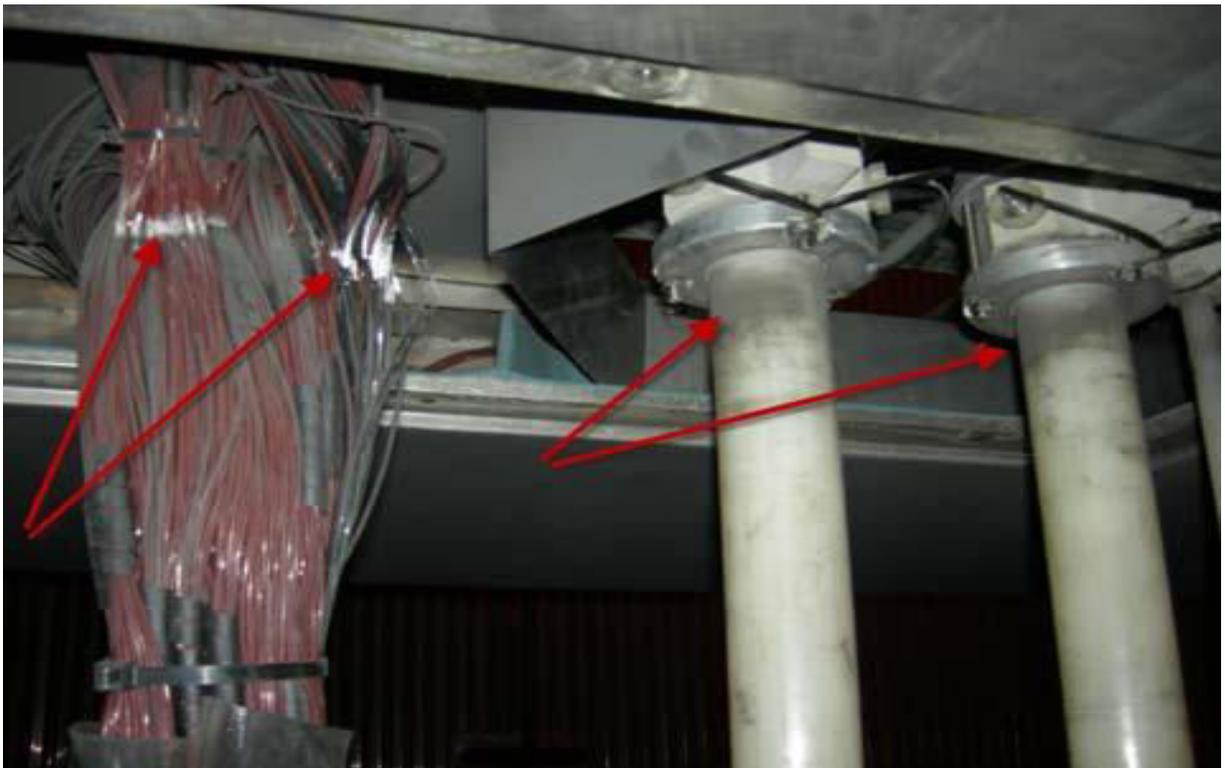
PART-C

1. Retro-fitment of breakers at Kanpur, Agra, Ballabgarh and Mandola;
2. Retro-fitment of isolator at Agra, Kanpur, Mandola & Ballabgarh substations;
3. Replacement of CTs at Agra, Kanpur, Ballabgarh, Mandola & Muradnagar substation;
4. Replacement of Fire Fighting System at Kanpur substation;
5. Spare Air Core Reactor at Kanpur substation;
6. Refurbishment of SVC at Kanpur substation.

The proposed project activities involve only replacement, retrofit/refurbishment of old equipments within the existing HVDC Stations at Rihand, Dadri and also at Agra, Kanpur, Ballabgarh, Mandola & Muradnagar substations. The condition of such equipments for which replacement/refurbishment to be undertaken are depicted below;



Damaged Thyristor Control Units



Damaged Light Guide & Black Dust on Water Tubes



Failed Capacitor



Condition of Valve Cooling System



Condition of HVDC Control Equipment



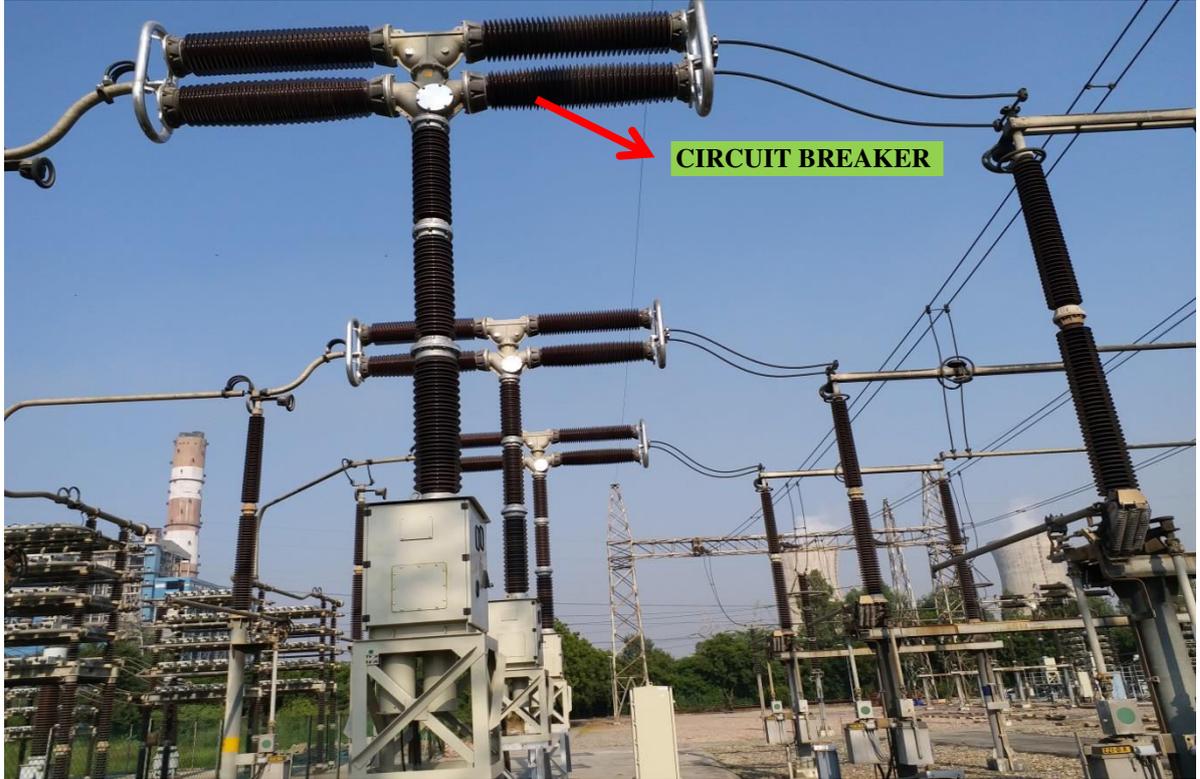
Condition of Ventilation Equipment at HVDC Rihand Station



Converter Transformer Bushings



Smoothing Reactor Bushings



Refurbishment/Replacement of Yard Equipments



SECTION - II: BASELINE DATA

2.0 The proposed refurbishment works at various substations are located in Sonbhadra, Gautam Budh Nagar, Kanpur, Agra and Ghaziabad district of Uttar Pradesh State and Faridabad district of Haryana State respectively. The basic environmental settings of these states and subproject districts in particular are discussed below:

2.1 Uttar Pradesh:

Uttar Pradesh is the most populous State of the country with a geographical area of 2,40,928 sq.km which constitutes 7.3% of the total area of the country. It shares border with nine states as well as international border with Nepal. Uttar Pradesh is situated between 23°52' N -30°24' N latitude and 77°05'E - 84°38'E longitude. It is bounded by Uttaranchal on the NW, Nepal on the NE, Bihar on the East, Madhya Pradesh in the South, and Haryana, Delhi & Rajasthan in the West. It is the fourth largest state in India by area. Hindi is the official and most widely spoken language in its 75 districts along with English.

Physiographically the State is divided into two region viz. Vast Gangetic Plains and Smaller Southern Hill Plateau & Vindhya Range. The larger Gangetic Plain region having highly fertile alluvial soil is in the north, which includes the Ganges-Yamuna Doab, the Ghaghra plains, the Ganges plains and the Terai. The smaller Vindhya Range and plateau region is in the south and it is characterized by hard rock strata and a varied topography of hills, plains, valleys and plateaus. The detailed land use pattern of the State is given in **Table 2.1**.

Table-2.1: Land use Pattern in Uttar Pradesh

Land use	Area in '000 ha	Percentage
Geographical Area	24,093	-
Reporting Area for Land Utilization	24,170	100
Forests	1,658	6.86
Not available for cultivation	3,371	13.95
Permanent pasture and other grazing land	66	0.27
Land under misc. tree crops and groves	350	1.45
Culturable wasteland	423	1.75
Fallow land other than current fallow	537	2.22
Current fallow	1,201	4.97
Net Area sown	16,564	68.53

Source: Land Use Statistics, Ministry of Agriculture, GOI, 2012-13

Sonbhadra district is the 2nd largest district of Uttar Pradesh, India. It is the only district in India which borders four states namely Madhya Pradesh, Chhattisgarh Jharkhand and Bihar. It is positioned in the southernmost district of the State with an area of 6788 sq.km and it lies between 24^o 41'23"N latitudes and 83^o 03'55"Elongitudes. It is bounded by Mirzapur District to the northwest, Chandouli District to the north, Kaimur and Rohtas districts of Bihar state to the northeast, Garhwa district of Jharkhand State to the east, Koriya and Surguja districts of Chhattisgarh State to the south, and Singrauli district of Madhya Pradesh State to the west. The elevation of the area varies from 150-400m

above MSL. The general slope of the tract is from North to South. The topography is influenced or modified by the existing rivers and streams.

Gautam Budh Nagar is a largely suburban district of Uttar Pradesh State in northern India. It is part of the National Capital Region (India) and lies between 28° 31'N' and 77° 23'E longitudes. It has geographical area of 1442 sq. km with headquarters at industrial city of Greater Noida. The Gautam Budh Nagar district falls in Yamuna Sub-basin and forms a part of Ganga Yamuna Doab. Major part of the district is covered by Hindon river water shed.

Kanpur Nagar district lies in middle of Uttar Pradesh State. It lies between 25°55' and 27° N latitude and 79°30' and 80°35' E longitudes having a total geographical area of the district is 3155 sq.km. The major parts of the area are almost a flat plain with some minor undulations. The river Ganga and Yamuna with their tributaries form the drainage system (Dendritic type).The Kanpur Nagar district is part of Indo Gangetic Plain. The clay, silt, gravel and sands of different grades are main sedimentary constituents.

Agra district occupies the western most part of the Uttar Pradesh. The district is bounded by the Rajasthan and Madhya Pradesh States in the west & south and by Mathura, Etah, Firozabad, Mainpuri and Etawah district from north to east respectively. The Agra district encompasses an area of 4027 sq.km. and lies between latitude 26° 44'10", to 27°24'30" N and longitude 77°30'15" to 78°51'30" E. The area is more or less flat and gently sloping from northwest to southeast. The altitude of the area generally varies from 120 to 190 m above MSL.

Ghaziabad district is situated in the middle of Ganga-Yamuna doab and spreads over 2590sq.km. It is bounded by longitude 77°12' 78°13'N and latitude 28° 26' 28° 54'E and is underlain by Quaternary sediments. District at Ghaziabad is drained by river Yamuna and Ganga and their tributaries namely Hindon and Kali, Minor distributaries of Kali Nadi being Hawa drain Chhoiya Nala and Chhoiya Nadi. The entire district of Ghaziabad forms the part of Ganga-Yamuna doab, eastern boundary is marked by Ganga River and the river Yamuna defines the western boundaries.

Climate:

Uttar Pradesh experiences a sub-humid and tropical climate with three distinct seasons summer, monsoon & winter. The intervening periods are transitional period on the basis of Indian Meteorological Department (IMD) long term normal data. The summer is hot and dry with maximum daily temperature ranging between 38°C to 43°C. The rainy season commences by late June when south western monsoon sets in over the State. The humidity gradually increases and reaches above 80%. The bulk of annual rainfall about 85% occurs during monsoon period (June to September). The monsoon starts retreating from the State in late September or early October. January is the coldest month of the period. Another transitional period follows between winter and summer.

Sonbhadra district experiences sub humid and is characterized by hot summer and pleasant monsoon and cold season. The Average temperature ranges from 16.15 to 39.80 °C. May is the hottest months with the mean daily maximum temperature is

45.5°C and mean daily minimum temperature is 2.5°C. The average relative humidity ranges from 25 to 81%. The mean wind velocity is 5.4 km/h and potential evapotranspiration rate is 1556.7 mm. The average annual rainfall is 1115.00 mm. About 90% of rainfall takes place from June to September.

Gautam Budh Nagar district climate is sub-humid and characterized by hot summer and bracing cold season. After February there is continuous increase in temperature till May which is generally the hottest month. The district experiences the hottest weather in the month of June with average mean temperature of 32.85°C followed by May with 31.9°C. The coldest month is January with average mean temperature of 14.2°C followed by December with 15.4°C.

The climate of **Kanpur Nagar** district is sub humid and is characterized by hot summer and general dryness except in the south west monsoon. May and early part of June constitute the hottest part of the year. The mean daily maximum temperature in May is 41.7°C. The mean daily minimum temperature is 27.2°C and maximum temperature rises up to 45°C or over. With the onset of the monsoon in June the day temperature drops down appreciably. The January is the coldest month with mean daily maximum temperature at 22.8°C and mean daily minimum temperature at 8.6°C. The average annual rainfall in the district is 821.9 mm. The mean monthly morning relative humidity is 69% and mean monthly relative humidity is 50%.

Agra district climate features a semi-arid climate that borders on a humid subtropical climate. The city features mild winters, hot and dry summers and a monsoon season. Agra has a reputation of being one of the hottest towns in India. In summers the city witnesses a sudden surge in temperature and at times, mercury goes beyond the 46°C mark in addition to a very high level of humidity. During summer, the daytime temperature hovers around 46-50°C. Nights are relatively cooler and temperature lowers to a comfortable 30°C. Winters are bit chilly but are the best time to visit Agra. The minimum temperature sometimes goes as low as 2 or 3°C but usually hovers in the range of 6 to 8°C. The annual normal rainfall of the district comes to 715.84 mm. The maximum rainfall occurs during the monsoon period i.e. June to Sept. having the normal value of 633.1 mm which is 88.44% of annual rainfall. The highest % of humidity occurs in the month of August with normal relative humidity of 78% followed by 70.5% in July.

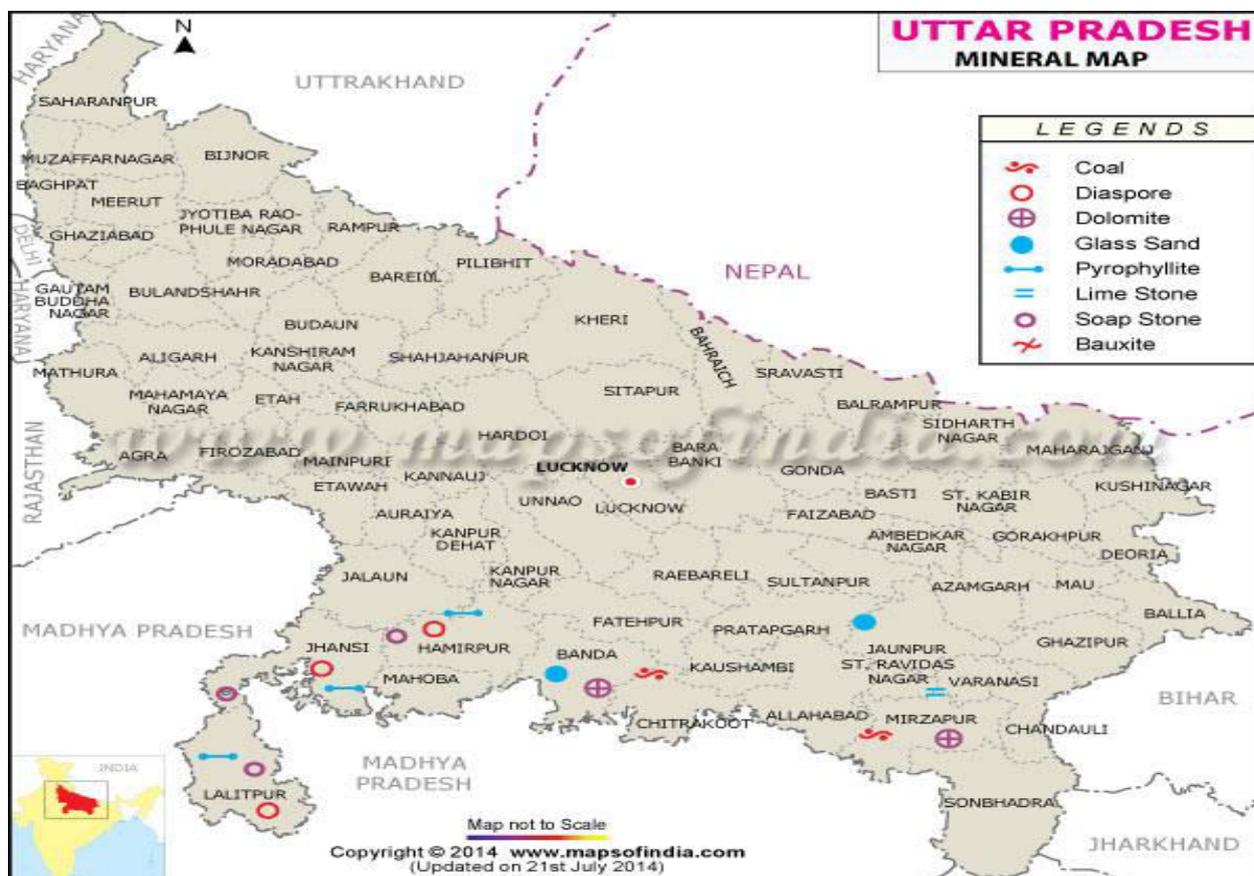
Ghaziabad district is endowed with typical climate with extremes in summer as in winters. The mercury shoots up to 40°C or even more during peak summer and dips to less than 5°C during the month of January. Winter spans from mid of November to mid of February. Summer months are April to middle of June which ends with onset of monsoon. The rainfall in the area is mainly due to southwest monsoon and nearly 80 to 85% of the annual rains occurs between July and September.. The normal Annual rainfall of the district has been reported 731 mm.

Minerals:

Uttar Pradesh has ample reserves of coal, dolomite and gems. The State is the principal holder of country's andalusite & diaspore resources and is said to possess 78% andalusite, 37% diaspore and 10% pyrophyllite. The minerals found in project area

districts are provided below;

District	Minerals found
Sonbhadra	Coal, China Clay, Dolomite, Fireclay, Limestone, Potash & Sillimanite
Gautam Budh Nagar	Nil
Kanpur Nagar	Morang (sand)
Agra	Sand, Silica, Red Sand Stone
Ghaziabad	Reh(which is essentially a mixture of sodium sulphate with traces of calcium and magnesium salt) and Kankar



Soil:

Much of the area of Uttar Pradesh is covered by a deep layer of alluvium spread by the slow-moving rivers of the Ganges system. Those extremely fertile alluvial soils range from sandy to clayey loam. The soils in the southern part of the state are generally mixed red and black or red-to-yellow.

Sonbhadra district region has Deep Loamy to Clayey Red and Yellow Soils.

Gautam Budh Nagar district soil ranges from pure sand to stiff clays and including all combination of the two extreme litho units. The pure sand is called Bhur and clay is called Matiar. The mixture of sand and clay in equal proportion forms Dumat or loam, a good agriculture soil. Alluvial soils occurring in flood plain of rivers is called Kemp which yield good crops.

Kanpur Nagar district exhibits a great variety of composition and appearance in soil.

The major part of the district consists of ordinary soils known locally as Bhur and Sand on ridges, Matiyar or clay in depressions and Domat or Loam in the Plains. The 'Reh' prevails in the clay dominant areas.

Agra district exhibits great variance mainly due to the influence of different rivers and variation in the provenance of the sediments. It consist mainly of Sandy loam, loam, clayey loam and rocky of various colors, which varies from fine to coarse in texture.

Ghaziabad district soil ranges from pure sand to stiff clays, with combinations of these two extreme litho units. The pure sand is called Bhur. Clay is called Matiyar. When the sand is mixed with clay in equal proportion the soil may be termed as Dumat or loam a good agricultural soil.

Water Resources:

A) Surface Water

Major source of surface water in the Uttar Pradesh are rivers flowing from southeast to southwest direction. Major rivers include Ganges, Yamuna, Ghagra, Gomti, Gandak, Sone and Sarada. The Ganges being too large to be tamed, no major irrigation projects have been created on its mainstream. In recent years, some of the northern and southern tributaries of Ganges and their minor feeder streams have been tamed, creating a few reservoirs.

The Sone River flows through the **Sonbhadra** district from west to east and its tributary the Rihand River, which rises to the south in the highlands of Surguja district of Chhattisgarh, flows north to join the Son in the center of the district.

The **Gautam Budh Nagar** district falls in Yamuna sub-basin and forms a part of Ganga Yamuna Doab. Major part of the district is covered by Hindon river water shed.

In **Kanpur Nagar** district the two chief rivers are the Ganga and the Yamuna. The Isan and the Non are the tributaries of the Yamuna. The river next in importance is Pandu. The Yamuna first touches the district in the extreme west of Bhognipur and maintains a south easterly course.

In **Agra** district the major rivers flowing are Yamuna, Chambal & Utangan. The main southern bank tributaries of the Yamuna River are Utangan or Gambhir & Khari. The Chambal River is also a very important perennial tributary of Yamuna flowing from West to East forming the southeastern boundary of the district. The Karoan is a seasonal northern bank tributary of the Yamuna draining the northeastern parts of the study area.

In **Ghaziabad** district Ganga, Yamuna and Hindon are the main rivers flowing through and they are filled with water throughout the year. Other than these there are some small rain fed rivers, prominent among them is the Kali River. Apart from these rivers the Ganga Canal flows through the district and irrigation work is carried out through different branches of Canal. The Ganga canal also caters the drinking water needs of

the people of Ghaziabad as well as Delhi.

b) Ground Water

According to Central Ground Water Board (CGWB) study, in Uttar Pradesh the depth to ground water level is highly variable throughout the year ranging from ground level to 38.5 meter below ground level (mbgl). The distribution pattern remains same during the year with the areas under different ranges increasing/reducing in different seasons. The water level in general increases from north-east to south-west roughly parallel to the northern boundary of the State. The shallow water level occurs in the north, north eastern part and parts of central region of the State. The deeper water level occurs in the western part, along Yamuna river, parts of southern U.P. and cities.

There are four canal command areas in the state but these do not have the same depth to water level pattern and all do not necessarily show very shallow ground water levels. The Gandak and Saryu command areas in general show very shallow water level 2-5 mbgl and water logging conditions exists in the monsoon and post monsoon period with few areas within these zones showing 5-10 mbgl. Generally the larger areas in Sharda Sahayak command fall 28 under 5 -10 mbgl water level range. In comparison to above commands, in Ramganga command the water level is generally deeper falling in the range of 5-10 mbgl in the north eastern part and 10-20 mbgl in the south western part along the River Yamuna. The different water level zones are controlled by geomorphological features such as flood plains, natural levees of main rivers, interfluves areas etc. as well as by the nature of deposits.

According to Central Ground Water Board (CGWB) study, ground water of **Sonbhadra** district is mainly controlled by drainage, topography and lithological behavior, it occurs under phreatic condition at shallow depths and fractures & granular zones under at deeper depths. Depth to water in pre-monsoon ranges between 4.00 to 22.00 mbgl. Post monsoon water level varies between 2.10 to 20.50 mbgl. Water level fluctuation is minimum in Ghorawal and maximum in Chatrah block. After the study of long term water level trend, it is inferred that the well show the decline trend during pre-monsoon period. The shallow fractures and phreatic ground water has poor sustainability

The ground water of **Gautam Budh Nagar** district occur under Phreatic conditions (as per study by CGWB) in shallow aquifers down to the depth of 100 mbgl, in intermediate and deeper aquifers it occurs under confined to semi-confined conditions. Depth to water level maps for pre-monsoon and post monsoon periods have revealed that the entire area can be divided into different zones on the basis of depth to water ranges. Fairly a large area has shallow to moderate depth to water conditions. Water level in phreatic aquifer ranges from 3.35 to 14.40 mbgl during pre-monsoon period whereas it ranges from 2.00m to 13.95 mbgl during post monsoon period. Water levels greater than 9 mbgl occur in most of the non-command areas of the district.

Similarly, the ground water of **Kanpur Nagar** occurs under unconfined condition in phreatic zones and under confined condition in deeper zones (as per study by CGWB). The sediment logical constitution of the subsurface granular zones shows remarkable

variation in the depth and the nature of occurrence in north and southern part of the district. In southern part specially along Yamuna river, feldspar-quartz, Jasper sands and gravel (Mourum) are the main constituents of the granular zones that occurs comparatively at shallow levels i.e. 24 to 57 mbgl whereas in the northern parts along the Ganga river, these reworked sedimentary formations are existing at deeper levels i.e. 265 to 310 mbgl

According to Central Ground Water Board (CGWB) study, ground water of **Agra** varies from 7.23 to 31.14 mbgl during pre-monsoon period and the water level fluctuation between pre and post monsoon period varies from 0.00 to 7.00 meters Rise, and 0.00 to 0.30 m Fall in 2012. The long term behavior of water table shows declining trend in the major part of the area, only the canal command areas are depicting somewhat rising trend.

According to Central Ground Water Board (CGWB) study, available subsurface alluvium in the **Ghaziabad** district varies from 115 m to 450 m. In Hindon Yamuna doab, the thickness of quaternary sediments including alluvial deposit varies from 300 m the north to 115 m in the central part of the Western side of Hindon river.

Ecological Resources:

Forest:

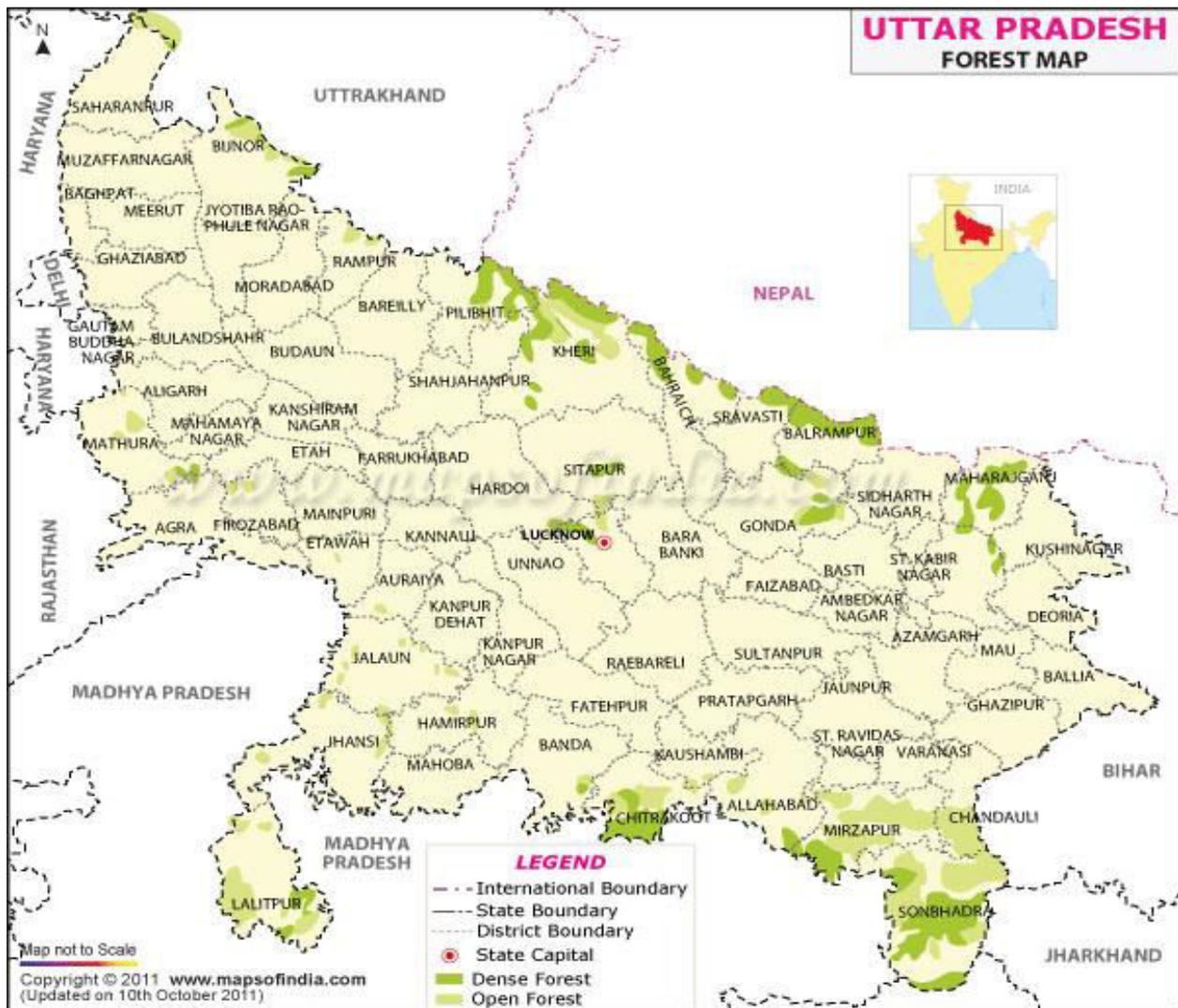
The recorded forest area of the State is 16,582 sq. km. which is 6.88% of the total geographical area of the State. As per legal classification, Reserved Forest constitutes 72.79%, Protected Forest 6.97% and Un-classed Forest 20.22%. The State has 27 forest types which belong to five forest type groups, viz. Tropical Semi Evergreen, Tropical Moist Deciduous, Littoral & Swamp, Tropical Dry Deciduous and Tropical Thorn Forests. The forest cover of the project area districts ranges from 1.76% to 37.48. The details are provided below.

District	Geographic Area (Sq.km.)	(Area in Sq. km.)				%Forest cover
		Very Dense forest	Mod. Dense forest	Open forest	Total	
Sonbhadra	6,778	45	870	1629	2544	37.48
Gautam Budh Nagar	1,442	0	12	24	36	2.50
Kanpur	6,176	0	12	97	109	1.76
Agra	4,027	0	65	208	273	6.78
Ghaziabad	2,590	0	18	31	49	1.89

Source: Indian State of Forest Report, 2015

Protected Areas:

Uttar Pradesh has one National Park and 23 Wildlife Sanctuaries covering 5,712 sq.km. which constitutes 2.37% of the State's geographical area. The oldest Wildlife Sanctuary of the country, the Chandraprabha Wildlife Sanctuary is located in Uttar Pradesh. Uttar Pradesh has one Tiger Reserve namely, Dudhwa Katarniaghat (extension) which is also famous for Swamp Deer and Rhinoceros.



Human and Economic Development

Uttar Pradesh is the most populous State in the country. Uttar Pradesh is rich in human and natural resources. The population of the state is 199.81 million (Census 2011) of which 77.73% is rural and 22.27% urban population. Population density is 829 persons per sq.km. Most of State's farm land is well watered and naturally fertile U.P is the largest producer of food grains and oilseeds in the country. It leads all the states in India in the production of wheat, maize, barley, gram, sugarcane and potatoes. Wheat, rice, sugar cane, pulses, oil seeds and potatoes are its main products. Sugar cane is an important cash crop almost throughout the state and sugar mills and other cane crushers who produce Gur and Khandasari are common throughout the state. Uttar Pradesh is an important State as far as horticulture is concerned. There are different types of minerals and several industries have come up based on the minerals. There are cement plants in the Mirzapur area in the Vindhya region, a bauxite based aluminium plant in the Banda area, Coal deposits are found in the Singrauli area. The industries include a large printing establishment units engaged in manufacturing of scales, locks, letter boxes, furniture, badges and belts, leather goods, scissors etc. Handloom, carpet, glass, electrical goods, electro-plating, building material industries are also found in this State.

2.2 Haryana:

The State of Haryana lies between 27°39'-30°55' N latitude and 74°27'-77°36' E longitude with a geographical area of 44,212 sq.km. Physiographically, the State is divided into three zones, viz. the Shiwaliks, the Aravalli hills and the Indo-Gangetic plains. The general land use pattern of the state is given below in **Table 2.2**:

Table 2.2: Land use Pattern in Haryana

Land use	Area in '000 ha	Percentage
Geographical Area	4,421	-
Reporting Area for Land Utilization	4,371	100
Forests	40	0.92
Not available for cultivation	643	14.71
Permanent pasture and other grazing land	25	0.57
Land under misc. tree crops and groves	4	0.09
Culturable wasteland	26	0.59
Fallow land other than current fallow	18	0.4
Current fallow	103	2.37
Net Area sown	3513	80.35

Source: Land Use Statistics, Ministry of Agriculture, GOI, 2012-13

Faridabad district is located on south eastern part of State and it lies between 27° 39'-28°31'N latitude and 76°40' and 77°32' E longitudes. In the north it is bordered by the Union Territory of Delhi in the east by Uttar Pradesh, in the North West by Mewat Gurgaon districts of Haryana and in the west. Total geographical area of the district is 2151 sq. km. Faridabad district is divided into Two Blocks, namely, Faridabad, Ballabhgarh.

Climate:

The climate of the State is semi-arid to sub-tropical. The State experiences extreme winter and summer. The hottest months are May and June and the coldest December and January. The state receives its rainfall primarily through southwestern monsoon. The average annual rainfall varies from as little as 313 mm in areas bordering Rajasthan in South-western parts of the state over 862 mm in the North Eastern parts. Drought conditions are common in Mahendragarh, Rewari, Bhiwani, Hissar and Sirsa. The mean wind speed of the State is reported to be 2.9 km/h. The mean relative humidity on an average varies from 30% in April to 90% in August, the annual average being 60%.

Faridabad district climate can be classified as tropical steppe, semiarid and hot which is mainly characterized by the extreme dryness of the air except during monsoon months. The mean maximum temperature is 41°C. The normal annual rainfall is about 542 mm. The south west monsoon sets in the last week of June and withdraws towards the end of September and contributes about 85% of the annual rainfall. The period from October to December constitutes post monsoon season. The cold weather season prevails from January to the beginning of March and followed by the hot weather or summer season which prevails up to the last week of June.

Minerals:

Haryana is the principal holder of country's resources of tin (64%), quartz-silica sand (52%) and quartzite (49%). The principal minerals occurring in Haryana are china clay in Faridabad, Gurgaon and Rewari districts; limestone in Ambala, Bhiwani, Mahendragarh and Panchkula districts; quartz/silica sand in Bhiwani, Faridabad, Gurgaon and Mahendragarh districts; quartzite in Faridabad and Gurgaon districts; slate in Mahendragarh and



Gurgaon districts. Other minerals, such as, barytes, calcite, felspar and marble occur in Mahendragarh district; copper in Bhiwani and Mahendragarh districts; dolomite in Ambala and Mahendragarh districts; granite in Bhiwani district; tin and tungsten mineralization in Tosham area of Bhiwani district have also been reported. The major minerals found in project area districts are China clay, quartz/silica sand, and quartzite.

Soil:

In Haryana Soil is formed almost entirely of alluvium, the state is situated towards the depressions of the rivers Ganges and Indus. It is a broad level plain standing nearly on the watershed between the basins of the two rivers. It is a vast ground of moist land. In the whole of the region except the flood plains of the Yamuna and the Ghaggar, the alluvium is of the old type containing sand, clay, silt and hard calcareous concentrations about the size of nuts known as 'Kankars'. In the Khaddar the deposits of the alluvium are the recent type. They consist of coarse sand and some silt regularly deposited by the rivers and small mountain streams of the Indo-Gangetic watershed. In the south-western part, a great deal of wind-blown sand has been piled up in the form of sand dunes. These dunes are sometimes many meters high and extend many kilometers in length. The alluvium is covered by sand, making the region as arid and unproductive as a desert.

Soils of **Faridabad** district are classified as tropical and brown soils, existing in major parts of the district. In Hathin block the organic content of soils ranging from 0.41 to 0.75 percent which is of medium category. In rest of the area organic contents is 0.2 to 0.4 percent and falls in Low category. The average conductivity of the soil is not more than 0.80 $\mu\text{mhos/cm}$ and the average pH of the soil is between 6.5 and 8.7.

Water Resources:

A) Surface Water:

The Yamuna flows along the Haryana State eastern boundary while the ancient Sarasvati River is said to have flowed from Yamuna Nagar, but has now disappeared. Haryana's main seasonal river, the Ghaggar rises in the outer Himalayas, between the Yamuna and the Sutlej and enters the state near Pinjore in the Panchkula district. Passing through Ambala and Hissar, it reaches Bikaner in Rajasthan and runs for 460 km before disappearing into the deserts of Rajasthan. Important tributaries include the Chautang and Tangri. The surplus water is carried on to the Sanisar Lake where the Markanda joins the Sarasvati and later the Ghaggar. Shahbad Markanda town is situated on its bank. Mentioned in the epic Shatapatha Brahmana as the Drishadwati, the Sahibi River originates in the Jaipur district in Rajasthan. However, before seismic activities some 7,500 years ago in the Aravalli Hills, the river brought water from as far as the Ajmer district. Gathering volume from about a hundred tributaries in Rajasthan and the Mewat areas, it reaches voluminous proportions, forming a broad stream around Alwar and Patan. Further flowing via Rewari District and Dharuhera, it reaches Jhajjar then splits into two smaller streams, finally reaching the outskirts of Delhi and flowing into the Najafgarh Lake that flows into the Yamuna through the Najafgarh drain. Three other rivulets in and around the Mewat hills, the Indori, Dohan and Kasavati all flow from East to West.

The **Faridabad** district is mainly drained by the rivers Yamuna, which is a perennial besides this a number of small streams originates from the hill ranges of the central parts of the district, which do not meet any major stream or Rivers but disappears in the permeable deposits of alluvial plains after traversing some distance. The drainage of the area is dendritic sub parallel to sub-angular pattern. The river Yamuna separates the district Boundary on eastern side with UP State.

B) Ground Water:

On the basis of geohydrological conditions as well as groundwater movement and surface drainage pattern, the entire Haryana state is divided into the following basins:-

1. Yamuna basin; (a) Upper, (b) Lower
2. Ghaggar Basin; (a) Upper, (b) Lower
3. Inland Alluvial Basin
4. Krishnawati Basin
5. Sahibi Basin
6. Landoha Nala Basin
7. Kanti Sub Basin (Loharu Satnali area)

Ground water occurs both under confined and unconfined conditions in the alluvial formation whereas it is mostly under un-confined conditions in Shiwaliks and piedmont deposits and semi-confined conditions in hard rocks.

Ground water in **Faridabad** district occurs in alluvium and the underlying weathered/fractured quartzite. Alluvium comprises sands, silt, Kankar and gravel which

form the principal ground water bearing horizon. In Quartzite formation, occupying the north- western part of the district, ground water occurs in weathered and jointed fractured horizons. Weathering and fracturing has resulted in formation of semi-consolidated sand beds, which form potential aquifer zones. This quartzite formation has not been explored for ground water occurrence. In alluvium, granular zones are evenly distributed in entire thickness which is negligible near the quartzite outcrops to over 350 m in the eastern parts near Yamuna River.

Ecological Resources:

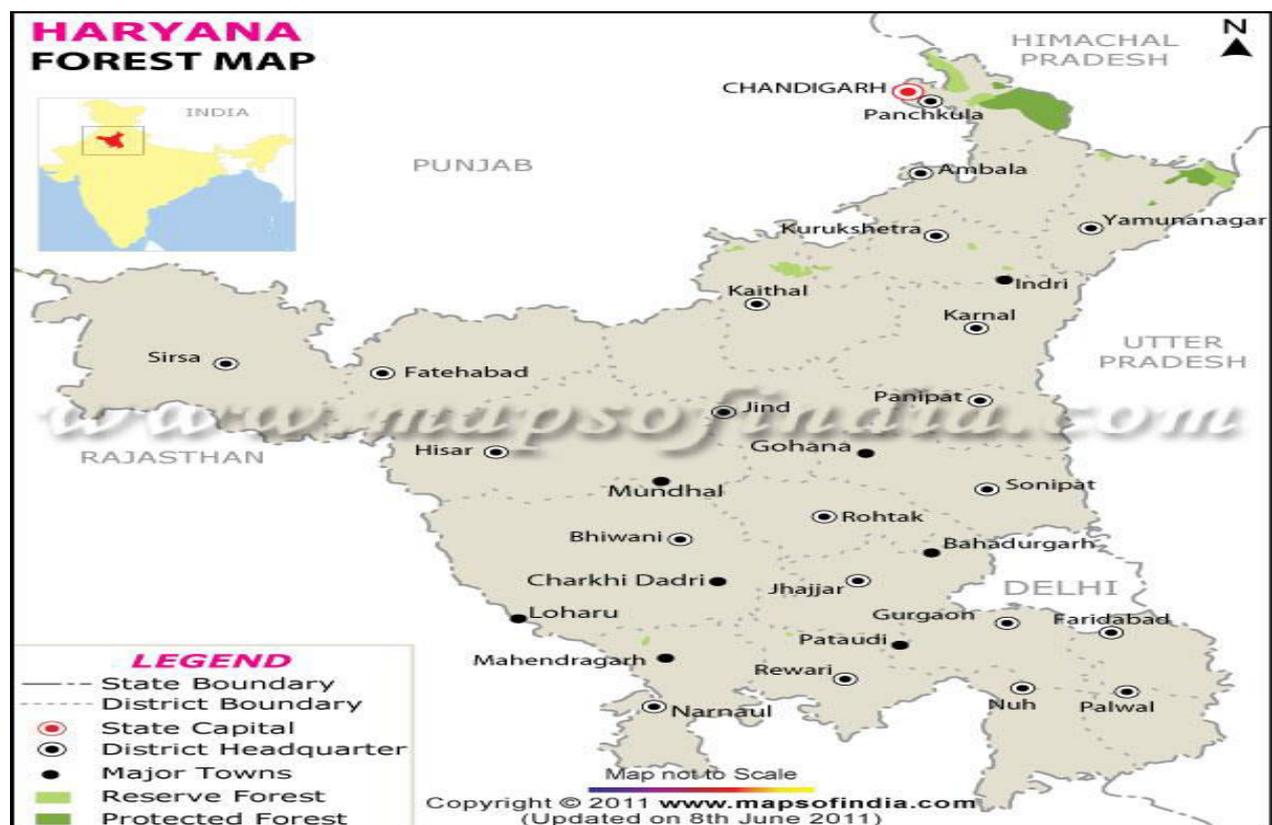
Forest:

The forest cover in the state is 14,461 sq. km of which the State has 2,195 sq.km. areas under very dense forests, 4,060 sq.km area under moderately dense forests and 8,206 sq.km area under open forests.

The recorded forest area is 1,559 sq.km which is 3.53% of the geographical area of the state. Reserved Forests constitute 15.97%, Protected Forests 74.28% and Un-classed Forests 9.75%. Most of the road side plantations in the State have been notified as Protected Forests. The state has four forest types which belong to two forest type groups, viz. Tropical Dry Deciduous and Subtropical Pine. The details of forest cover of the Faridabad district is provided below.

District	Geographic Area (Sq.km.)	(Area in Sq. km.)				%Forest cover
		Very Dense forest	Mod. Dense forest	Open forest	Total	
Faridabad	2,151	0	28	64	92	4.28

Source: Indian State of Forest Report, 2015



Protected Areas:

In Haryana, an area of 303.92 sq.km. is being managed as protected area under two National Parks and 8 Wildlife Sanctuaries. This constitutes 0.69% of the State's geographical area.

Human and Economic Development

Haryana has become India's fastest growing State, offering its citizens the third highest per capita income. Agricultural development in Haryana has been tremendous. Per capita per day availability of milk is 579 grams against the Indian average of 180 grams. The major industries are cement, sugar, paper, cotton, textiles, glassware, brassware, cycles, tractors (largest production in the country), motorcycles, timepieces, automobile tyres and tubes, sanitary ware, television sets, steel tubes, hand tools, cotton yarn, refrigerators, vanaspati, ghee and canvas shoes. A factory of the Hindustan Machine Tools producing tractors is located at Pinjore. Haryana produces the largest number of tractors in the country. It is well known for its handloom products. Panipat has earned the reputation of being the "weaver's city" of India for its exquisite hand-tufted woollen carpets and colourful handloom products. As per 2011 census of India, the state is eighteenth largest by population with 25,353,081 inhabitants. The city of Chandigarh is its capital while the National Capital Region city of Faridabad is the most populous city of the State and the city of Gurugram is financial hub of NCR.

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. POWERGRID 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". (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". {Article 51A(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. Recently, Supreme Court has broadly and liberally interpreted the Article 21, transgressing into the area of protection of environment, and held the protection of environment and citizen's right to live in eco-friendly atmosphere 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.

3.1.2 MANDATORY REQUIREMENTS (NATIONAL)

- **MoP order/sanction under The Electricity Act, 2003**

Sanction of Ministry of Power (MoP), GoI is a mandatory requirement for taking up any new transmission project under the section 68(1) of The Electricity Act, 2003. The sanction authorizes POWERGRID to plan and coordinate activities to commission the new projects. Electricity act does not explicitly deal with environmental implications of activities related to power transmission. However, POWERGRID always integrates environmental protection within its project activities.

- **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(EPA). However, amendment in the Environment (Protection) Act, 1986 on 7th May' 1992 made it necessary to obtain clearance from MoEFCC for power transmission projects in three districts in the Aravalis (*viz.*, Alwar in Rajasthan and Gurgaon & Nuh-Mewat in Haryana). The Aravali range, in these 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 MoEFCC Power transmission projects are not included in this list.

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

MoEFCC vide its notification dated 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. POWERGRID shall follow provisions of notification and phase out all equipment which uses these substances and planning to become a CFC free organization in near future.

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

MoEFCC vide its notification dated 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 (POWERGRID) 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 & Other Wastes (Management & Transboundary Movement) Rules, 2016**

Vide notification dated 4th April, 2016 under the EPA, 1986, MoEFCC notified rules for environmentally sound management of hazardous & other wastes to ensure that the

these wastes are managed in a manner which shall protect health and the environment against the adverse effects that may result from such waste. The used transformer oil has been declared as hazardous wastes vide this notification. As per the notification, all used oil is to be auctioned / sold to registered recyclers only and file annual return on prescribed form to the concerned State Pollution Control Board.

- **E-waste (Management and Handling) Rules, 2016**

Vide notification dated 23rd March 2016 under the EPA, 1986, MoEFCC 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 effects that may result from hazardous substance contained in such wastes. Thus, it is the responsibility of the bulk consumer (POWERGRID) to ensure that e-waste generated is channelized to authorized collection center(s) or registered dismantler(s) or recycler(s) or is returned to the pick-up of take back services provided by the producer. POWERGRID, being a bulk consumer of electrical and electronics equipment shall maintain the record as per Form-2 and file annual return in Form-3 to State Pollution Control Board.

3.1.3 FUNDING AGENCY:

For POWERGRID, mandatory environment requirements with respect to ADB's Safeguard Policy Statement (SPS) are as follows:

- **ADB's Safeguard Policy Statement (SPS) 2009¹**

The SPS 2009 describes ADB's policy and operational procedures on three key safeguard areas: environment, involuntary resettlement, and indigenous people, as well as a set of specific safeguard requirements that borrowers are expected to meet when borrowing for development projects. Its objective is to ensure social and environmental sustainability of projects through avoidance, minimization, mitigation and/or compensation of adverse impacts on environment and affected peoples (APs); and help Borrowers to strengthen their safeguard systems and to develop their capacity in managing the environmental and social risks.

SPS 2009 includes categorization of projects based on significance of potential environmental impacts. The category is determined by the project's most environmentally-sensitive component including direct, indirect, cumulative, and induced impacts within the project's area of influence. Project categorization system is given below:

Category A –an environmental impact assessment (EIA) is required for a project that is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented, and may affect an area larger than the sites or facilities subject to physical works.

¹The safeguard requirements of ADB vis-s-vis POWERGRID's ESPP have been analyzed in detailed for use of Country Safeguards System (CSS) under ADB's SPS' 2009 and an action plan has been drawn to make it fully compliant under CSS.

Category B –an initial environmental examination (IEE) is required for a project that is likely to have adverse environmental impacts that are less adverse than those of Category A which are site-specific, few if any of them irreversible and in most cases mitigation measures can be designed more readily than Category A.

Category C –no environmental assessment is required but environmental implications will be reviewed for a project that is likely to have minimal or no adverse environmental impacts.

Category FI –if a project involves investment of ADB funds to or through a financial intermediary.

Based on the significance of the potential environmental impacts resulting from the transmission project and SPS 2009, the project is classified as environment category “B” requiring an IEE. However, the instant project doesn’t involve construction of new transmission line/substation and only replacement/ refurbishment of old equipments is proposed in existing substations where the likely environmental impacts are negligible/nil.

Power transmission projects financed by ADB are also required to follow the World Bank Group Environmental, Health, and Safety (EHS) General Guidelines and EHS Guidelines for Electric Power Transmission and Distribution published by the International Finance Corporation, 30th April 2007.

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. POWERGRID shall implement the said constitutional provision in true spirit to fulfill its environmental and social obligations and responsibilities.

3.2.3 FUNDING AGENCY

For POWERGRID, mandatory social requirements with respect to ADB’s Safeguard Policy Statement (SPS) are as follows:

- **ADB’s Safeguard Policy Statement 2009**

ADB’s Safeguard Policy Statement (SPS), June 2009 set out specific safeguard requirements for borrower as per its policy & operational procedures on three key safeguard areas: environment, involuntary resettlement, and indigenous peoples.

The key objective is to avoid or minimize involuntary resettlement (IR) by exploring project and design alternatives and to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels and to improve the standards of living of the displaced poor and other vulnerable groups. Regarding Indigenous People the objective of the policy is to design and implement projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the Indigenous Peoples themselves so that they (i) receive culturally appropriate social and economic benefits, (ii) do not suffer adverse impacts as a result of projects, and (iii) can participate actively in projects that affect them.

It may be noted that no permanent acquisition of land and R & R issues is involved in the instant project as the scope of works only include replacement/ refurbishment of old equipments which will be undertaken in the existing substations. Hence, applicability of IR & IP policy as per SPS, 2009 is not envisaged.

SECTION – IV: POTENTIAL ENVIRONMENTAL IMPACTS, EVALUATION AND MANAGEMENT

As mentioned in previous chapters, the present scope of work only involve refurbishment/replacement of ageing equipments in existing substations. Hence, unlike transmission projects no major environmental and social impacts such as change in land use, RoW problem, Land acquisition and resultant R & R issues, tree felling, soil erosion, etc. associated with construction of new transmission line and substation are anticipated in the instant project. Besides, the project activities don't involve any large scale civil construction activities and all other activities shall be confined to existing substation premises which are already inaccessible for general public due to its secured location and declaration as restricted area. Hence, all possible impacts during the execution of works will be purely temporary and confined to the boundaries of secured substations. That will ensure that no direct or indirect impact to nearby habitation/property and health & safety of neighboring community.

As per above, it may be seen that such activities will not have any impacts on air, water, soil etc. However, the only significant impacts associated with the instant project will be the generation of waste materials and safety issues which require careful management/planning. A substantial amount of solid and liquid waste in the form of replaced metals structures, electrical panel, cables, insulators, packaging material as well as capacitors & transformer will be generated which requires proper handling and disposal. Accordingly, all the waste material generated will be managed/disposed as per applicable regulatory framework and following the best practices, keeping in consideration the characteristics of such materials. Since Rihand-Dadri HVDC systems are in operation and are critical for feeding power to Capital through NR Grid, shut down of the important operational line for carrying out replacement of equipments at terminals may be a problem and has to be strictly aligned with the availability of shut down.

In order to minimize/mitigate the above identified impacts, an Environmental Management Plan including monitoring plan has been drawn (**Table – 4.1**) in respect to present scope of work for its proper implementation.

Table- 4.1: ENVIRONMENT MANAGEMENT PLAN

CI. No.	Project activity stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
1.	Equipment specifications	Release of chemicals and gases in receptors (air, water, land)	Transformers designed with oil spill containment systems, and purpose-built oil, lubricant and fuel storage system, complete with spill clean-up equipment	Equipment specifications with respect to potential pollutants & design	Tender document to mention specifications – once	POWERGRID	Part of detailed equipment design & tender specifications for the equipment
			PCBs not used in new transformers		Exclusion of PCBs in transformers stated in tender specification – once		
2.	Noise related	Nuisance to neighbouring properties	Equipment selected/designed to ensure noise will not be a nuisance	Noise levels	Noise levels to be specified in tender documents – once	POWERGRID	Part of detailed equipment design
		Noise and vibrations	Machinery selection & proper maintenance equipment to comply national noise standards	Use of machinery	Machine creating minimal ground disturbance- once at the start of work	POWERGRID (Contractor through contract provisions)	Replacement/ Refurbishment activity
			Replacement activities only undertaken during the day	Timing of construction [noise level, dB(A)]	Daytime construction only – every 2 weeks		
3.	Explosions /Fire	Hazards to life	Provision/replacement of fire fighting equipment close to transformers	Compliance with fire prevention and control codes	Tender document to mention detailed specifications – once	POWERGRID	Part of detailed layout and design /drawings
4.	Storage of 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	POWERGRID (Contractor through contract provisions)	Replacement/ Refurbishment activity

CI. No.	Project activity stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
5.	Generation of waste materials	Contamination of receptors (land, water, air)	Reuse of materials, wherever possible	Technical suitability of materials for reuse	Quantity of materials reuse	POWERGRID	Replacement/ Refurbishment activity
			Disposal to authorized recycler/ preprocessor/ refurbisher as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016	Authorized vendors by State Pollution Control Board and its suitability w.r.t quantity & nature of waste	Disposal to authorized vendor – once		
			Return to manufacturer through buy/take back service as per E-Waste (Management) Rules, 2016		Disposal to manufacture – once		
6.	Health and safety	Injury and sickness of workers and members of the public	Safety equipment's (PPEs) for construction workers	Contract clauses (number of incidents and total lost-work days caused by injuries and sickness)	Contract clauses compliance – once every quarter	POWERGRID (Contractor through contract provisions)	Replacement/ Refurbishment activity
			Contractor to prepare and implement a health and safety plan				
			Contractor to arrange for health and safety training sessions				
6	Electric Shock Hazards	Injury/ mortality to worker/staff	Careful planning of work schedule vis-à-vis shutdown period	Work plan schedule for each activities in close coordination with site in-charge	Continuous monitoring	POWERGRID (Contractor through contract provisions)	Replacement/ Refurbishment activity
			Work permit system after due risk assessment of activities	Implementation of work permit system			
			Provision of proper and adequate PPEs for protection against electrocution	Availability of PPEs & their proper usage			
			Electricity safety awareness raising in project areas	Training /awareness programs and mock drills for all concerned parties	Number of programs and % of total persons covered –every month		

Cl. No.	Project activity stage	Potential Impact	Proposed mitigation measures	Parameter to be monitored	Measurement & frequency	Institutional responsibility	Implementation schedule
			Appropriate warning signs indicating hazards at work place	Display of warning signs	Continuous monitoring		
7.	Provision of facilities for workers	Contamination of receptors (land, water, air)	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	POWERGRID (Contractor through contract provisions)	Replacement/ Refurbishment activity
8.	SF ₆ 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	POWERGRID	Replacement/ Operation
9.	Oil spillage	Contamination of land/nearby water bodies	Oil sump of adequate capacity already existing	Substation bunding (Oil sump) (“as-built” diagrams)	Bunding (Oil sump) capacity and permeability - once	POWERGRID	Replacement/ Operation

CONCLUSIONS:

It is clear from the above assessment/studies that the project will not result in any significant environmental impacts. Some short-term environmental impacts particularly in respect of disposal of waste materials and safety concerns during replacement/refurbishment activities are anticipated. However, these can be mitigated successfully by implementing various management measures as listed in EMP. Moreover, the proposed investment for up-gradation of already ageing HVDC systems will not only enhance its life but also improve reliability of power to Northern Grid.

SECTION- V: PROJECT IMPLEMENTATION ARRANGEMENT & MONITORING

6.0 ENVIRONMENTAL MONITORING PROGRAM IN POWERGRID:

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

The success of POWERGRID lies in its strong monitoring systems. Apart from the site managers reviewing the progress on daily basis regular project review meetings are held at least on monthly basis which is chaired by Executive Director of the region 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 & Managing Director of the Corporation. The progress of various on-going projects is also informed to the Board of Directors. Flow chart showing institutional arrangement for implementation ESPP. A three-tier support structure has also been developed at corporate, regional and site level with following functions for effective implementation of environment and social safeguard measures.

6.1.1 Corporate Level

An Environmental Management Cell at corporate level was created within POWERGRID in 1992 and subsequently upgraded to an Environment Management Department (EMD) in 1993 and in 1997 it has been further upgraded to Environment & Social Management Deptt. (ESMD) by incorporating social aspect of project. Briefly, the ESMD's responsibilities are as follows:

- Advising and coordinating RHQs and Site to carry out environmental and social surveys for new projects;
- Assisting RHQs and site to finalize routes of entire power transmission line considering environmental and social factors that could arise en-route;
- Help RHQs and Site to follow-up with the state forest offices and other state departments in expediting forest clearances and the land acquisition process of various ongoing and new projects;
- Act as a focal point for interaction with the MoEFCC for expediting forest clearances and follow-ups with the Ministry of Power;
- Imparts training to POWERGRID's RHQs & Site Officials on environment and social issues and their management plan.

6.1.2 Regional Level

At its Regional Office POWERGRID has an Environmental and Social Management Cell (ESMC) to manage Environmental and Social issues and to coordinate between ESMD at the Corporate level and the Divisional Headquarters. The key functions envisaged for ESMC are:

- Advising and coordinating field offices to carry out environmental and social surveys for new projects envisaged in the Corporate Investment Plan;

- Assisting the ESMD and site to finalize routes of entire power transmission lines considering the environmental and social factors that could arise en-route;
- To follow-up forest clearances and land acquisition processes with state forest offices and other state departments for various ongoing and new projects;
- Acting as a focal point for interaction with the ESMD and site on various environmental and social aspects.

6.1.3 Site Office

At the Divisional Headquarters level, POWERGRID has made the head of the division responsible for implementing the Environmental and Social aspect of project and are termed as Environmental and Social Management Team (ESMT). Key functions of the ESMT are:

- Conduct surveys on environmental and social aspects to finalize the route for the power transmission projects;
- Conduct surveys & Interact with Revenue Authorities for land acquisition;
- Interact with the Forest Departments to make the forest proposal and follow it up for MoEFCC clearance;
- Implementation of Environment Management Plan (EMP);
- Monitoring of EMP & producing periodic reports on the same.

From above, it may be noted that POWERGRID is well equipped to implement and monitor its environment and social management plans.

As discussed in previous chapter, various management/mitigation measures as listed in the Environment Management Plan (EMP) will be implemented during project execution. Though most of the activities related to EMP are in the scope of contractor, regularly monitoring shall be undertaken by POWERGRID for ensuring its compliances. However, in order to implement the EMP provisions and its proper monitoring a budgetary provision of Rs 35.00 Lakh (approx. @ Rs. 5.0 Lakh for each substation) has also been made.

6.2 ENVIRONMENTAL REVIEW:

Periodic review by corporate ESMD and higher management including review by POWERGRID CMD of all environmental and social issues is undertaken to ensure that EMP and other measures are implemented at site.

A semi-annual environmental monitoring report reflecting the status of EMP implementation and corrective actions if any, will be prepared and disclosed on POWERGRID's website. The monitoring report will also be submitted to ADB for disclosing on its website. The IEE, the EMP, and revisions and updates, if any will also be disclosed. Besides, an annual review by Independent Auditor under ISO: 14001 shall also be undertaken for compliance of agreed policy and management plan.