Initial Environmental Examination

Project Number: 51308-008
September 2023

India: Uttarakhand Climate Resilient Power System Development Project

Main Report Part 1

Prepared by Power Transmission Corporation of Uttarakhand Limited and Uttarakhand Power Corporation Limited for the Asian Development Bank.

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Acronyms and Abbreviations

ADB	Asian Development Bank
AH	Affected Household
BOD	Biochemical oxygen demand
CSEMP	Construction Specific Environmental Management Plan
COD	Chemical oxygen demand
dB	Decibel
EA	Executing Agency
EHS	Environmental, Health, and Safety
EIA	Environmental Impact Assessment
EM	Environmental Manager
EMP	Environmental Management Plan
EMS	Environmental Management System
EN	Endangered
ESO	Environmental and Social Officer
EPC	Engineering, Procurement and Construction
ERP	Emergency Response Plan
FGD	Focused Group Discussion
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GoI	Government of India
GoU	Government of Uttarakhand
GRC	Grievance Redressal Committee
GRM	Grievance redress mechanism
HH	Household
HSO	Health and safety officer
IBAT	Integrated Biodiversity Assessment Tool
IES	International Environmental Specialist
IFC	International Finance Corporation
IFI	International Financial Institutions
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
LARP	Land Acquisition and Resettlement Plan
LC	Least concern
Masl	Meters above sea level
MOEF&CC	Ministry of Environment, Forests and Climate Change
MW	Megawatt
NDA	Non degraded Airshed
NES	National Environmental Specialist
NGO	Non-governmental Organization
NO_2	Nitrogen Dioxide
NT	Near Threatened
O&M	Operation and Maintenance
PCB	Polychlorinated Biphenyl
PCR	Physical Cultural Resource
PGA	Peak ground acceleration
PISC	Project Implementation and Supervision Consultant
PM	Particulate Matter
PISC	Project Management Consultant
PMU	Project Management Unit
PPE	Personal Protective Equipment
PTCUL	Power Transmission Corporation of Uttarakhand Limited
SEAA	State Level Environmental Impact Assessment Authority

SPCB	State Level Pollution Control Board
SCADA	Supervisory Control and Data Acquisition
SEMPs	Specific Environmental Management Plans
SF6	Sulphur Hexafluoride
SO_2	Sulphur Dioxide
SPS	Safeguard Policy Statement
UG	Underground
UNEP	United Nations Environment Program
UPCB	Uttarakhand Pollution Control Board
UPCL	Uttarakhand Power Corporation Limited
VOC	volatile organic compounds
VU	Vulnerable
WHO	World Health Organization
WLS	Wildlife Sanctuary

Units of Measurement

dB(A)	A-weighted Decibel
HZ	Hertz
in/sec	Inch per second (25.4mm/sec)
km	Kilometer
km/h	Kilometers per Hour
km^2	Square kilometer
kV	Kilovolt
L_{eaq}	Equivalent Continuous Level
mg/l	Milligram per liter
mg/m^3	Milligram per cubic meter
mg/kg	Milligram per kilogram
m^3/s	Cubic meters per second
m^3/h	Cubic meters per hour
m^3/d	Cubic meter per day
m	Meter
m^2	Square meter
m^3	Cubic Meter
m^3/s	Cubic meter per second
$MtCO_2e$	Million tons of CO_2 equivalent
PPM	Parts per million
°C	Degrees Celsius
$\mu g/m^3$	Micrograms per cubic meter

Exchange Rates

Currency Exchange Rates as of July 2023
1 US$ = 82.17 (Indian Rupee)
($ refers in this report to US-Dollars)

Executive Summary

Introduction

1. This Initial Environmental Examination (IEE) is part of the process of compliance by Power Transmission Corporation of Uttarakhand Limited (PTCUL) and Uttarakhand Power Corporation Limited (UPCL) with the Asian Development Bank's (ADB) Safeguard Policy Statement (2009) in relation to the Uttarakhand Climate Resilient Power System Development Project or the "Project".

2. Safeguard requirements for all projects funded by ADB are defined under ADB's Safeguard Policy Statement (2009) which establishes an environmental screening, assessment and management process. All ADB projects must comply with its requirements and Operational Manual F1, 2013 to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process.

3. In accordance with its environmental assessment requirements, the IEE provides a road map to the environmental measures needed to avoid, minimize, and/or mitigate the adverse environmental impacts and risks associated with the Project on physical, biological, social, and physical-cultural resources in the project area of influence during the construction and operation and maintenance (O&M) phases of the Project. More specifically, the IEE:

   - Describes the project design, construction activities and operational parameters;
   - Describes the existing socio-environmental conditions within the project area of influence;
   - Describes the extent, duration and severity of potential direct, indirect, cumulative, and induced environmental impacts and risks;
   - Analyzes all significant environmental impacts and risks; and
   - Formulates the mitigation actions and presents them in the form of an Environmental Management Plan (EMP) for implementation following project approval.

Project Description

4. The Project is an electricity sector project and involves three outputs, under which there are several components involving physical works and several sub-activities under each component as follows:

Output 1 Power network strengthened, modernized and climate proofed

5. The Project will finance PTCUL and UPCL to provide: (i) climate and disaster resilient underground cable network in Dehradun, the capital city of Uttarakhand. This includes 381 kilometers (km) of underground cables, 354 11 kV ring main units, 99 compact substations and related low voltage lines; (ii) distribution investments in urban and suburban areas of Dehradun to improve distribution system reliability. This includes three distribution substations and approximately 24km 11 kV distribution lines including underground cables; (iii) grid investments to reduce network congestion and support the increasing electricity demand from industrial, commercial, and domestic consumers. To facilitate this, the project will construct 8 grid substations, about 70km (as currently routed approximately 64km) of related power lines,

and stringing of a second conductor of 39km on an existing power line; and (iv) renovation of distribution network in rural areas to enable grid connection of community energy projects and support gender inclusive income generation activities.

Component 1: High Voltage (HV) Power

- Sub-activity 1.1 - New overhead HV power lines 132kV, 220kV and 400kV (mainly line in – line out (LILO) connecting substations to existing power lines) – 59.78 km
- Sub-activity 1.2 - Construction of eight new substations.
- Sub-activity 1.3 - Second circuit stringing of an existing HV power line 132 kV – 39.33 km.
- Sub-activity 1.4 - Underground (UG) HV cabling (LILO) 132 kV and 220 kV – 4.3km.

Component 2: Medium and Low Voltage (MLV) Power

- Sub-activity 2.1 - New / Conversion of 33kV lines to UG cable. Conversion of 11kV line to UG cable. Conversion of 0.4kV Low Tension (LT) line to UG cable – 381 km 33/11kV + 150km 0.4kV.
- Sub-activity 2.2 - Capacity enhancement and upgradation of existing 33/11kV substations.
- Sub-activity 2.3 - Construction of three new 33/11kV substations.
- Sub-activity 2.4 - Construction of additional two 33 kV OHL and one 33 kV UG cable – 24km.

Output 2, Institutional capacity of implementing agencies enhanced.

6. This output involves institutional capacity building of the organizations involved in Output 1 and will have no adverse environmental and social impacts and so is not considered further in the IEE.

Output 3, Component 3: Gender equality and social inclusion awareness raising, and energy-based livelihood activities promoted

7. The project will engage at least 2500 local community members (50% women and 30% from poor and vulnerable communities) from 250 selected women self-help groups (SHGs) in seven hilly districts gaining access to renewable energy and energy efficient equipment to enhance their income. The envisaged activities also include (i) training for 400 local community members (at least 50% women) in renewable energy technology, energy conservation, management, business skills, marketing, and leadership; (ii) conducting awareness campaign and providing learning opportunities covering at least 600 university and higher secondary school students (at least 30% girls) in STEM streams on the energy sector career path; and (iii) engaging local nongovernmental organizations to support the implementation and monitoring for the intervention to SHGs. The activities under output 3 will be implemented by Uttarakhand Renewable Energy Development Agency (UREDA) and supported by a Japan Fund for Poverty Reduction grant.

8. Output 3 will have minimal or no adverse environmental and social impacts apart from some minimal waste management and occupational and community health and safety issues relating to roof-top solar installation, like a typical rooftop solar installation at a residential home. These issues can be managed via compliance with national regulations for waste management and health and safety. Accordingly, the IEE does not include Component 3 within the impact assessment itself but does provide standard good practice measures in a separate EMP for implementation by UREDA.

9. Three different organizations are responsible for project implementation under the umbrella of the Energy Department, Government of Uttarakhand who will be responsible for project execution.

Summary of Key Impacts

10. Key impacts identified and mitigation measures are summarized as follows:

Air Quality

11. Emissions from construction machinery and vehicles, e.g., diesel generation sets, could cause some localized short-term pollution, however, the main impacts to air quality will come from dust generated by vehicle movements and excavation works. Excavation will be required for tower footings and substation construction, but generally these works are undertaken away from residential areas. UG works in Dehradun will be completed within the town center and here dust will be an issue around the areas of open trenching. Where practical, horizontal directional drilling will be implemented, and this will help reduce dust impacts in Dehradun. Where this is not possible a range of good practice measures will be employed to manage dust, including the use of water bowsers and spraying of stockpiles with water, limiting the extent of work zones to avoid extensive areas of open trenching and timely reinstatement of roads by the Public Works Department. Sulphur hexafluoride (SF6), a potent greenhouse gas, will be used during the operational phase of the project. A range of design and operational mitigation measures have been proposed to manage the use of SF6 and identify any leaks from equipment.

Soil Contamination

12. Soil conditions at the 25 existing substations were similar with some degree of contamination of oil from spillage/leaks in one or more spots, mostly under the transformers. Potential soil contamination was also observed at Selaqui SS, Araghar SS and Daulakhera SS. A limited soil sampling exercise at these sites, and other project sites, did not reveal the presence of elevated levels of soil contamination, including polychlorinated biphenyls (PCBs). However, further investigation of this issue will be required during construction to confirm these results. It is possible that without adequate protection measures, soil contamination could occur during the construction and operational phases of the Project through leaks and spills of hazardous liquids. However, application of good practice mitigation measures will ensure that residual impacts are low during construction. Construction of containment measures around transformers and oil storage areas according to national requirements and Good International Industry Practice (GIIP) will further ensure that leaks and spills at substations do not result in highly significant impacts during operation.

Water Environment

13. Construction and operation of overhead power lines is unlikely to have any significant impacts to hydrology. The good practice mitigation measures applied to prevent impacts to soils should also limit any impacts to surface water and groundwater. Open trenches will be shallow and unlikely to impact groundwater, however, the use of oil or bentonite clay as a drilling fluid will be prohibited. A key potential impact identified by stakeholders was the potential for damage to water supply systems during construction of UG cables. During the design phase, the Engineering, Procurement and Construction (EPC) Contractor will identify all water supply systems and water pumps and ensure that alignments avoid any interference with them. However, it is possible that temporary disruptions could occur which will need to be immediately rectified. Permits for any boreholes at substations will need to be secured prior to their installation.

Noise and Vibration

14. Sub-activity sites are in both urban/semi-urban and rural locations. Noise will be generated from the removal and/or cutting of vegetation, during the movement of construction vehicles, the operation of plant, equipment, and machinery on-site, the presence of construction workers at the construction site, temporary worker camps and any overnight accommodation etc. Depending on ground conditions encountered piling could be required for overhead HV power line tower foundation construction (specifically near rivers and marshy areas), resulting in a large increase in noise compared to the background noise level as well as ground vibration. The project activities will create noise impacts and in the absence of mitigation, short term, localized exceedance of noise standards/guidelines may occur although impacts are readily mitigated and reversible with ease in the short term. Keeping work to short durations and the use of temporary mobile noise barriers should reduce the noise levels to acceptable levels during the working day. EPC Contractors will avoid soil compaction, piling, and other vibration inducing activities as much as possible. During the operational phase, corona and transformer hum are not anticipated to be significant, apart possibly from three new substations located close to residential areas. In these locations acoustic enclosures should be placed around the transformers.

Designated Sites of Ecological Importance

15. None of the proposed sub-activities are in notified or draft notified Environmentally Sensitive Zones (ESZ) except for portions of UPCL UG cable works in Dehradun which are in the Rajaji National Park 10km draft notified ESZ buffer and one existing substation. No sub-activities are located within the 10km buffer for non-notified sites except for Kaniya SS and UG cable and two existing substations. However, UG cable works are regulated (allowed) within the ESZ buffer per guidelines. UG cable works in Dehradun are also partially located within the Doon Valley Ecologically Sensitive Area (ESA). The Department of Forests and the Uttarakhand Pollution Control Board have confirmed that for MLV works within the Rajaji National Park ESZ buffer and Doon Valley ESA no official government clearance is required, but written permission to proceed will be obtained by the EPC Contractors prior to the commencement of work.

16. None of the sub-activity sites are located within any other Protected Areas. UPCL UG cable works in Dehradun are located within 1km of Rajaji National Park, but not within it. None of the sub-activities are in critical habitat (as mapped by the UNEP) except for Kaniya SS and UG cable which are in ‘likely’ critical habitat. No sub-activities are located within a Key

Biodiversity Area (KBA) or Important Bird Area (IBA). UPCL UG cable works in Dehradun are to be excluded from the New Forest Campus KBA and Kaniya SS and UG cable are 250m outside of the Corbet Tiger Reserve KBA/IBA. Three other sub-activities are located within 10km of KBAs. Two of these sites are substations and they are not considered to represent a significant risk to the KBAs. The remaining site is the 1.0km Khatima - Sitarganj LILO. This very short section of OHL is not considered to represent a significant risk to the KBA, or species within it. No sub-activities are located within tiger corridors or elephant corridors. Khatima-II SS and Khatima - Sitarganj LILO are located within 1km of a tiger corridor. Construction and operation of the SS and LILO in this area is not considered to represent a significant risk to tiger movements as the facilities will be in a semi-rural environment dominated by agriculture and residential properties. No projects are in forest areas (Reserve Forest (RF)) requiring forest clearances. One activity (second circuit stringing) is partially located in a RF. Forest clearances were obtained by PTCUL for the existing overhead line and Department of Forests has provided their written approval for the second stringing works. Several other sub-activities are located close to Reserve Forests (closest at 120m) but are not within the RF themselves.

17. To ensure there are no impacts to designated sites of ecological importance UPCL UG cable works in Dehradun must avoid impacts to Rajaji NP and New Forest Campus KBA. To achieve this the following mitigation measures will be applied:

    - A project buffer zone of 100m from Rajaji National Park to be applied by UPCL in approving detailed designs to ensure no encroachment into the protected area from UG cabling works.

    - UPCL cabling works shall not be permitted within 100m of the New Forest Campus KBA.

18. Kaniya SS and UG cable will be permitted within 250m of the Corbett Tiger Reserve KBA/IBA due to the fact the MLV line will be UG.

19. Awareness training for workers will help limit potential construction phase impacts to the Corbett Tiger Reserve KBA/IBA close to Kaniya SS and UG cable, and the tiger corridor and RF close to Khatima-II SS and Khatima - Sitarganj LILO but it is still possible that workers could stray into these sensitive areas due to its proximity to the proposed SS, UG cables and OHL.

<u>Flora and Fauna</u>

20. Habitat loss will occur as land is cleared for site works. For OHL works most of the power lines traverse agricultural and modified habitat and no highly significant impacts are anticipated in these areas. Pithrogarh – Champawat OHL involves installation of an additional conductor on an existing OHL (also referred to as ‘second stringing’). As mentioned above, second stringing is permitted in this area with the following conditions applied by the Champawat Divisional Forest Officer (DFO) of the Forest Department of Uttarakhand: a) No new forest land will be utilized, b) No new poles, towers will be constructed other than the approved, c) Stringing of the 2nd circuit line will be done on the double circuit towers already erected, and d) No new tree felling will be done. As part of the original single circuit project a requirement to replant cleared areas within the RoW plantation of dwarf conifers and install bird divertors was specified. PTCUL has paid the Forest Department the required compensation money for the plantation activity and is awaiting the Forest Department to commence the planting whilst the bird divertors are still to be installed. Retrofitting of bird divertors on the existing power line

passing through forest land will be undertaken as part of the Project, to comply with the forest clearance requirement.

21. UG cable alignments (both PTCUL and UPCL) are located within urban areas and follow road alignments. Discussions with UPCL indicate that tree felling is not required during UG cabling works in either Dehradun or Kaniya, although this risk cannot be entirely ruled out. PTCUL have not confirmed this is also the case for UG cabling in Dehradun, although site surveys indicate that tree felling is not likely to be needed. Site survey of routes will be completed by the EPC Contractor during the design phase and adaptive management measures will be applied according to the findings of the surveys, e.g., realignment of route towards road center to avoid tree roots, etc. For the overhead power lines, the only tree cutting anticipated is for trees that are grown as commercial plantation. Most substations are sites on open land. However, some trees are present on substation sites and about 113 trees will need to be cleared for construction. The most trees will be cut at Ladhora SS where up to 90 trees may be affected. Trees will be surveyed to determine the presence of any birds nesting before cutting. Cutting of trees in non-forest land requires a tree cutting permit from the Department of Forests and compensatory plantation to be provided. To ensure no net loss of biodiversity this requirement will be complied with by PTCUL and UPCL.

22. Electrocutions from HV power lines are rare. Nonetheless the project will take a precautionary approach to this issue and will ensure OHL tower designs are adapted to provide additional clearances between live wires and grounded surfaces to accommodate the largest at-risk species identified – the White Rumped Vulture. Electrocutions are more likely on overhead MLV power lines, and two UPCL OHL represent a risk of bird electrocutions (Bharauni SS and Near Collectorate SS). These OHL must be designed to prevent electrocutions using the design measures provided in the Project design phase EMP – these include covered conductors and ensuring that all energized parts at the poles are adequately spaced or insulated.

23. To further reduce the potential for electrocutions on both overhead HV and MLV power lines, it is recommended to identify, and if possible, move carcass dumps away from Project alignments (but not closer to other lines). A two-step approach to this task is required as follows:

    a) UPCL consult with local village heads and any ‘skinners’ in Bharauni and Near Collectorate to identify the presence of any carcass dumps in relation to the proposed alignments.

    b) If carcass dumps are identified in close proximity (within 500m) of the OHL recommend to the village heads / skinners that the dumps be moved away from the line, but not closer to other lines. It is noted that these recommendations may not be actioned by village heads, or the skinners that use the dumps.

24. In addition, the Project, through UPCL, will provide community awareness raising with the support of an NGO in relation to vulture conservation and the need to avoid carcass dumps near power lines.

25. Diurnal bird species, including vultures and raptors, identified in the project area of influence are at low collision risk. However, certain locations close to overhead HV power lines are more likely to see bird activity, including areas around surface waters, carcass dumps, communal roosts and historic nests. In these areas, the risk of collisions with overhead HV power lines

is greater. Here bird divertors (markers which make the OHL more visible) are recommended. The assessment has identified all locations on overhead HV power lines over 3km where bird divertors are required due to their locations close to or above surface water. They shall be spaced at 10m intervals and designed and installed according to Central Electricity Authority (CEA) guidelines. It is vitally important that the bird divertors are placed on the earth line on the top of the tower. According to some reports, this can reduce collision accidents by 50-85%. Bird diverters shall also be included in all RF land through which the Pithrogarh – Champawat line (second stringing) passes to comply with the original forest clearance. During the detailed design phase, the EPC Contractor shall also complete a survey of the lines to identify any carcass dumps, communal roosts and historic nests close to the site. In these areas bird divertors will also be added.

Occupational and Community Health and Safety

26. A range of hazards can affect occupational and community health and safety, including electrocution at sub-activity sites, substations, OHL, etc., accidents at worksites, e.g., falling into excavated areas, pedestrian – vehicle accidents, etc. There is also potential for electromagnetic field (EMF) exposure to impact people living and working to close to live electrical equipment, especially high voltage substations and OHL. A range of mitigation measures have been provided to help manage the risk of accidents occurring and the impacts of EMF. However, despite these measures it is still possible that accidents could occur due to unforeseen circumstances. Training of workers and communication with the local community will be a key activity in the pre-construction and construction phases to ensure that they are informed about the risks relating to worksites and live electrical equipment. Ensuring safety clearances are respected around project infrastructure should ensure that EMF impacts are not significant.

Removal of Streetlights and Impacts to Sidewalks/Roads

27. Removal of streetlights and impacts to sidewalks during construction was identified as a key issue by stakeholders in Dehradun. Many streetlights are attached to UPCL poles which will eventually be removed by UPCL once UG cable works are completed. Stakeholders also noted that on-going open trenching works in Dehradun were often poorly managed with open trenches in sidewalks/roads being left open for long periods, and final rehabilitation of the sidewalks/roads after closing of the trenches taking months to complete. Keeping poles in-situ for at least six months should help the city transition to new streetlights, but it is still possible that streetlights may not be replaced after this time without the cooperation of the high-level committee to ensure reinstatement of utilities etc. High-level committee coordination and agreements on the timely reinstatement of sidewalks/roads with the Public Works Department are required to ensure there is no more than a 15-day period after construction works are completed to complete final rehabilitation.

Geohazards

28. Uttarakhand is seismically active and all physical components are located in Seismic Zone IV, a high risk for earthquakes. Flood risks were identified at several existing UPCL substations however, landslide risk is generally low for most of the sub-activities which are located in flat areas. Exceptions are the second stringing line and its connecting substation, Lohaghat SS and one existing UPCL substation located at higher elevations in steep terrain. Forest fires are reported at Pines SS, an existing UPCL substation. Other sub-activities close to forest areas could also be at risk. Design measures have been included to account for these

potential issues, however, floods, landslides and forest fires are all potential issues which, despite adoption of good practice mitigation measures, may continue to occur and affect the project infrastructure in the future mainly due to climate change, e.g., increased temperatures, drought and extreme rainfall events.

Consultations

29. Stakeholder engagement has been undertaken throughout the development of the Project, with the view to determining and responding to the views of interested stakeholders and persons potentially affected by the Project, and to ensure open and transparent, two-way communication between UPCL, PTCUL and their stakeholders. To date for environment and social safeguards over 75 different consultation sessions, held in 39 locations (*Gram Panchayat*) with 560 people. These consultations have been undertaken in 2022 and 2023 for components 1 and 2 as follows:

    - PTCUL HV Substation Consultations: 10 sessions comprising 105 people
    - PTCUL HV OHL Power Line Consultations: 11 sessions comprising 180 people
    - PTCUL HV OHL Power Line Consultations with *Gram Panchayats*: 8 sessions comprising 85 people
    - UPCL Existing Substations: 17 sessions comprising 30 people
    - UPCL UG cables, Dehradun: 23 sessions comprising 27 ward members as representatives of affected people
    - UPCL UG cables, Dehradun Multi-stakeholder Consultation: 1 session comprising 40 people mostly Ward member representatives of affected people (Each ward member representing an average of 5,000 people).
    - UPCL UG cables, Dehradun: One site walkover session consulting with 35 residents and business owners.
    - UPCL New Substations: 3 sessions comprising 36 locals.
    - Divisional Forest Officer (DFO) Champawat (12 December 2022) and Dehradun (25th November 2022) as well as the Wildlife Institute of India and the Archaeological Survey of India.
    - No record is available of the balance of persons who have been consulted per the total.

30. Out of the 560 people consulted 303 or 54% were women.

31. Key issues raised during the consultation sessions relate to management of community health and safety issues, project employment opportunities, consultation with utilities prior to the start of works, ensuring footpaths are rehabilitated in a timely manner, providing streetlights where poles are removed in Dehradun, requirement for a coordination committee to keep the local community in the loop, ensuring that the GRM is established and communicated with stakeholders, and implementing works when they are less likely to affect receptors, e.g. works outside schools undertaken during holidays. Stakeholders also requested that consultation

continues throughout the project implementation phase. These concerns raised by stakeholders have been incorporated into the mitigation measures included as part of the Project EMP.

Conclusions and Recommendations

32. This IEE has established that, except for the residual impacts mentioned above, there are no significant environmental issues that cannot be either totally prevented or adequately mitigated to levels acceptable to the national standards and international guidelines for project activities. Mitigation and monitoring measures have been included in the Project Environmental Management Plan (EMP) incorporated into the IEE. PTCUL, UPCL and UREDA will implement the EMP measures ensuring adequate budget and human resources are allocated to this. UPCL and PTCUL will also complete the activities outlined in the Corrective Action Plan (CAP) for existing substations, per the timetable included in the CAP.

33. The Project EMP, its mitigation and monitoring programs, will be included within the bidding documents for project works for all Project components of PTCUL, UPCL and UREDA with physical works involved. The bid documents will state that the EPC Contractor will be responsible for the implementation of the requirements of the EMP allocated to them (including specific design phase actions) and preparing their own Construction Specific EMP (CSEMP) which will adopt all the conditions of the EMP and add in site specific elements that are not currently known, such as the EPC Contractor's storage and camp locations. This ensures that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs. The EMP and all its requirements will then be added to the EPC Contractor's Contract, thereby making implementation of the EMP a legal requirement according to the Contract.

34. The EPC contractors will then prepare their detailed designs and CSEMP which will be approved and their works supervised and monitored. Before the detailed designs are approved the IEE will need to be updated to reflect the final cable routes, reviewed and cleared by ADB for disclosure on the ADB website and locally. Should PTCUL, UPCL or UREDA note any non-conformance with the EMP (and CSEMP) the EPC Contractor can be held liable for breach of the contractual obligations of the EMP. To ensure compliance with the CSEMP the EPC Contractor is required to employ an Environmental and Social Officer and team of safeguards experts to monitor and report Project activities throughout the construction phase. Project implementation supervision consultants will also include environment, health and safety experts to support supervision and monitoring of Project EMP implementation and to build the capacity of PTCUL and UPCL.

I. INTRODUCTION

1.1. Uttarakhand Power Sector Overview

35. The state of Uttarakhand was carved out of Uttar Pradesh on November 9, 2000, as the 27th state of India. Uttarakhand has a highly varied topography, with the northern part of the state shrouded by Himalayan ranges and glaciers, whereas the lower parts of the state are thickly forested (covering about 60% of the state). Due to its topography and geology, Uttarakhand is one of the most disaster-prone states in India and is prone to various natural disasters like flash floods, cloud bursts, avalanches, landslides, mudflows, and earthquakes, among others.[1] The power systems are affected by such disasters resulting in the disruption of power supply.[2] These disruptions, in turn, adversely affect critical services and facilities (e.g., hospital services, water treatment, and communications networks), affecting the rescue operations, and safety of the public.

36. The state is one of the fast-growing Indian states supported by manufacturing industries (particularly in automobiles, pharmaceuticals, and food processing, due to its business-friendly environment, conducive investment policies, and simplified regulations) and tourism. Uttarakhand's gross state domestic product for 2021-2022 was recorded with a growth rate of 8.17% at current prices and net state domestic product was 6.82% rise from previous fiscal year.[3] About 17.72% of the population in Uttarakhand is classified as multidimensionally poor, as per the national multidimensional poverty index report published in 2021.[4] Considering the state's reliance on hydroelectric power generation (which is susceptible to climate change) and inadequate transmission and distribution infrastructure there are power reliability issues, especially for the manufacturing and tertiary sectors. As these contribute to 77% of gross state domestic product per capita, power reliability issues are becoming an impediment to economic growth.

37. As per the provisions of Electricity Act 2003, there are independent unbundled utilities operational in the state namely (i) Generation Company - Uttarakhand Jal Vidyut Nigam Limited (UJVNL); (ii) Power Transmission Corporation of Uttarakhand (PTCUL); and (iii) Uttarakhand Power Corporation Limited (UPCL). The power sector of the state is regulated by Uttarakhand Electricity Regulatory Commission (UERC). The Uttarakhand Renewable Energy Development Agency (UREDA) was established in July 2001 to promote renewable energy, energy efficiency, demand side management etc. Uttarakhand had a total installed electricity generation capacity of 4,092 MW as of October 2022. Of this, 2,095 MW (51.20%) is generated from hydropower, 520 MW (12.7%) from natural gas, 512 MW (12.5%) from coal, 933 MW (22.8%) from renewable energy (small hydro, wind and solar) and 31 MW (0.77%) from nuclear sources.[5]

38. The existing power networks in Uttarakhand are facing challenges due to congestion in the existing power evacuation facilities and growing energy demand in both domestic and industrial sectors driven by economic growth in the state. The state has been imposing power cuts in 2022 and 2023 due to increasing demand and capacity limits faced by the existing

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[3] https://des.uk.gov.in/files/ECONOMIC_SURVEY_2021-22-vol-II.pdf
[4] Government of India, NITI Aayog. 2021. India: National Multidimensional Poverty Index, Baseline Report. Delhi
[5] Source: https://cea.nic.in/wp-content/uploads/installed/2022/10/IC_Oct_2022.pdf

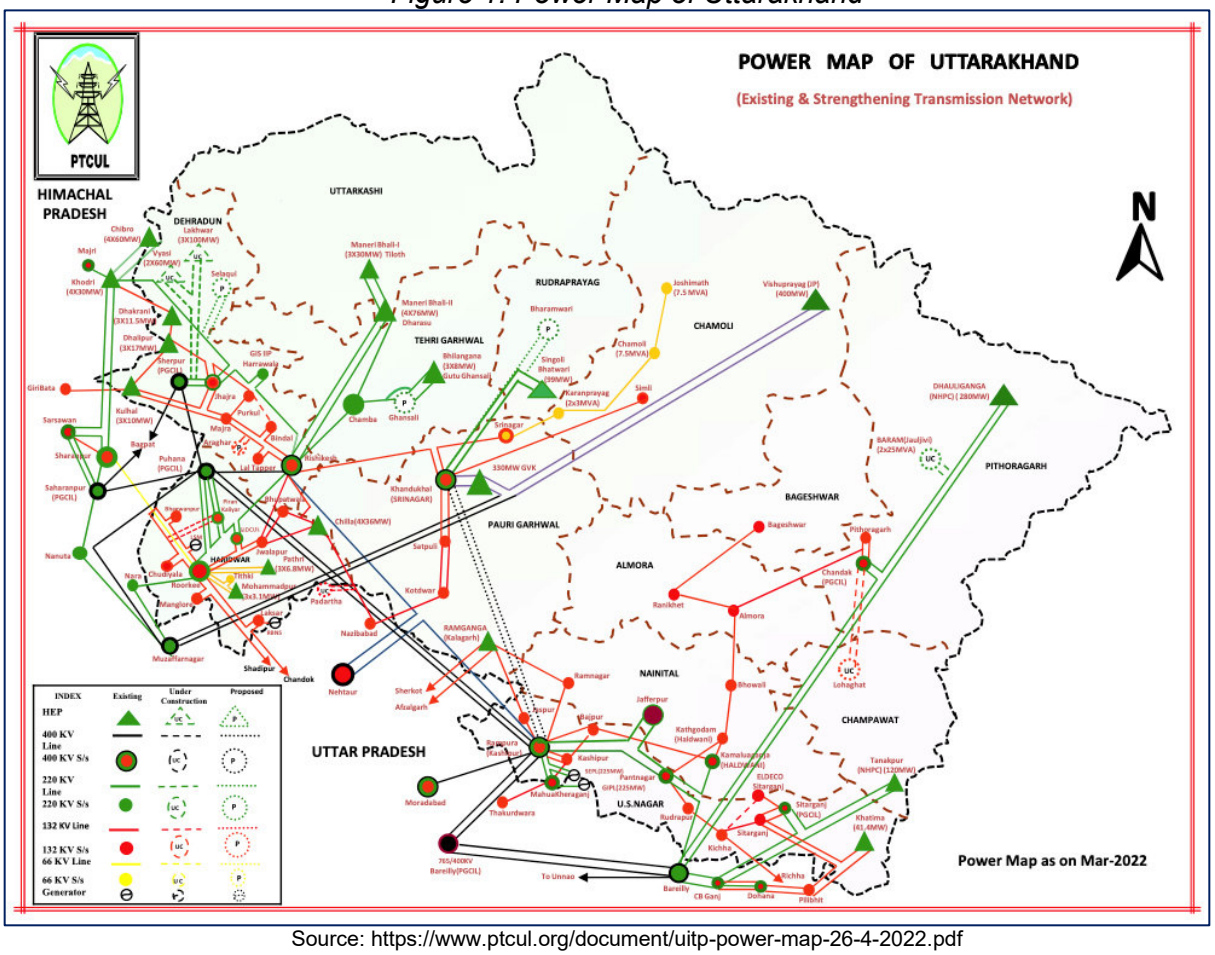
power network.[6] The state achieved 100% household electrification (248,000 new connections) in March 2019 under the Sahaj Bijli Har Ghar Yojana (Saubhagya) scheme and increased the domestic consumer base by about 20%.[7] This has created additional capacity constraints on existing power networks. The compound annual growth rate (CAGR) for electricity is estimated to be around 5.5% for Uttarakhand for next 5 years. Hence the existing power networks would require significant investments for improvement of reliability and quality of supply and to provide necessary capacity additions to meet future demand growth. It is also critical to ensure that these power system investments are designed to be resilient to reduce the impacts of climate change threats and decreasing recovery time after negative events. The capacity constraints are also hindering the integration of distributed renewable energy into the power system.

39. At the same time, development of the power distribution networks in Dehradun, the capital city of Uttarakhand and a favorite tourist destination, has become very critical. However, it is becoming difficult to find space to renew and upgrade the existing overhead power distribution network which is aged and overloaded, leading to increased number of outages and higher technical losses. Operation, maintenance, and development of power distribution network infrastructure is facing acute pressure from space constraints in the city compounded by vehicular traffic due to narrow roads, lack of planning in the past and hilly terrain of the district. Road traffic congestion is affecting the number of tourists visiting during the peak season. This situation demands immediate solution for developing a resilient distribution network without serious impact on the road infrastructure.

[6] https://www.newindianexpress.com/nation/2022/mar/26/power-crisis-grips-uttarakhand-people-endure-one-to-six-hours-of-power-cuts-2434577.html

[7] Under India's Saubhagya scheme, the state achieved 100% electrification by providing last-mile connectivity to rural consumers and subsidized electricity to households below the poverty line.

Figure 1: Power Map of Uttarakhand



Source: https://www.ptcul.org/document/uitp-power-map-26-4-2022.pdf

1.2. Project Overview

40. To address the issues with the power sector of Uttarakhand, Government of India has requested Asian Development Bank (ADB) to finance a project to strengthening its power system network to meet future electricity demand growth and to improve quality and reliability of power supply to its consumers; whilst facilitating efficient utilization of the state's hydropower and renewable energy resources. ADB will provide a loan of $200 million and a grant of $2 million from the Japan Fund for Poverty Reduction together with $50 million of counterpart government fund under the Uttarakhand Climate Resilient Power System Development Project.

41. The project is aligned with the following impact: 24x7 power for all electricity consumers achieved, and climate and disaster resilience of power system improved, renewable energy generation integrated via resilient distribution networks. The project will have the following outcomes: efficiency, reliability, and quality of power supply to consumers in Uttarakhand improved. The project is an electricity sector project and involves three outputs, under which there are several components involving physical works and several sub-activities under each component as follows:

Output 1 Power network strengthened, modernized and climate proofed

42. The project will finance PTCUL and UPCL to provide: (i) climate and disaster resilient underground cable network in Dehradun, the capital city of Uttarakhand. This includes 381 kilometers (km) of underground cables, 354 11 kV ring main units, 99 compact substations and related low voltage lines; (ii) distribution investments in urban and suburban areas of Dehradun to improve distribution system reliability. This includes three distribution substations and approximately 24km of 11 kV distribution lines including underground cables; (iii) grid substations and related investments to reduce network congestion and supporting the increasing electricity demand from industrial, commercial, and domestic consumers. To facilitate this, the project will construct 8 grid substations, related power lines of approximately 70km (as currently routed approximately 64km) and stringing of second conductor of 39km on existing power line; and (iv) renovation of distribution network in rural areas to enable grid connection of community energy projects and support gender inclusive income generation activities.

Component 1: High Voltage (HV) Power

- Sub-activity 1.1 - New overhead HV power lines 132kV, 220kV and 400kV (mainly line in – line out (LILO) connecting substations to existing power lines) – 59.78 km
- Sub-activity 1.2 - Construction of eight new substations.
- Sub-activity 1.3 - Second circuit stringing of an existing HV power line 132 kV – 39.33 km.
- Sub-activity 1.4 - Underground (UG) HV cabling (LILO) 132 kV and 220 kV – 4.3km.

Component 2: Medium and Low Voltage (MLV) Power

- Sub-activity 2.1 - New / Conversion of 33kV lines to UG cable. Conversion of 11kV line to UG cable. Conversion of 0.4kVLow Tension (LT) line to UG Cable – 381 km 33/11kV + 150km 0.4kV.
- Sub-activity 2.2 - Capacity enhancement and upgradation of existing 33/11kV substations.
- Sub-activity 2.3 - Construction of three new 33/11kV Substations.
- Sub-activity 2.4 - Construction of additional two 33 kV OHL and one 33 kV UG cable – 24km.

Output 2, Institutional capacity of implementing agencies enhanced.

43. This output involves institutional capacity building of the organizations involved in Output 1 and will have no adverse environmental and social impacts and so is not considered further in this IEE.

Output 3, Component 3: Gender and social inclusion awareness raising, and energy-based livelihood activities promoted

44. The project will engage at least 2500 local community members (50% women and 30% from poor and vulnerable communities) from 250 selected women self-help groups (SHGs) groups

in seven hilly districts gaining access to renewable energy and energy efficient equipment to enhance their income. The envisaged activities also include (i) training for at 400 local community members (at least 50% women) in renewable energy technology, energy conservation, management, business skills, marketing, and leadership; (ii) conducting awareness campaign and providing learning opportunities covering at least 600 university and higher secondary school students (at least 30% girls) in STEM streams on the energy sector career path; and (iii) engaging local nongovernmental organizations to support the implementation and monitoring for the intervention to SHGs. The activities under output 3 will be implemented by Uttarakhand Renewable Energy Development Agency (UREDA) and supported by a Japan Fund for Poverty Reduction grant.

45. Output 3 will have minimal or no adverse environmental and social impacts apart from some minimal waste management and occupational and community health and safety issues relating to roof-top solar installation, like a typical rooftop solar installation at a residential home. These issues can be managed via compliance with national regulations for waste management and health and safety. Accordingly, this IEE does not include Component 3 within the impact assessment itself, but does provide standard good practice measures in a separate EMP provided in **Appendix S**.

1.3. Implementing Agencies

46. Three different organizations are responsible for project implementation under the umbrella of the Energy Department, Government of Uttarakhand who will be responsible for project execution:

- **Component 1 and 2** – Power Transmission Corporation of Uttarakhand Limited (PTCUL)
- **Component 1 and 2 -** Uttarakhand Power Corporation Limited (UPCL)
- **Component 3 –** Uttarakhand Renewable Energy Development Agency (UREDA)

1.4. Project Goals

47. **Improving climate resilience of power system**. The state of Uttarakhand is susceptible to climate and disaster risks in particular flash floods and resulting landslides / mudslides which show a rapid increasing trend after 1980s.[8] The frequency of occurrence of other climate phenomena such as extreme winds, cyclones, thunderstorms and lightning also shows increasing trend. These phenomena cause moderate to high and in some cases devastating levels of impacts on existing power networks. The state power utilities are experiencing difficulties in restoration of supply in such events, due to technical constraints and high repair / reconstruction costs. The impacts are higher particularly in the capital city of Dehradun due to higher concentration of consumers and its role as the commercial hub of the state. This emphasizes the pressing need for climate proofing of power networks in the state, particularly in the capital city of Dehradun. The strategies planned to be implemented under the project to address this important requisite consists of a two-level climate and disaster risk adaptation approach; (a) climate adaptation measures incorporated in the project components, and (b) adaptation measures to be implemented during technical design and implementation of the

[8] SANDRP (2013) Uttarakhand and Climate Change: How long can we ignore this in the Himalayas? https://sandrp.in /2013/06/25/uttarakhand-and-climate-change-how-long-can-we-ignore-this-in-himalayas/

project. The project component level strategies include underground cabling of Dehradun distribution networks that provide a high degree of climate resilience over long term. The other project component level measures include provision of firm (redundant) capacity in proposed substations for emergency requirements and provision of alternate feeding arrangements for high-risk areas (to meet N-1 contingency criteria). The technical design and implementation level strategies include various measures to minimize climate risk impacts in the construction of substations and power lines, such as the selection of sites, foundation designs, protection, and safety measures etc.

48. **Role of power sector in gender mainstreaming**. The clean energy sector, including the power sector utilities as well as renewable energy technologies, provide an opportunity for women to improve their lives and livelihoods. Without electricity, women and girls spend more hours in drudgery filled, unpaid domestic chores; and it is more difficult for their enterprises and businesses to be run competitively. Women comprise an important market segment for the power industry— as community members using energy services, as distribution agents to help reach last-mile connection customers and/or behavior change catalysts to help improve the adoption of new energy technologies and products. However, women have traditionally been underrepresented in power utilities and more generally in Science, Technology, Engineering and Mathematics (STEM) fields. In the context of the Project, gender mainstreaming takes a holistic approach, including developing women's leadership in the utility; exposing girls and young women to the opportunities in power sector as well as supporting rural women enhance their livelihoods through renewable energy technologies.

49. **Government program for the power sector.** The state government has developed policies to harness solar energy[9], hydropower through private sector and through community participation[10] to meet the fast-growing energy demand of the state. In June 2021, the Government of India launched the revamped distribution sector scheme (RDSS) to improve the poor operational and financial condition of the distribution sector. The broad objectives of RDSS are (i) strengthening institutional capabilities for the modernization of distribution utilities, (ii) lowering AT&C losses to 12%–15% by FY2025, and (iii) reducing the average cost of supply (ACS)–average revenue realized (ARR) gap to zero by FY2025. The state has secured financing of about ₹25,000 million from GOI under RDSS to support smart metering and distribution strengthening. This will complement ADB project and to collectively achieve envisaged results under RDSS.

50. **Energy transition potential.** Uttarakhand has an estimated potential of 25 GW of hydro power resources and aims to be leader in developing and operating large hydropower projects. The ADB project proposes to strengthen the power system infrastructure of the state which will not only improve the energy security and quality and reliability of power but will also help in renewable energy integration. The state's hydropower resources will provide the flexible electricity source essential for renewable energy integration to help meeting national net-zero target. Uttarakhand shares border to the west with Himachal Pradesh (rich in hydro resources) and to the south with Uttar Pradesh (the largest Indian state in terms of population with peak electricity demand of about 27 GW which has a renewable energy purchase obligation target[11]), and thus can facilitate transmission of flexible green hydro energy in the northern region of India. Hence the state can act as a major intermediary link of electricity

[9] CEEW-_Uttarakhand_State_Solar_Policy_Draft_10Nov22.pdf (uk.gov.in)
[10] https://www.iitr.ac.in/wfw/web_ua_water_for_welfare/power/25_MW_Plus_Policy_of_Uttaranchal.pdf
[11] FY 2023-24, its solar renewable purchase obligation has been set at 5%, hydro power obligations of 3% and 7% from non-solar sources. Purchase obligations means out of the total quantum electricity purchased, the allotted quantum has to be purchased from solar, hydro or non-solar sources.

generated, especially in major hydro resources states e.g., Uttarakhand and Himachal Pradesh and transmit it to major consuming states e.g., Uttar Pradesh.

51. **Strengthening of existing power networks.** The compound annual growth rate (CAGR) of 5.5% for electricity demand in the Uttarakhand indicates that existing loading levels in power networks will increase by 30% in next 5 years. If similar demand growth pattern continues beyond 5 years, the existing loading levels are likely to be doubled within next 15 years. Hence future demand growth would exert tremendous pressure on existing power networks that would cause increased losses, frequent failures, curtailed supply due to network bottlenecks and poor quality of supply to consumers. Strengthening and reinforcing existing networks to meet future demand growth is therefore a necessity, by augmenting existing substations and power lines and by adding new ones as required. The Government of India (GOI) funded RDSS program would address these network development requirements to a certain extent but there are some gaps that are not covered. The distribution and upstream level substations and power lines proposed under the project are designed to address these gaps to ensure adequate network capacity and performance to efficiently meet future demand growth. Strengthening of distribution networks in Dehradun is not covered under GOI's RDSS scope and is covered under this project with undergrounding distribution networks in Dehradun, which also address the need for climate proofing of the power distribution system in the capital city. The proposed project investments for strengthening existing power networks would also ensure improved system reliability, reduced losses and improved quality of supply to consumers over the long term.

52. **Alignment with country priorities and ADB's Strategy 2030.** The project is aligned with (i) pillars 1 and 3 of ADB's country partnership strategy for India, 2018–2022 and the mitigation of negative climate change impacts;[12] (ii) the Sustainable Development Goals (SDGs) 5, 7, and 13 by providing affordable, clean, and sustainable energy;[13] (iii) ADB's Strategy 2030[14] operational priorities of (a) making cities more livable; (b) strengthening governance and institutional capacity; (c) accelerating progress in gender equality; (d) tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability; and (e) promoting rural development; and (iv) India's climate change mitigation and adaptation objectives incorporated in the updated NDC commitments announced at COP26.[15]

1.5. Purpose of the IEE Report

53. Safeguard requirements for all projects funded by ADB are defined under ADB's Safeguard Policy Statement (2009) which establishes an environmental screening, assessment and management process. All ADB projects must comply with its requirements and Operational Manual F1, 2013 to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. In accordance with its environmental assessment requirements, the IEE provides a road map to the environmental measures needed to avoid, minimize, and/or mitigate the adverse environmental impacts and risks associated with the project on biological, physical,

[12] India: Country Partnership Strategy (2018-2022) | Asian Development Bank (adb.org)
[13] SDGs 5 (gender equality), 7 (affordable, clean, and sustainable energy), 11 (sustainable cities and communities) and 13 (climate action).
[14] Strategy 2030: Achieving a Prosperous, Inclusive, Resilient, and Sustainable Asia and the Pacific | Asian Development Bank (adb.org)
[15] https://www.un.org/sustainabledevelopment/

social, and physical-cultural resources in the project area during the construction and O&M phases. More specifically, the IEE:

- Describes the project design, construction activities and operational parameters;
- Describes the existing socio-environmental conditions within the project area of influence;
- Describes the extent, duration and severity of potential direct, indirect, cumulative, and induced environmental impacts and risks;
- Analyzes all significant environmental impacts and risks; and
- Formulates the mitigation actions and presents it all in the form of an Environmental Management Plan (EMP) for implementation following project approval.

1.6. Category of the Project

54. For each ADB project, screening and categorization is conducted at the earliest stage of project preparation when sufficient information is available and is undertaken to (i) reflect the significance of potential impacts or risks that a project might present; (ii) identify the level of assessment and institutional resources required for the safeguard measures; and (iii) determine disclosure requirements. ADB uses a classification system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Based on the ADB Safeguards Policy Statement (2009), this Project falls under ADB's environment Category B as the proposed project's potential adverse environmental impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. This is due to the following facts: (i) components are mostly located in urban, semi-urban and rural areas which do not support high biodiversity values; (ii) no protected areas or internationally or nationally recognized biodiversity areas or physical cultural resources will be passed by new overhead distribution lines, only underground cables following existing road corridors are proposed in ecologically sensitive zones or areas and only second stringing is proposed in forest land with no tree cutting to be undertaken; and (iii) there will not be any major, large-scale civil or structural works, construction of new substation control buildings will the largest civil or structural works involved, the majority of the works will be electrical. As a result, significant adverse irreversible, diverse, or unprecedented environmental impacts are unlikely to arise. For a Category B project, an Initial Environmental Examination (IEE) including an EMP is required by the borrower. This IEE has been prepared on behalf of PTCUL and UPCL by a team of ADB funded TA consultants (Nick Skinner, International Environment Expert, Dibyendu Banerjee, National Expert – Environment Audit, and Anjali Semwal, National Expert – Environmental Assessment).

1.7. Report Structure

55. Section 1: Introduction – The section in hand provides introductory information.

56. Section 2: Policy, Legal, and Administrative Framework – This section presents an overview of the policy/legislative/administrative framework as well as the environmental assessment guidelines of India that apply to the project.

57. Section 3: Description of the Project – Section 3 describes the Project need and its environmental setting. A scope of works is also provided indicating the type of construction works required and operational aspects.

58. Section 4: Analysis of Alternatives – This section presents a summary analysis of the 'no project' alternative as well as any alternative alignment and technical design options that were considered.

59. Section 5: IEE Approach – Section 5 outlines the methodology used to complete the assessment.

60. Section 6: Description of the Environment – This section of the report discusses the local environmental baseline conditions. This section is divided into subsections relating to the physical, biological, and social environment.

61. Section 7: Substation Audits – Provides the findings of the environmental audit of existing substations and corrective actions required.

62. Section 8: Environmental Impacts and Mitigation Measures – Outlines the potential environmental impacts and proposes mitigation measures to manage the impacts. The residual impacts of the Project are also presented.

63. Section 9: Stakeholder Engagement, Information Disclosure and Grievance Mechanism – Section 9 provides a summary of all the stakeholder consultation activities undertaken and includes the Project's grievance redress mechanism.

64. Section 10: Environmental Management Plan – This section of the IEE comprises an Environmental Mitigation Plan and an Environmental Monitoring Plan, as well as the institutional arrangements for environmental management.

65. Section 11: Conclusions and Recommendations – The final section of the IEE provides the conclusions and recommendations, including a summary of residual impacts.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

66. This chapter is about the applicability of national laws and regulations, international agreements, and ADB safeguards requirements to the project. The chapter also lays out the various permissions required for the project from national authorities. It considers the environmental, health and safety (EHS) policies and procedures that are presently available with PTCUL and UPCL as well as their existing environment safeguards capacity with respect to environmental management plan (EMP) implementation.

2.1. Administrative Framework and Main Regulatory Bodies

67. The main regulatory bodies responsible for administration of the environmental policy and legislation pertinent to the distribution component are:

68. **Ministry of Environment and Forests, Forest, and Climate Change (MOEF&CC).** Responsible for the administration and implementation of Government of India's policy with respect to environmental conservation, management, and pollution control. It formulates and regulates all country level legislations and enforces the regulations in conjunction with various autonomous organizations under MoEF&CC and the states. The environmental management and pollution control framework at Government of India level defines the roles and responsibility of various ministries and government departments at central level and state level with the MoEF&CC at central level as the apex body and state boards/departments working under their guidance and overall coordination. Both central and state governments can enact environmental legislation. The ministry also reviews and issues prior environmental clearances through an Expert Appraisal Committee for category A projects as per Government of India's legislation besides according to wildlife and forest diversion clearances.

69. **State Environmental Impact Assessment Authority (SEIAA).** An authority constituted by central government under sub-section (3) of section 3 of the Environment (Protection) Act, 1986 for every state and union territory. The composition of the SEIAA is published through separate gazette notifications and normally has a term of three years. It issues Prior environmental clearances to Category B projects.

70. **Central Pollution Control Board (CPCB).** Statutory authority under the MoEF&CC with headquarters in New Delhi and several regional offices. Responsibilities include planning and implementing air and water pollution control programs, setting air and water standards; and coordination with the state level pollution control boards (SPCB). The project shall be required to adhere to the various standards set by CPCB.

71. **Uttarakhand Pollution Control Board (UPCB).** Responsible for pollution control activities at the state level for Uttarakhand including planning and executing state level air and water quality initiatives, establishing standards for air and water quality based on national minimum standards and enforcing and monitoring of all the activities within the state under air and water related legislation. UPCL shall be issuing Consent to Establish (CTE) and Consent to Operate (CTO) for establishing and operating of any construction plant required such as batching plant, hot mix etc.

72. **Uttarakhand Forest Department.** The Principal Chief Conservator of Forests (PCCF) and Head of the Forest Force (HoFF) is the senior most forest officer and is from Indian Forest

Service (IFS) cadre. The department is empowered to declare protected and reserved forests. It has also been given the authority to acquire land for extension and preservation of forests. Recommendations for forest diversion accorded by the department are forwarded to MoEF&CC. Under the PCCF (HoFF), two offices, PCCF (Van Panchayat) for village forest and the PCCF (Wildlife) are present. These are followed by the Additional PCCF (APCCF), the Chief Conservator of Forest (CCF). The next level is the Conservator of Forest (CF), followed by the District Forest Officers (DFO). The PCCF (Wildlife) is the head of the wildlife division, reporting to the PCCF (HoFF) and is responsible for the protection and conservation of all protected areas in the state besides dealing with all wildlife issues. The PCCF (Wildlife) is also a member of the State Board of Wildlife which recommends projects sited within notified ecologically sensitive zones (ESZ) and protected areas and forwards the same to the semi-autonomous National Board of Wildlife (NBWL) under MoEF&CC. The project may require permissions from the Forest Department for any felling of timber and non-timber tree and transit of felled trees. No forest clearance or wildlife clearance are anticipated to be required, this will be reconfirmed by PTCUL/UPCL in consultation with the Forest Department during project implementation.

73. **Central Ground Water Board (CGWB) and Central Ground Water Authority (CGWA).** Separate to the MoEF&CC, CGWB is a multi-disciplinary scientific organization under the Ministry of Jal Sakti, providing scientific inputs for the management, exploration, monitoring, assessment, augmentation, and regulation of ground water resources. Besides advising states on planning and management of ground water resources, it provides technical know-how for scientific ground water exploration, development, and management. CGWA is a sister concern of CGWB engaged in various activities related to regulation of ground water development to ensure its long-term sustainability. A no objection certificate (NOC) is required to be obtained from the CGWA for withdrawal of ground water through bore wells for project purpose.

74. **Archaeological Survey of India (ASI**). Sitting under the Ministry of Culture, ASI is responsible for maintenance of ancient monuments and archaeological sites and remains of national importance. It is also responsible for regulating all archaeological activities in the country as per the provisions of the Ancient Monuments and Archaeological Sites and Remains Act, 1958 and Antiquities and Art Treasure Act, 1972. The Dehradun Circle of the ASI is responsible for maintenance of monuments in Uttarakhand.

75. **National Green Tribunal (NGT).** The NGT based out of New Delhi was established in 2010 under the National Green Tribunal Act 2010. This tribunal is headed by a chairman and has both judicial and expert members (having multidisciplinary expertise). It is responsible for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources. It is also responsible for enforcement of any legal right relating to the environment and giving relief and compensation for damages.

76. **Ministry of Labor and Employment.** The labor, health and safety framework of Government of India level defines the roles and responsibility of various ministries and government departments at central and state level, notably the Ministry of Labor and Employment and the Uttarakhand Department of Labor. They are responsible for protecting and safeguarding the interests of workers with due regard to creating a healthy work environment along with the promotion of welfare and providing social security to the labor forces in both the organized and unorganized sectors. This is achieved through enactment and implementation of various labor laws (presently 44 statutes dealing with minimum wages, accidental and social security benefits, occupational safety and health, conditions of employment, disciplinary action,

formation of trade unions, industrial relations, etc.) which regulate the terms and conditions of service and employment of workers. Both central and state governments can enact legislation. Numerous labor statutes regulate the terms and conditions of service and employment of workers and are enforced and monitored through the State Labor Commissioner.

77. **Central Electrical Authority (CEA).** Electrical health and safety is under the CEA which is a statutory organization constituted under the Electricity Supply Act 1948, superseded by the Electricity Act of 2003. The authority advises the central government, state governments and regulatory commissions on all policy and technical matters relating to generation, transmission and distribution of electricity and formulates plans for the development of electricity systems. The CEA is also responsible for prescribing the technical standards related to construction of electrical plants, electric lines and connectivity to the grid, installation and operation of meters and safety and grid standards etc. The project is required to adhere to the safety regulations and standards as prescribed by the CEA.

78. **Uttarakhand Electricity Regulatory Commission (UERC).** Under Section 86 of the Electricity Act, 2003, UERC determines the tariff for generation, supply, transmission and wheeling of electricity, wholesale, bulk or retail, as the case may be, within the State and issue licenses to persons seeking to act as transmission licensees, distribution licensees and electricity traders with respect to their operations within the State and other functions.

2.2. National Environment (EIA) Classification

79. The Project is exempted from requiring environmental clearance under the GoI's Environmental Impact Assessment (EIA) Notification, 2006 and its subsequent amendments.

2.3. National Environmental, Health and Safety Framework

80. The legal framework of the country consists of several acts, notifications, rules, and regulations to protect the environment and wildlife. In 1976, the 42nd Constitutional Amendment created Article 48A and 51A, placing an obligation on every citizen of the country to attempt to conserve the environment. The legal framework is broadly divided under following categories:

    - Environmental Protection
    - Forests Conservation
    - Wildlife Protection

81. The umbrella legislation under each of the above categories is as follows:

82. **The Environment (Protection) Act, 1986** was enacted with the objective of providing for the protection and improvement of the environment. It empowers central government to establish authorities charged with the mandate of preventing environmental pollution in all its forms and to tackle specific environmental problems that are peculiar to different parts of the country. Various rules are framed under this act for grant of environmental clearance for any development project, resources conservation and waste management. In 1976, the 42nd Constitutional Amendment created Article 48A and 51A, placing an obligation on every citizen of the country to attempt to conserve the environment. The Environment (Protection) Act 1986 was enacted with the objective of providing for the protection and improvement of the

environment. It empowers the central government to establish authorities charged with the mandate of preventing environmental pollution in all its forms and to tackle specific environmental problems that are peculiar to different parts of the country. Various rules are framed under this Act for grant of environmental clearance for any development project, resources conservation and waste management. The most notable legislation with respect to environmental assessment is the Environmental Impact Assessment (EIA) Notification, 2006 and its subsequent amendments. This identifies projects and activities that require Prior Environmental Clearance (and lays the procedure for obtaining the same). Projects are categorized as Category A or B as per the EIA Notification, 2006 and these require environment clearance. Category A projects are required to conduct EIA and public consultations and obtain EC from the Expert Appraisal Committee of Ministry of Environment, Forests and Climate Change (MoEF&CC). Category B projects are required to obtain environment clearance from the State Environmental Impact Assessment Authority (SEIAA). Category B is further sub-divided into Category B1 projects (require an EIA and public consultation) and Category B2 projects (do not require an EIA or public consultation). However, per Schedule 1 which list out the activities that require prior environmental clearance, power distribution projects, due to Government of India view they are non-polluting activities, are exempted. Unless large scale building and construction is involved, more than 20,000 square meters in footprint and 150,000 square meters of built-up (floor) area, which is not currently anticipated, the project components do not need a prior environment clearance.

83. **The Forest Conservation Act, 1980 as amended** was enacted to help conserve the country's forests. It strictly restricts and regulates the de-reservation of forests or use of forest land for non-forest purposes without the prior approval of central government. To this end the act lays down the pre-requisites for the diversion of forest land for non-forest purposes. The Forest (Conservation) Act 1980 is also of note as it strictly restricts and regulates the de-reservation of forests or use of forest land for non-forest purposes without the prior approval of Central Government. It provides guidance on the right of way (ROW) and tree cutting beneath power lines in forest land. Where routing of power lines through the forest areas cannot be avoided, these should be aligned in such a way that it involves the least number of trees being cut. Felling/pollarding/pruning of trees will be done with the permission of the local forest officer whenever necessary to maintain the electrical clearance. One outer strip of 2 m shall be left free of encroachments to permit for maintenance of the power line. Cutting of trees on non-forest land requires a tree cutting permit from the local forest department. All trees that are cut under a project must be compensated by compensatory plantation as required by the Forest Department.

84. **Wildlife (Protection) Act, 1972 as amended** was enacted with the objective of effectively protecting the wildlife of the country and to control poaching, smuggling and illegal trade in wildlife and its derivatives. It defines rules for the protection of wildlife and ecologically important protected areas. As per recently published minutes of the meeting[16] (1 February 2022) of the 66th meeting of the Standing Committee for National Board of Wildlife (NBWL) held on 31 December 2021 MoEF&CC will be requesting details of protected and forest areas with power lines and the vegetation, terrain, and periodicity of maintenance of the area. Following this a guideline shall be framed for management of the protected or forest areas below power lines. Future proposals for laying of power lines submitted to the NBWL will need to be accompanied with a management plan for the area below the power line. Permission is still being granted by NBWL for the laying of power lines in protected and forest areas; an 11kV transmission line case in Gujarat included the condition that laying of underground lines

[16] http://forestsclearance.nic.in/writereaddata/Order_and_Release/211312301212166THMinutesofMeeting.pdf

was required if technically feasible, or else to lay overhead insulated lines whilst an 11 kV transmission line case in Rajasthan included for the option of laying underground lines to be examined, but that bird diverters were to be fixed per CEA guidelines indicating NBWL considered it unlikely in both cases the underground lines would be laid.

85. Table 1 expands on the above and outlines all national environmental, health and safety policies, laws and regulations and their applicability to the Project.

Table 1: Relevant Environmental, Health and Safety and Social Legislation

Name	Applicable	Relevancy to Project	Responsible Authority
Environment, General			
The Right to Information Act, 2005 as its amendments of 2019	Yes	In relation to information disclosure during all stages of the project wherein any citizen of India may request information after paying a fee from a PTCUL/UPCL which is a government body and which PTCUL/UPCL is required to respond within thirty days.	(i) PTCUL (ii) UPCL (Project Information Officers and First Appellate Authority) (iii) Uttarakhand Information Commission
National Environment Policy 2006	Yes	Policy objectives on the conservation of critical environmental resources, intra-generational equity, livelihood security for the poor, inter-generational equity, integration of environmental concerns in economic and social development, efficiency in environmental resource use, environmental governance, and enhancement of resources for environmental conservation to be considered during the design, construction and operation of the substations and power lines	MOEF&CC
The National Environmental Appellate Authority Act, 1997	Yes	This act applies in case of infringement of any environmental laws by the project. PTCUL/UPCL will need to comply with any NGT rulings in case of application against it. NGT has dedicated jurisdiction in environmental matters to provide environmental justice and help reduce the burden of litigation in the higher courts. It is mandated to endeavor for disposal of applications or appeals within 6 months of them being filled.	NGT
National Green Tribunal Act, 2010	Yes		

Name	Applicable	Relevancy to Project	Responsible Authority
The EIA Notification 1994, as amended to 2006, 2016 and subsequent amendments	No	Not applicable for the power line and the substation components as the EIA notification exempts these from obtaining prior environmental clearance. Prior environment clearance is applicable for direct sourcing of sand and stone during construction when mineral extraction exceeds the area specified in Schedule 1. However, no new borrow pits or quarries will be opened, instead materials will be sourced by the contractor from existing approved sources. The contractor will need to confirm existing sources used by third party vendors already obtained any Prior environment clearance required to operate.	MoEF&CC and SEIAA
Pollution Control and Natural Resource Use			
National Water Policy, 2012	Yes	Recognizes that water is required during construction activities including curing of concrete structures and poles and the utilization should be optimized and an awareness of water as a scarce resource should be fostered	Ministry of Jal Shakti
The Environment (Protection) Act 1986 and Environment (Protection) Rules 1987 and its amendments	Yes	Umbrella Act to the Air, Water and Noise Acts and relevant during design, construction and operation of the substations and power line. Both construction and operation of the substations must comply with the legislation issued under this act and rules, the IEE process and implementation of the EMP will enable this. Construction and operation must also comply with the environmental quality standards	MoEF&CC, Uttarakhand DOF, CPCB and UPCB
Noise Pollution (Regulation and Control) Rules, 2000 and the Noise Pollution (Regulation and Control) (Amendment) Rules, 2010 as amended	Yes	To be taken into account when undertaking activities emitting noise or the operation of noise generating equipment during the construction and operation. Applicable during both construction and operation, project components must adhere to the ambient noise emission standards; any diesel generator sets used by the contractor or PTCUL/UPCL must also be compliant	UPCB
The Air (Prevention and Control of Pollution) Act, 1981. The Air (Pollution and Control of Pollution) Rules 1982	Yes	To be taken into account when undertaking activities emitting air pollution or the operation of air pollutant generating equipment during the construction and operation. Applicable if CTE and CTO are required for major construction plant to protect against pollution of air. Need to adhere to the air emission standards	UPCB

Name	Applicable	Relevancy to Project	Responsible Authority
The Water (Prevention and Control of Pollution) Act, 1974 The Water (Prevention and Control of Pollution) Rules, 1975 The Water (Prevention and Control of Pollution) Cess Act, 1977 & amendment in 2003	Yes	To be taken into account when undertaking activities emitting pollutants to water during construction and operation. Applicable as CTE and CTO are required from UPCB for major construction plant to protect against pollution of surface and ground water. Need to adhere to the water quality standards	UPCB
The Motor Vehicle Act. 1988 and its subsequent amendments	Yes	Applicable and all vehicles utilized during construction and operation mandatorily require obtaining of a "*Pollution Under Control Certificate*" (PUC) for the duration of their use to manage the vehicular emissions.	State Motor Vehicles Department
Comprehensive Environmental Pollution Index (CEPI) 2018	No	Not applicable as the project does not fall under any of the industrial clusters nor under the Critically Polluted Areas (CPAs) as per the CEPI. Industrial clusters are categorized under the CEPI as Polluted Industrial Areas giving weight to various pollutants, ambient pollutant concentrations, receptors (that is, the number of people affected) and additional high-risk elements; they are to be remediated seeking compensation from polluting industries, and any expansion or development of new sites in these areas will be rejected.	CPCB, SPCB, enforced by NGT
Forest Related			
National Forest Policy, 1988	Yes	Seeks to protect and conserve forest, this policy is to be taken into account during the siting and design of the substations and power lines.	MOEF&CC
Indian Forest Act, 1927 Forest (Conservation) Act, 1980 as amended. Forest (Conservation) Rules, 2003 & its amendments	Yes	It provides guidance on the right of way (ROW) and tree cutting beneath power lines in forest land. Cutting trees on non-forest land requires a tree cutting permit from the local forest department. All trees that are cut under a project must be compensated by compensatory plantation as required by the Forest Department.	MOEF&CC and Uttarakhand DoF

Name	Applicable	Relevancy to Project	Responsible Authority
Forest Panchayat Act was enacted under Section 28(2) of the Indian Forest Act, 1927	Yes	The Village Forest Council (Van Panchayats) implement the rules for accessing and distributing forest resources, monitoring them, imposing penalties on violators, and generating and judiciously using income for forest welfare. It is applicable as some existing SS (Sairaghat, Tarikhet and Bajol) are part of such village council forest ranges and must adhere to village council requirements.	Van Panchayats
Biodiversity			
National Conservation Strategy and Policy Statement on Environment and Development, 1992	Yes	It provides the measures to be taken for prevention and control of pollution and energy efficient devices in the power system	MOEF&CC
The Wildlife (Protection) Act, 1972 amended 1993, The Wildlife (Protection) Rules, 1995; Wild Life (Protection) Amendment Act, 2002	Yes	Provides for the protection of wild animals, birds and plants and is applicable given the presence of threatened biodiversity in wider project area.	National Board of Wildlife (NBWL), State Board of Wildlife (SBWL) and PCCF (Wildlife) of Uttarakhand
Biological Diversity Act, 1992 Biological Diversity Rules, 2004	Yes		
Coastal Regulation Zone Notification, MoEF&CC, (Department of Environment, Forests and Wildlife), 6th January, 2011	No	Govern human and industrial activity close to the coastline, in order to protect the fragile ecosystems near the sea.	MOEF&CC
Hazardous Materials, Hazardous Waste and Waste Management			
Ozone Depleting Substances (Regulation and Control) Rules, 2000 as amended in 2005	Yes	Prohibition on usage of ozone depleting substances during construction and operation period e.g., for servicing of fire extinguishers	UPCB

Name	Applicable	Relevancy to Project	Responsible Authority
Regulation of Polychlorinated Biphenyls (PCBs) Order 2016	Yes	Prohibits the use of Polychlorinated Biphenyls (PCBs) in new project equipment and is also applicable to disposal of any PCBs in UPCL/PTCUL's old transformers. New transformers provided for the substations must be PCB free and any existing PCB containing transformers at the existing substations and along power lines must be inventoried and removed by the cut of date of 31st December 2025. Disposal of PCB containing equipment must be done as per Hazardous and Other Wastes (Management, & Trans-boundary Movement) Rules.	UPCB
The Hazardous Waste (Management, Handling and Trans-boundary Movements) Rules, 2016 as amended 2019	Yes	Relevant to the use of transformer oil at substations and management of other construction and operational hazardous waste	UPCB
Batteries (Management and Handling) Rules, 2001 and further amendments	Yes	Relevant to the use of batteries at substations. Used batteries must be properly disposed to UPCB authorized and registered recyclers.	UPCB
The Municipal Solid Wastes (Management and Handling) Rules, 2000	Yes	Relevant to the management of construction and operational solid waste. Local bodies are required to ensure that solid waste generated in city/town is managed in accordance with the provisions relating to collection, segregation, storage, transportation, processing and disposal.	CPCB, UPCB and Uttarakhand Municipal Authorities
The Bio-medical Waste (Management and Handling) Rules, 1998	Possible	Generators of bio-medical waste such as hospitals, nursing homes, clinics, and dispensaries etc. will not use chlorinated plastic bags and gloves beyond March 27, 2019. Potentially applicable if COVID-19 PPE kits are still being used.	CPCB
The Explosives Act 1884 and its subsequent amendments. The Explosives Rules 1983	Not Anticipated	Applicable if explosives need to be used, they must also be followed if petroleum products are stored beyond the permissible capacities	Chief Controller of Explosives
The Petroleum Rules 2002	Yes	Applicable for the supply and storage of diesel for generator sets and for transformer oils etc.	Ministry of Petroleum and Natural Gas, Chief Controller of Explosives
Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989	Yes	Applicable as there shall be storage of hazardous chemicals including petroleum products (oils etc.) at the substations.	UPCB

Name	Applicable	Relevancy to Project	Responsible Authority
Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996	Yes	Emergency response planning must involve the responsible authorities in case during construction and operation a chemical accident that could impact the public occurs while handling any hazardous chemicals (flammable, toxic and explosive).	District and Local Crisis Group headed by the District Magistrate and Sub Divisional Magistrate
Construction and Demolition Waste Management Rules, 2016	Yes	Construction and demolition waste will be generated and will need to be managed and disposed of in accordance with these rules during construction	UPCB
Solid Waste Management Rules 2016	Yes	Solid waste will be generated and will need to be managed and disposed of in accordance with these rules during construction and operation.	PCB, Panchayats
The Plastic Waste Management Rules, 2016	Yes	Plastic will be generated for disposal in the wastes from packaging materials during both construction and operation period. The rules apply to "*every waste generator, local body, Gram Panchayat, manufacturer, Importers and producer*". Wastes to be segregated and disposed as per Solid Waste Management Rules, 2016	UPCB
E-Waste (Management) Rules, 2016 as amended in 2018	Yes	Applicable during construction and operation used e-waste must be properly disposed to UPCB authorized and registered recyclers.	UPCB
Related to Labour			
The Occupational Safety, Health And Working Conditions Code, 2020 (Gazette notification dated 29th September 2020)	Yes	This Act consolidates and amend the laws regulating the occupational safety, health and working conditions of the persons employed in an establishment and for matters connected therewith or incidental thereto. This includes the: Building & Other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 Contract Labour (Regulation & Abolition) Act, 1970 and The Contract Labour (Regulation & Abolition) Rules, 1971 Indian Factories Act, 1948 Code shall apply in case of contract labour employed through contractor in the offices of the Central Government or in the offices of the State Government, where the Central Government or, as the case may be, the State Government is the principal employer as in the case of PTCUL/UPCL	Ministry of Law and Justice
Interstate Migrant Workers Act 1979	Yes	In case workers and laborers working at the project sites are migrants from other states during construction	Department of Labor

Name	Applicable	Relevancy to Project	Responsible Authority
The Child Labour (Prohibition and Regulation) Act, 1986 and its amendment	Yes	Prohibits the use of child labor. A "Child" is defined as any person below the age of 14, and the act prohibits employment of a Child in any employment including as a domestic help. It is a cognizable criminal offence to employ a Child for any work. Children between age of 14 and 18 are defined as "Adolescent" and the law allows Adolescent to be employed except in the listed hazardous occupation and processes which include mining, inflammable substance and explosives related work and any other hazardous process as per the Factories Act, 1948.	Labor Inspector
The Bonded Labour (Abolition) Act 1976	Yes	Prohibits the use of bonded labor	District Magistrate as Inspector for the district or any officer delegated by him/her
The Trade Union Act, 1926	Yes	Provides for registration of trade unions with a view to render lawful organization of labour. Applicable as it allows the formation of Trade Unions for the purpose of regulating the relations between workers and PTCUL/UPCL	Registrar of Trade Unions, Uttarakhand
The Code on Wages, 2019	Yes	Payment of minimum stipulated wages, avoiding inequality in payment of wages etc. to be ensured during the construction and operation phases. The code repealed and replaced Payment of Wages Act, 1936, the Minimum Wages Act, 1948, the Payment of Bonus Act, 1965, and the Equal Remuneration Act, 1976. The Code has consolidated all the provisions of these four labor laws that have been repealed regarding wage and bonus payments and makes it mandatory for payment of minimum wages and timely payment of wages for all workers in India. To be complied with during employment of labor by contractors and UPCL/PTCUL	Labor Commissioner

Name	Applicable	Relevancy to Project	Responsible Authority
The Code on Social Security, 2020	Yes	To be complied with during employment of labor by contractors and UPCL/PTCUL. The code repeals and consolidated the Workmen's Compensation Act, 1923, The Employees' Provident Funds and Miscellaneous Provisions Act, 1952, The Payment of Gratuity Act, 1972, The Employees' State Insurance Act, 1948 and five other acts. The act brings generation, transmission and distribution of power works under the ambit of the act. Workmen Compensation Insurance, regular Provident Fund (PF), gratuity and other insurances have to be obtained by the contractors for the project	Labor Commissioner, PF Commissioner
The Employee Provident Fund (EPF) and Miscellaneous Provisions act, 1952	Yes	To be complied with during employment of labor by contractors and UPCL/PTCUL. An Act to provide for the institution of provident funds [pension fund] and deposit-linked insurance fund] for employees in factories and other establishments	Ministry of Labor and Employment, Central Provident Fund Commissioner
Employees State Insurance Act, 1948 (ESI)	Yes	To be complied with during employment of labor by contractors and UPCL/PTCUL. An Act to provide for certain benefits to employees in case of sickness, maternity and 'employment injury' and to make provision for certain other matters in relation thereto	Ministry of Labor and Employment. Labor Commissioner
Payment of Gratuity Act, 1972	Yes	To be complied with during employment of labor by contractors and UPCL/PTCUL, financial support at retirement and to the surviving members of the family in cases of death	Ministry of Labor and Employment
Employers' Liability Act no. 24 of 1938	Yes	Deals with injuries to workers and the responsibility of the employer to maintain machinery and work site in good and safe conditions. To be complied with during employment of labor by contractors and UPCL/PTCUL, accident and occupational disease compensation	Ministry of Labor and Employment
Public Liability and Insurance Act, 1991	Yes	The act is applicable to protect the public from any fortuitous accidents during construction or in the operation phases of the project's components. Liability Insurances are to be obtained by the EPC contractor and PTCUL/UPCL for construction and operation. The act provides for protection to the public from accidents caused from hazardous materials resulting in continuous or intermittent or repeated exposure to death of, or injury to, any person or damage to any property	Labor Commissioner and District Magistrate

Name	Applicable	Relevancy to Project	Responsible Authority
Health And Safety			
The Occupational Safety, Health And Working Conditions Code, 2020 (Gazette notification dated 29th September 2020)	Yes	This Act consolidates and amend the laws regulating the occupational safety, health and working conditions of the persons employed in an establishment and for matters connected therewith or incidental thereto. This includes the: Building & Other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 Contract Labour (Regulation & Abolition) Act, 1970 and The Contract Labour (Regulation & Abolition) Rules, 1971 Indian Factories Act, 1948 Code shall apply in case of contract labour employed through contractor in the offices of the Central Government or in the offices of the State Government, where the Central Government or, as the case may be, the State Government is the principal employer as in the case of PTCUL/UPCL	Ministry of Law and Justice
National Policy on Safety, Health and Environment at Work Place, 2009	Yes	Applicable as workers will be involved during construction and operation. To strive for the objective of improving safety, health, and environment in the workplace during both the construction and operation. To be complied with during employment of labor by contractors and UPCL/PTCUL	Ministry of Labour and Employment
National Policy on HIV/AIDS and the World of Work,	Yes	Applicable as influx of laborers for the construction works may lead to transmission of HIV/AIDS. Policy aims to prevent transmission amongst workers and protect the rights of the infected. To be complied with during employment of labor by contractors and UPCL/PTCUL	Ministry of Labour and Employment
The Shops and Establishment Act, 1948	No	To regulate the condition of work and employment and therefore to secure maximum benefits to the employees working in different categories of establishment.	Uttarakhand Labor Department
The Indian Electricity Act, 1910 and its amendments The Indian Telegraph Act, 1885	Yes	Applicable as new power lines will be laid. To be followed during project design, construction and operation. Safety measures to be taken in laying of electrical lines and connections.	Central Electricity Authority (CEA)

Name	Applicable	Relevancy to Project	Responsible Authority
Electricity Act, 2003 and its amendments	Yes	Applicable as electric works will be carried out so the act must be complied with. Also, the provisions stipulated in section 67–68 of the Electricity Act, 2003 read with section 10 and 16 of the Indian Telegraph Act, 1885 deals with compensation due for any damages due to the construction of any distribution lines. Guiding act related to electricity in India. Sections 53, 67, 73, 161 and 177 deal with safety related to electricity including power to make regulations.	CEA
Central Electricity Authority (Safety Requirements for Operation, Construction and Maintenance of Electric Plants and Electrical Lines) Regulations 2008 Central Electricity Authority (Measures Relating to Safety and Electricity Supply) Regulations, 2010 CEA (Measures relating to Safety and Electric Supply) Amendment Regulations 2015 CEA (Measures Relating to Safety and Electric Supply) Regulations, 2019 CEA (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2010	Yes	Applicable as the acts deals with power companies and mandates the provision for safety requirements including mandatory appointment of an Electrical Safety Officer and their qualifications.	CEA
Central Ground Water Authority (CGWA) Notification no.21-4/Guidelines/CGWA/2009-832 dated 14th October 2009	Yes	Applicable if use of ground water during construction of power lines and substations (as source for construction/drinking water) or substations being upgraded intend to extract ground water through new bore wells; prior to construction permission to abstract will be required from CGWA in accordance with this notification.	CGWA

Name	Applicable	Relevancy to Project	Responsible Authority
Drinking Water Standard (IS 10500:2012)	Yes	Applicable as provides the standards of drinking water in India. The drinking water provided in construction and substations must adhere to the standards.	Bureau of Indian Standards, CPCB, UPCB
Land Acquisition and Compensation			
National Resettlement & Rehabilitation Policy, 2007 (NRRP) (Ministry of Rural Development, Department of Land Resources).	Yes	In case land acquisition is required as a result of the project. There is land acquisition involved for new substations. Power line construction does not involve land acquisition.	Ministry of Rural Development
Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	Yes	In case land acquisition or resettlement is required as a result of the project. Provides directions related to fair compensation of any land acquired for public works purpose.	Revenue Department and District Administration
The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006 The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Rules 2007	No	Not applicable as no land is being acquired from scheduled tribes and no new power lines are passing through notified forest areas.	Department of Forest, Department of Revenue and Department of Tribal Welfare
The Provision of the Panchayats (Extension to the Scheduled Areas) Act, 1996	No	Not applicable as there is no land acquisition under areas involved. It applicable only for areas that have been declared under fifth schedule of the constitution. It gives special powers to the Gram Sabhas in Scheduled Areas especially for the management of natural resources	Village Panchayats/Gram Sabhas
Physical Cultural Resources			
Indian Treasure Trove Act 1878 (as modified up to September 1949)	Yes	In case of chance find during any excavations. Deals with treasures and other artifacts which are of antique value and origin	Archaeological Survey of India (ASI)
The Antiquities and Art Treasures Act, 1972	Yes		

Name	Applicable	Relevancy to Project	Responsible Authority
Ancient Monuments Preservation Act 1904 Ancient Monuments and Archaeological Sites and Remains Act 1958 and its amendments. Ancient Monuments and Archaeological Sites and Remains (Framing of Heritage Bye laws and Other Functions of Competent Authority) Rules, 2011 National Monument Authority Rules, 2011 Heritage Conservation and Preservation Act, 2010	Yes	Deals with activities that may be permitted and prohibited near the protected monuments. Construction works are prohibited within 100m of a protected monument (prohibited area) and another 200m from the prohibited area (so 300m total distance) is demarcated as the regulated area in which construction is regulated by the competent authority. In event of any chance finds being made they must be notified / surrendered to the competent authority.	ASI, Dehradun ASI Circle, Uttarakhand Department of Archaeology

2.4. Government of Uttarakhand (GoU)

86. GoU policies, acts and rules pertaining to the project are detailed in Table 2.

Table 2: GoU Environmental, Health and Safety and Social Legislation

#	Name of Policy / Law / Regulation	Applicability to Project	Remarks
1	The Uttarakhand Forest Transit Rules, 1952 & its amendments	Applicable. The rules provide for transit passes for forest products including timber.	**Responsible Authorities:** UFD
2	Uttar Pradesh Tree (Protection), Act 1976, as adopted in Uttarakhand	Applicable for cutting of non-forest trees.	**Responsible Authorities:** UFD
3	Uttarakhand Contract Labour (Regulation and Abolition) Rules 1978	Deals with hiring of laborers by a licensed labor contractor. It also provides for provision of rest rooms, canteens, toilets (one for every 25 laborers), first aid facilities, wages etc. It is applicable to construction and operation as more than 25 construction laborers will be hired for the Project.	**Responsible Authorities:** Directorate of Labour, GoU
4	Uttarakhand Occupational Safety, Health and Working Conditions Rules, 2021	Applicable as workers will be involved during construction and operation as health and safety risks are involved.	**Responsible Authorities:** Labor Commissioner

2.5. Clearances and Permissions Required

87. Clearances, Permissions and NOCs to be obtained for the project by both the borrower (PTCUL/UPCL) and the EPC contractors are given in Table 3. Clearances will need to be applied for early on as they can take more than one year to secure. If clearances are not legally required, then the EPC Contractor must secure written permission for the works from Department of Forests and/or ASI.

Table 3: List Of Consent Requirements for the Project Components

#	Clearances / Permissions / NOC	Authority	Responsible Party	Status as of June 2023
1	Certificate of Registration of Principal Employer	Labor Commissioner, Ministry of Labor and Employment	PTCUL/ UPCL	To be obtained prior to construction
2	Tree felling/trimming permissions	Forest Department		To be obtained prior to construction
3	NOC for installing bore wells for ground water withdrawal in substations or where new bore wells may be required	CGWA		To be obtained prior to construction
4	NOC for change of land use for establishing temporary construction camps (if outside PTCUL/UPCL land area)	Revenue Department and District Administration	EPC Contractor	To be obtained prior to construction
5	Consent to Establish (CTE) construction plant	State Pollution Control Board		To be obtained prior to construction
6	Consent to Operate (CTO) construction plant	State Pollution Control Board		To be obtained prior to construction
7	Labor License	Labor Commissioner, Uttarakhand		To be obtained prior to construction
8	Pollution Under Control Certificates for construction vehicles	Motor Vehicles Department		To be obtained prior to construction

CGWA = Central Ground Water Authority, CTE = Consent to Establish, CTO = Consent to Operate, EPC = engineering, procurement and construction, NOC = No Objection Certificate, PTCUL = Power Transmission Corporation of Uttarakhand Ltd., UPCL = Uttarakhand Power Corporation Ltd.

2.6. Other Special Provisions Related to the Project

88. Table 4 depicts recommendations to protect elephants and other wildlife from linear power sector projects. MOEF&CC guidelines require that to prevent the death of animals like elephant, in the forest areas by electrocution, power companies shall preferably use UG

cables. In the case of overhead lines, the clearance of 11kV and 33kV power lines should be per CEA regulation [17] or above the maximum trunk height of the elephant, whichever is higher.

Table 4: Other Biodiversity Related Provisions

Name	Applicability
Forest Advisory Committee meeting on 10.11.2016 recommended study of threats faced from high tension HV lines and route planning, underground cabling, removal of earth/ground wires, line modifications, and mandatory installation of bird divertors on all HV lines with tall pylons (35m of higher for 150kV or more) to make them more visible. Subsequent to this meeting the Forest Department are requiring bird divertors on HV power lines crossing forest areas.	Yes
54th meeting of the Standing Committee of the NBWL, chaired by Union Environment Minister Prakash Javadekar on August 29,2019 communicated via Vide no. F-No.6.-104.2019WL dated 29.08.2019 by Ministry of Environment, Forests and Climate Change "Implementation of recommendations of the Task Force by the Ministry vide O.M.No. 1-29/2017WL (pt.3) dt. 05.02.2019 for Suggesting Eco-Friendly Measures to mitigate Impacts of Power lines and other Power Infrastructures on Elephants and other wildlife"	Yes

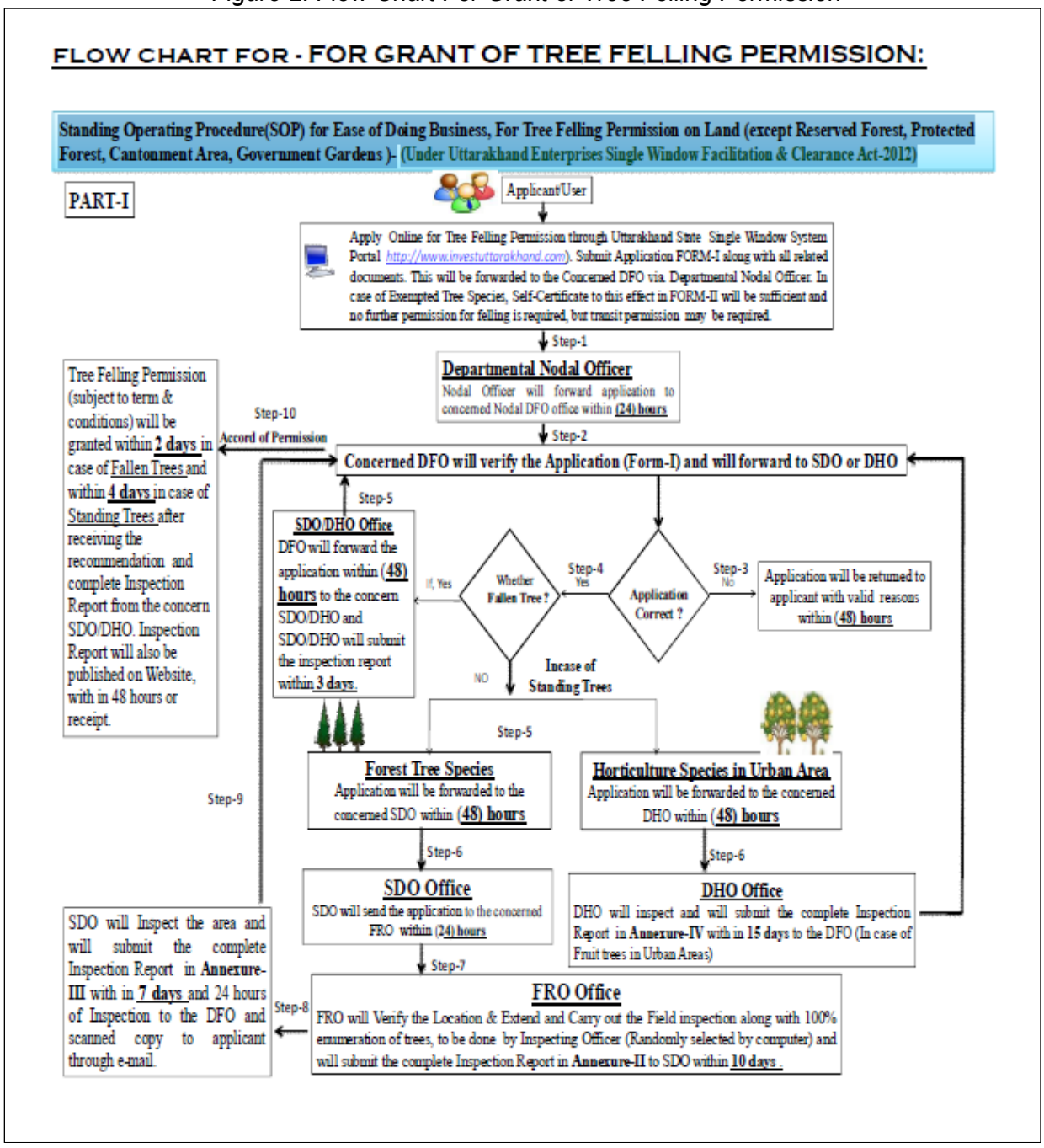
2.7. Forest Areas

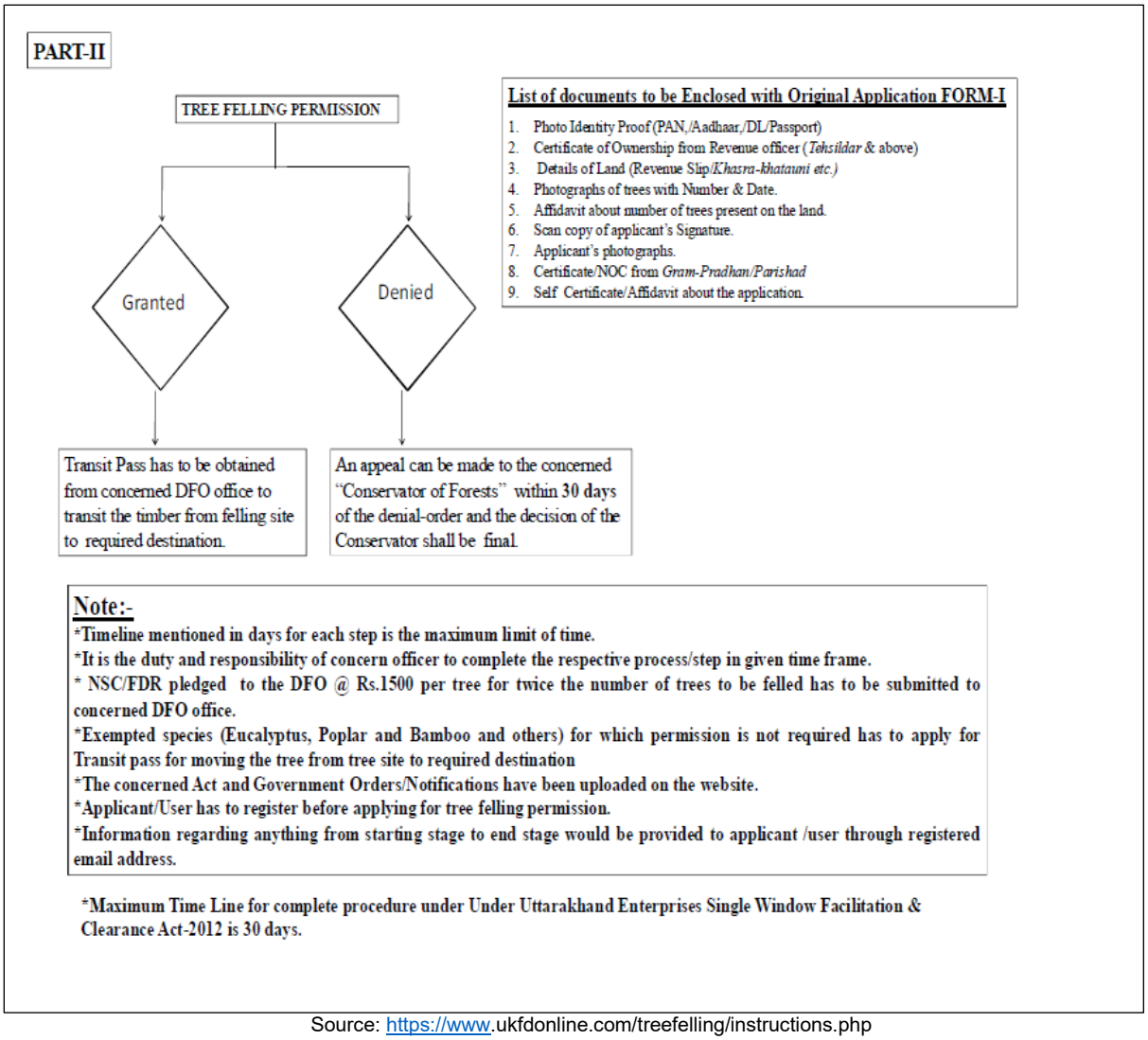
89. Per the Forest Conservation Rules (1981, amended 2003) a forestry clearance from Department of Forests is required for diversion of forest land for non-forest purpose. Processing of the forestry clearance entails two stages: stage I and stage II. Among other requirements, stage I clearance requires the applicant to make payments for compensation of forest land that will be acquired and trees that will be cut under the project. Accordingly, timely allocation of budget for this purpose by the applicant is necessary to expedite the clearance process. Information provided by UPCL and PTCUL and mapped by the IEE Consultants indicate that none of the sub-activities within Components 1 or 2 are located within forest areas with the exception of one activity (second circuit stringing) for which the original power line has relevant Forest Clearances (Appendix W). However, tree cutting in non-forest land will be required.

90. Cutting of trees in non-forest land require a tree felling permission under "Uttar Pradesh Tree (Protection), Act 1976, as adopted in Uttarakhand" under "Uttarakhand Enterprises Single Window Facilitation and Clearance Act, 2012". Procedure For Grant of Tree Felling Permission is depicted in Figure 2. The interested person applies for In-Principle Approval. They furnish details of trees proposed to be felled in a Common Application Form through the Uttarakhand State Single Window Facilitation and Clearance System. Upon successful filling of an application, it is forwarded to concerned Nodal Officer/DFO/Designated Officer (for single window clearance through online portal). Nodal Officer forwards the application to concerned DFO, who will then forward it to concerned Sub-Divisional Officer for inspection. SDO will verify the location and extent of land and tree species status and growth, condition of trees and distance from nearest forest area and submits the report to the DFO who approves or rejects the proposal along with reasons and forwards the same to the Nodal DFO. The Nodal DFO forwards the in-principle approval to District Level Empowered Committee or State Level Empowered Committee. Then final Grant of Tree Felling Permission is given as per the procedures outlined under "Uttarakhand Enterprises Single Window Facilitation and Clearance Act, 2012.[18]

[17] *CEA (Measures relating to Safety and Electric Supply) Regulations 2023*
[18] https://investuttarakhand.uk.gov.in/uttarakhandtourism/assets/uploads/sop/3.pdf

Figure 2: Flow Chart For Grant of Tree Felling Permission





Source: https://www.ukfdonline.com/treefelling/instructions.php

2.8. General Safety Clearances[19]

91. WBG EHS Guidelines for Electric Power Transmission and Distribution note that installation of power lines or other high voltage equipment above or adjacent to residential properties or other locations intended for highly frequent human occupancy, (e.g., schools or offices), should be avoided.

92. In addition, the following national general safety clearance requirements for the Project shall be applied.

[19] Key Extracts from:

- The Draft Standard Technical Specification for Steel Pole Structure. GoI. Ministry of Power. Central Electricity Authority. April 2021
- Central Electricity Authority (Measures relating to Safety and Electricity Supply) Regulations, 2010
- Indian Electricity Rules, 1956. https://www.dgms.net/IErules1956.pdf

2.8.1. Clearance above Ground of the Lowest Conductor of Overhead Lines

- No 11kV / 33kV conductor erected across a street shall be at a height of less that 6.1m
- No 11kV / 33kV conductor erected along a street shall be at a height of less that 5.8m
- No 11kV conductor erected elsewhere shall be at a height of less that 4.0m
- No 11kV - 33kV conductor erected elsewhere shall be at a height of less that 5.2m
- For lines exceeding 33kV the clearance above ground shall not be less than 5.2m plus 0.3 meters for every 33,000 volts

2.8.2. Horizontal and Vertical Clearances above Buildings

93. Where a low or medium voltage, overhead line passes above or adjacent to or terminates on any building, the following minimum clearances from any accessible point, on the basis of maximum sag, shall be observed:

    a. For any flat roof, open balcony, veranda roof and lean-to-roof-

        i. When the line passes above the building a vertical clearance of 2.5 meters from the highest point, and

        ii. When the line passes adjacent to the building a horizontal clearance of 1.2 meters from the nearest point, and

    b. For pitched roof-

        i. When the line passes above the building a vertical clearance of 2.5 meters immediately under the lines, and

        ii. When the line passes adjacent to the building a horizontal clearance of 1.2 meters.

94. Where a high or extra-high voltage overhead line passes above or adjacent to any building or part of a building it shall have on the basis of maximum sag a vertical clearance above the highest part of the building immediately under such line, of not less than:

    a. For high voltage lines up to and including 33,000 volts - 3.7 meters

    b. For extra-high voltage lines - 3.7 meters plus 0.30 meter for every additional 33,000 volts or part thereof.

95. The horizontal clearance between the nearest conductor and any part of such building shall, on the basis of maximum deflection due to wind pressure, be not less than:

    a. For high voltage lines up to and including 11,000 volts – 1.2m

    b. For high voltage lines above 11,000 volts and up to and including 33,000 volts - 2.0m

c. For extra-high voltage lines - 2.0 meters plus 0.3 meter for every additional 33,000 volts for part thereof.

2.8.3. Spans

96. The route of HV power lines (66kV and above voltage level) shall be clearly identified as normal section without constraint and section through forest area or urban areas / populated area / approach section near substations. The applicable design span in these sections for various voltage levels of HV power lines as indicated in Table 5 shall be adopted.

Table 5: Span Criteria – HV Power Lines

AC Voltage (kV)	Normal Design Span (m)		
	Normal route without constraint	Forest Area	Urban area / populated areas / near SS
400-765	200m -250m		
220-230	300	250	200
110-132	300	200	150
66	250	150	100

2.8.4. Electro-magnetic Field

97. Minimum ground clearance for conductors shall be maintained as per requirement of Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations 2010. However, requirement of maintaining electrostatic and electromagnetic interference, radio interference voltage, audible noise etc. within acceptable limits becomes ruling condition specifically for power lines of 400 kV and above voltage class. All Project OHLs and UG LILO are below 400kV apart from the 400 kV Kashipur-Puhana LILO (2.48km long) which is not located close to any residential, or other sensitive receptor (**Error! Reference source not found.**).

2.9. Other General Safety Requirements

98. All Project activities shall follow the Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations 2010. The following key points from the regulation are of specific relevance to the IEE.

- The owner of every installation of voltage exceeding 650V shall affix permanently a danger notice in Hindi and English and local language of the district, with a sign of skull and bones of a design per IS-2551 (including all overhead lines).
- All street boxes (CSS) shall be inspected regularly for detecting the presence of SF6.
- Firefighting equipment shall be kept in all sub-stations and switching stations.
- Fire extinguishers shall be tested at least once per year.
- First aid boxes and cupboards, labeled and equipped as the state government may specify shall be provided at every substation, switching station and any vehicles used for the maintenance of lines.

- Instructions in English, or Hindi and the local language of the district for the resuscitation of persons suffering from electric shock shall be provided in substations.

- In every substation an artificial respirator shall be provided and kept in good condition.

- Where a substation has more than 2000 liters of oil installed the following measures shall be taken:

    a. Baffle walls of four hours fire rating shall be provided between equipment

    b. Provisions shall be made for a suitable oil soak pit. Where more than 9000 liters is stored a system to drain the oil away from the area will be provided along with provisions to extinguish any fire that occurs.

    c. Spare oil shall not be stored in the vicinity of any oil-filled equipment.

- Outdoor substations, unless the equipment is completely enclosed in metal covering connected with earth, shall be protected by fencing not less than 1.8m in height and earthed.

99. In addition, the requirements of the Central Electricity Authority (Measures Related to Safety and Power Supply) Regulations 2010, Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Power Plants and Power Lines) Regulations and relevant Indian Standards will be followed during erection and stringing along with the CEA Minimum Safety Guidelines.

2.10. Environmental Standards and Guidelines

100. India has a large set of specific standards that refer to emissions, effluent discharge, and noise standards, as well as standard to handle and dispose specific wastes ranging from sewage to hazardous wastes. The following summarizes these laws and standards along with other international best practice standards.

2.10.1. Air Quality and Emissions

101. National Standards – Under the authority of the Air (Prevention and Control of Pollution) Act of 1981, India's Central Pollution Control Board sets national ambient air quality standards and is responsible for both testing air quality and assisting governments in planning to meet such standards. State Pollution Control Boards are permitted to set stricter standards than those in effect nationally.

Table 6: National Air Quality Standards [20]

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government) (Applicable to Dehradun)
SO_2, µg/m^3	Annual*	50	20
	24 hours**	80	80

[20] *https://cpcb.nic.in/uploads/National_Ambient_Air_Quality_Standards.pdf*

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government) (Applicable to Dehradun)
NO_2, µg/m^3	Annual*	40	30
	24 hours**	80	80
PM_{10}, µg/m^3	Annual*	60	60
	24 hours**	100	100
$PM_{2.5}$, µg/m^3	Annual*	40	40
	24 hours**	60	60
O_3, µg/m^3	8 hours**	100	100
	1 hour**	180	180
Lead (Pb), µg/m^3	Annual*	0.50	0.50
	24 hours**	1	1
CO, mg/m^3	8 hours**	2	2
	1 hour**	4	4

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be compiled with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

102. International Guidelines – The following table provides WHO recommended air quality guidelines (2021)

Table 7: WBG Ambient Air Quality Guidelines [21]

Parameter	Averaging Period	Guideline Value (micrograms/m^3)
Sulphur Dioxide (SO_2)	24 Hour	40
Nitrogen Dioxide (NO_2)	24 Hour	25
	1 Year	10
Particulate Matter PM_{10}	24 Hour	45
	1 Year	15
Particulate Matter $PM_{2.5}$	24 Hour	15
	1 Year	5

Project Air Quality Standards

103. Any air quality monitoring during the construction phase will be undertaken against national standards although comparison will also be made to the more stringent WHO 2021 guidelines. This is based on the criteria adopted by the WBG Guidelines which state that:

'*Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards* ***by applying national legislated standards****, or in their absence, the current WHO Air Quality Guidelines*.'[22]

104. As noted above, India has their own national legislated standards and as such they will be applied to the Project, though impact monitoring will also be conducted against the WHO guidelines.

[21] Not including interim targets.
[22] Environmental, Health and Safety Guidelines. Air Emissions and Ambient 65Air Quality. WBG. 2007

2.10.2. Water quality standards

105. Water quality monitoring from surface and groundwater will be assessed against national standards set by the Central Pollution Control Board for surface water.[23] Drinking water will be monitored against Drinking Water Specifications: IS 10500:2012.

Table 8: Surface Water Quality Standard

#	Designated Best Use	Class Of Water	Criteria
1	Drinking Water Source (With Conventional Treatment)	A	• Total Coliform MPN/100 ml Shall Be 50 Or Less • pH Between 6.5 To 8.5 • Dissolved Oxygen 6 mg / l Or More • Biochemical Oxygen Demand (BOD) 5 Days 20°C 2 mg/l Or Less
2	Outdoor Bathing (Organised)	B	• Total Coliform MPN/100 ml Shall Be 500 Or Less • pH Between 6.5 To 8.5 • Dissolved Oxygen 5 mg / l Or More • Biochemical Oxygen Demand (Bod) 5 Days 20°C 3 mg/l Or Less
3	Drinking Water Source (Without Conventional Treatment)	C	• Total Coliform MPN/100 ml Shall Be 5000 Or Less • pH Between 6 To 9 • Dissolved Oxygen 4 mg / l Or More • Biochemical Oxygen Demand (BOD) 5 Days 20°C 3 mg/l Or Less
4	Propagation Of Wildlife	D	• pH Between 6.5 To 8.5 For Fisheries • Dissolved Oxygen 4 mg / l Or More • Free Ammonia (As N) 1.2 mg/l Or Less
5	Irrigation, Industrial Cooling, Controlled Waste	E	• pH Between 6.0 To 8.5 • Electrical Conductivity At 25°C µmhos/cm Max. 2250 • Sodium Absorption Ratio Max. 26 • Boron, Max. 2 mg/l

Source: CPCB (1999). Bio Mapping Of Rivers, Parivesh New Letter, 5 (Iv), Central Pollution Control Board, Delhi, Pp.20.

[23] https://cpcb.nic.in/wqstandards/

Table 9: Drinking Water Specifications: IS 10500:2012

#	SUBSTANCE / CHARACTERISTICS	REQUIREMENT (ACCEPTABLE LIMIT)	UNDESIRABLE EFFECT OUTSIDE THE DESIRABLE LIMIT	PERMISSIBLE LIMIT IN THE ABSENCE OF ALTERNATE SOURCE	METHODS OF TEST (REF. TO IS)	REMARKS
ESSENTIAL CHARACTERISTICS						
1	Colour, Hazen Units, Max.	5	Above 5, consumer acceptance decreases	15	IS 3025 (Part 4)	Extended to 15 only if toxic substances, in absence of alternate sources.
2	Odour	Agreeable	-	Agreeable	IS 3025 (Part 5)	A test cold and when heated. Test at several dilution
3	Taste	Agreeable	-	Agreeable	IS 3025 (Part 7 & 8)	Test to be conducted only after safety has been established
4	Turbidity Ntu, Max.	1	Above 5, consumer acceptance decreases	5	3025 (Part 10): 1984	
5	Ph Value	6.5 To 8.5	Beyond this range the water will not affect the mucous membrane and /or water supply system	No Relaxation	IS 3025 (Part 11)	
6	Total Hardness (As $CaCO_3$) mg/1, Max.	300	Encrustation in water supply structures an adverse effect on domestic use	600	IS 3025 (Part 21)	
7	Iron (As Fe) mg/l Max.	0.3	Beyond this limit taste/appearance are affected has adverse effect on domestic uses and water supply structures and promotes iron bacteria	No Relaxation	IS 3025 (Part 53)	Total concentration of manganese (as mn) and iron (as Fe) shall not exceed 0.3 mg/l
8	Chlorides (As Ci) mg/l Max.	250	Beyond this limit, taste corrosion and palatability are affected	1000	IS 3025 (Part 32)	
9	Residual, Free Chloride, mg/l Min.	0.2		1	IS 3025 (Part 26)	To Be Applicable Only When Water is Chlorinated. Tested At Consumer End. When Protection Against Viral Infection is Required, It Should Be Min. 0.5 mg/l
Desirable characteristics						
1	Dissolved Solids mg/l Max.	500	Beyond the palatability decreases and may cause gastrointestinal irritation	2000	IS 3025 (Part 16)	

#	SUBSTANCE / CHARACTERISTICS	REQUIREMENT (ACCEPTABLE LIMIT)	UNDESIRABLE EFFECT OUTSIDE THE DESIRABLE LIMIT	PERMISSIBLE LIMIT IN THE ABSENCE OF ALTERNATE SOURCE	METHODS OF TEST (REF. TO IS)	REMARKS
2	Calcium (As Ca) mg/l Max.	75	Encrustation in water supply structure and adverse effects on domestic use	200	IS 3025 (Part 40)	
3	Magnesium (As Mg) mg/l, Max.	30	Encrustation in water supply structure and adverse effects on domestic use	100	IS 3025 (Part 46)	
4	Copper (As Cu) mg/l Max.	0.05	Beyond taste, discoloration of pipes, fitting and utensils will be caused beyond this	1.5	IS 3025 (Part 42)	
5	Manganese (As Mn) mg/l, Max.	0.1	Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures.	0.3	IS 3025 (Part 59)	
6	Sulphate (As So_4), mg/l, Max.	200	Beyond this causes gastro-intestinal irritation when magnesium or sodium are present	400	IS 3025 (Part 24)	May be extended up to 400 provided (as mg) does not exceed 30
7	Nitrate (As No_3) mg/l, Max.	45	Beyond this methaemoglobinemia take place	No Relaxation	IS 3025 (Part 34)	To Be Tested When Pollution is Suspected
8	Fluoride (As F) mg/l, Max.	1.0	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1.5	IS 3025 (Part 60)	To Be Tested When Pollution is Suspected
9	Phenolic Compounds (As C6H5OH) mg/l, Max.	0.001	Beyond this it may cause objectionable taste and odor	0.002	IS 3025 (Part 43)	To Be Tested When Pollution is Suspected
10	Mercury (As Hg) mg/l, Max.	0.001	Beyond this the water becomes toxic	No Relaxation	IS 3025 (Part 48)	To Be Tested When Pollution is Suspected
11	Cadmium (As Cd), mg/l, Max.	0.003	Beyond this the water becomes toxic	No Relaxation	IS 3025 (Part 41)	To Be Tested When Pollution is Suspected
12	Selenium, (As Se). mg/l, Max.	0.01	Beyond this the water becomes toxic	No Relaxation	IS 3025 (Part 56)	To Be Tested When Pollution is Suspected
13	Arsenic (As) mg/l, Max.	0.01	Beyond this the water becomes toxic	0.05	IS 3025 (Part 37)	To Be Tested When Pollution is Suspected
14	Cyanide (As Cn) mg/l, Max.	0.05	Beyond this the water becomes toxic	No Relaxation	IS 3025 (Part 27)	To Be Tested When Pollution is Suspected
15	Lead (As Pb), mg/l, Max.	0.01	Beyond this the water becomes toxic	No Relaxation	IS 3025 (Part 47)	To Be Tested When Pollution is Suspected

#	SUBSTANCE / CHARACTERISTICS	REQUIREMENT (ACCEPTABLE LIMIT)	UNDESIRABLE EFFECT OUTSIDE THE DESIRABLE LIMIT	PERMISSIBLE LIMIT IN THE ABSENCE OF ALTERNATE SOURCE	METHODS OF TEST (REF. TO IS)	REMARKS
16	Zinc (As Zn) mg/l, Max.	5	Beyond this limit it can cause astringent taste and an opalescence taste and an opalescence in water	15	IS 3025 (Part 49)	To Be Tested When Pollution is Suspected
17	Anionic Detergents (As Mbas) mg/l, Max.	0.2	Beyond this it can cause a light froth in water	1	Annex K Of IS 13428	To Be Tested When Pollution is Suspected
18	Chromium (As Cr6+) mg/l, Max.	0.05	May be carcinogenic above this limit	No Relaxation	IS 3025 (Part 52)	To Be Tested When Pollution is Suspected
19	Poly Nuclear Aromatic Hydra Carbons (As PAH) mg/l, Max.	0.0001	May be carcinogenic above this limit	No Relaxation	Apha 6440	-
20	Mineral Oil mg/l, Max.	0.5	Beyond this limit undesirable taste and odor after chlorination take place.	0.03	IS 3025 (Part 39)	-
21	Pesticides mg/l, Max.	-	Toxic	-	-	-
22	Radioactive Material	-	-	-	IS 14194	-
23	Alpha Emitters Bq/1, Max.	0.1	-	No Relaxation	-	-
24	Beta Emitter Pci/1, Max.	1.0	-	No Relaxation	-	-
25	Total Alkalinity (As $CaCO_3$), mg/l, Max	200	Beyond this limit taste becomes unpleasant	600	IS 3025 (Part 23)	-
26	Aluminium (As Al) mg/l, Max.	0.03	Cumulate effect is reported to cause dementia	0.2	IS 3025 (Part 55)	-
27	Boron mg/l, Max.	0.5	-	1.0	IS 3025 (Part 57)	-

Source: Indian Standard Drinking Water Specification – IS 10500:2012

106. Water quality monitoring will be assessed against national standards set by the Central Pollution Control Board.[24]

Water Discharge Project Standards

107. Wastewater discharge from construction sites and camps shall be assessed against national standards (for any treated sanitary sewage discharge) based on the WBG EHS guidelines which state, "*treatment to meet national or local standards for sanitary wastewater discharges or, in their absence, the indicative guideline values*" which are included in the last column of Table 10. However, impact monitoring will also be conducted against the WBG EHS guidelines.

Table 10: General Standards For Discharge Of Environmental Pollutants: Effluents[25]

#	Parameter	Inland Surface Water	Public Sewers	Land For Irrigation	Marine/Coastal Areas	WBG EHS Guidelines for Public Sewer
1	Colour And Odour	All Efforts Should Be Made To Remove Colour And Unpleasant Odour As Far As Practicable		All Efforts Should Be Made To Remove Colour And Unpleasant Odour As Far As Practicable	All Efforts Should Be Made To Remove Colour And Unpleasant Odour As Far As Practicable	-
2	Suspended Solids mg/l, Max.	100	600	200	(A) For Process Wastewater (B) For Cooling Water Effluent 10 Per Cent Above Total Suspended Matter Of Influent.	50
3	Particle Size Of Suspended Solids	Shall Pass 850 Micron Is Sieve	-	-	(A) Floatable Solids, Solids Max. 3 Mm (B) Settleable Solids, Max 856 Microns	-
4	pH Value	5.5 To 9.0	5.5 To 9.0	5.5 To 9.0	5.5 To 9.0	6-9
5	Temperature	Shall Not Exceed 5°c Above The Receiving Water Temperature	-	-	Shall Not Exceed 5°c Above The Receiving Water Temperature	-
6	Oil And Grease, mg/l Max,	10	20	10	20	10
7	Total Residual Chlorine, mg/l Max	1.0	-	-	1.0	-

[24] *https://cpcb.nic.in/wqstandards/*

[25] *These standards shall be applicable for industries, operations or processes other than those industries, operations or process for which standards have been specified in Schedule of the Environment Protection Rules, 1989*

#	Parameter	Inland Surface Water	Public Sewers	Land For Irrigation	Marine/Coastal Areas	WBG EHS Guidelines for Public Sewer
8	Ammoniacal Nitrogen (As N),mg/l, Max.	50	50	-	50	10
9	Total Kjeldahl Nitrogen (As N) ; mg/l, Max.	100	-	-	100	-
10	Free Ammonia (As NH3), mg/l, Max.	5.0	-	-	5.0	-
11	Biochemical Oxygen Demand (3 Days At 27°c), mg/l, Max.	30	350	100	100	30
12	Chemical Oxygen Demand, mg/l, Max.	250	-	-	250	125
13	Arsenic (As As) mg/l, Max.	0.2	0.2	0.2	0.2	-
14	Mercury (As Hg), mg/l, Max.	0.01	0.01	-	0.01	-
15	Lead (As Pb) mg/l, Max	0.1	1.0	-	2.0	-
16	Cadmium (As Cd) mg/l, Max	2.0	1.0	-	2.0	-
17	Hexavalent Chromium (As Cr + 6), mg/l, Max.	0.1	2.0	-	1.0	-
18	Total Chromium (As Cr) mg/l, Max.	2.0	2.0	-	2.0	-
19	Copper (As Cu) mg/l, Max.	3.0	3.0	-	3.0	-
20	Zinc (As Zn) mg/l, Max.	5.0	15	-	15	-
21	Selenium (As Se) mg/l, Max.	0.05	0.05	-	0.05	-
22	Nickel (As Ni) mg/l, Max.	3.0	3.0	-	5.0	-
23	Cyanide (As Cn) mg/l, Max.	0.2	2.0	0.2	0.2	-
24	Fluoride (As F) mg/l, Max.	2.0	15	-	15	-
25	Dissolved Phos- Phates (As P), mg/l, Max.	5.0	-	-	-	2
26	Sulfide (As S) mg/l, Max.	2.0	-	-	5.0	-

#	Parameter	Inland Surface Water	Public Sewers	Land For Irrigation	Marine/Coastal Areas	WBG EHS Guidelines for Public Sewer
27	Phenolic Compounds (As C6H5OH) mg/l, Max.	1.0	5.0	-	5.0	-
28	Radioactive Materials: (A) Alpha Emitters Micro Curie mg/l, Max. (B) Beta Emitters Micro Curie mg/l	10^{-7} 10^{-6}	10^{-7} 10^{-6}	10^{-8} 10^{-7}	10^{-7} 10^{-6}	-
29	Bio-Assay Test	90% Survival Of Fish After 96 Hours In 100% Effluent	90% Survival Of Fish After 96 Hours In 100% Effluent	90% Survival Of Fish After 96 Hours In 100% Effluent	90% Survival Of Fish After 96 Hours In 100% Effluent	-
30	Manganese mg/l, Max.	2	2	-	2	-
31	Iron (As Fe) mg/l, Max.	3	3	-	3	-
32	Vanadium (As V) mg/l, Max.	0.2	0.2	-	0.2	-
33	Nitrate Nitrogen mg/l, Max.	10	-	-	20	
34	Coliform MPN/100ml	-	-	-	-	400

Notes:
MPN = most probable number
Annexure 1: The State Boards Shall Follow The Following Guidelines In Enforcing The Standards Specified Under Schedule Iv:

1. The Wastewater And Gases Are To Be Treated With The Best Available Technology (Bat) In Order To Achieve The Prescribed Standards.
2. The Industries Need To Be Encouraged For Recycling And Reuse Of Waste Materials As Far As Practicable In Order To Minimize The Discharge Of Wastes Into The Environment.
3. The Industries Are To Be Encouraged For Recovery Of Biogas, Energy And Reusable Materials.
4. While Permitting The Discharge Of Effluents And Emissions Into The Environment, State Boards Have To Take Into Account The Assimilative Capacities Of The Receiving Bodies, Especially Water Bodies So That Quality Of The Intended Use Of The Receiving Waters Is Not Affected. Where Such Quality Is Likely To Be Affected, Discharges Should Not Be Allowed Into Water Bodies.
5. The Central And State Boards Shall Put Emphasis On The Implementation Of Clean Technologies By The Industries In Order To Increase Fuel Efficiency And Reduce The Generation Of Environmental Pollutants.
6. All Efforts Should Be Made To Remove Color And Unpleasant Odour As Far As Practicable.
7. The Standards Mentioned In This Schedule Shall Also Apply To All Other Effluents Discharged Such As Mining, And Mineral Processing Activities And Sewage.
8. The Limit Given For The Total Concentration Of Mercury In The Final Effluent Of Caustic Soda Industry, Is For The Combined Effluent From (A) Cell House; (B) Brine Plant; (C) Chlorine Handling; (D) Hydrogen Handling; And (E) Hydrochloric Acid Plant.
9. All Effluents Discharged Including From The Industries Such As Cotton Textile, Composite Woolen Mills, Synthetic Rubber, Small Pulp & Paper, Natural Rubber, Petrochemicals, Tanneries, Paint, Dyes, Slaughterhouses, Food & Fruit Processing And Dairy Industries Into Surface Waters Shall Conform To The BOD Limit Specified Above, Namely, 30 mg/l. For Discharge Of An Effluent Having A BOD More Than 30 mg/l, The Standards Shall Conform To Those Given Above For Other Receiving Bodies, Namely, Sewers, Coastal Waters And Land For Irrigation.
10. Bioassay Shall Be Made Compulsory For All The Industries, Where Toxic And Nonbiodegradable Chemicals Are Involved.

11. In Case Of Fertilizer Industry, The Limits In Respect Of Chromium And Fluoride Shall Be Complied With At The Outlet Of Chromium And Fluoride Removal Units Respectively.
12. In Case Of Pesticides.

A. The Limits Should Be Complied With At The End Of The Treatment Plant Before Dilution.
B. Bio-Assay Test Should Be Carried Out With The Available Species Of Fish In The Receiving Water, The Cod Limits To Be Specified In The Consent Conditions Should Be Correlated With The Bod Limits.
C. In Case Metabolites And Isomers Of The Pesticides In The Given List Are Found In Significant Concentrations, Standards Should Be Prescribed For These Also In The Same Concentration As The Individual Pesticides.
D. Industries Are Required To Analyze Pesticides In Wastewater By Advanced Analytical Methods Such As GLC/HPLC

13. The Chemical Oxygen Demand (COD) Concentration In A Treated Effluent, If Observed To Be Persistently Greater Than 250 Mg/L Before Disposal To Any Receiving Body (Public Sewer, Land For Irrigation, Inland Surface Water And Marine Coastal Areas), Such Industrial Units Are Required To Identify Chemicals Causing The Same. In Case These Are Found To Be Toxic As Defined In The Schedule-I Of The Hazardous Rules, 1989, The State Boards In Such Cases Shall Direct The Industries To Install Tertiary Treatment Stipulating Time Limit.
14. Standards Specified In Part A Of Schedule Vi For Discharge Of Effluents Into The Public Sewer Shall Be Applicable Only If Such Sewer Leads To A Secondary Treatment Including Biological Treatment System Otherwise The Discharge Into Sewers Shall Be Treated As Discharge Into Inland Surface Waters.

Source: Gsr 801 (E), Epa, 1986, Dated 31 December 1993 and https://www.ifc.org/wps/wcm/connect/3d9a54ae-c44c-488d-9851-afeb368cb9f9/1-3%2BWastewater%2Band%2BAmbient%2BWater%2BQuality.pdf?MOD=AJPERES&CVID=ls4Xbfn

2.10.3. Noise

108. National Standards – The Noise Pollution (Regulation and Controls) Rules, 2000 provide the noise standards for India. They are shown in Table 11. It is to be noted these standards are on an area/zonal basis and not for individual receptors.

Table 11: Noise Standards

Area Code	Category of Area	Limits in dB(A) Leq	
		Day time (6am to 10pm)	Nightime (10pm to 6pm)
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Note: Silence zone is defined as an area comprising not less than 100 meters around hospitals, educational institutions and courts. The silence zones are zones, which are declared as such by the competent authority.

109. International Guidelines – To meet WBG EHS Guideline requirements noise impacts should not exceed the levels presented in Table 12 or result in a maximum increase in background levels of 3 dB at the nearest receptor location off site. These levels are applicable at individual receptors, based on type.

Table 12: WHO Noise Level Guidelines

Receptor	One-hour L_{aeq} (dBA)	
	Daytime 07.00-22.00	Night-time 22.00 – 07.00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

Source: WBG EHS Guidelines, 2007

110. Control room noise should follow best practice guidelines as set out in the WBG EHS Guidelines on Occupational Health and Safety (Table 2.3.1) where the average noise level within the control room shall not exceed 45-50 dB(A) during the length of the 8 hour working day.

Project Noise Standards

111. National standards will be followed as they are generally more comprehensive than WBG guidelines. The exception being at residential properties found in commercial/industrial areas where the receptor-based guideline not the area-based standard will apply and daytime noise in industrial areas where international guidelines will be followed. WBG EHS Guidelines shall be followed for control room noise.

2.10.4. Vibration

112. International Guidelines – some of the most recognizable standards for structural vibration measurements are ISO 4866, British BS 7385-2, and German DIN 4150-3. The German DIN 4150-3 – Vibration in Buildings – Part 3: Effects on structures Standard provides short term and long-term limits [26] for vibration at the foundation for various structures. It is useful as it provides short term values corresponding to construction impacts. Since the international standard focuses more on measurement of vibration this is considered as the international best practice to be followed by the Project, it has been used in various other recent ADB environmental assessments.[27]

Table 13: Guideline Values for Vibration Velocity to be Used When Evaluating the Effects of Short-term and Long-term Vibration on Structures

Group	Type of structure	Guideline Values for Velocity (mm/s)				
		Short-term				Long-term
		At foundation			Uppermost Floor	Uppermost Floor
		Less than 10 Hz	10 Hz to 50 Hz	50 to 100 Hz	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	10
2	Residential dwellings and buildings of similar design and/or use	5 (105 dB)	5 to 15	15 to 20	15	5 (105 dB)
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3 (100.5 dB)	2 to 8	8 to 10	8	2.5 (99.0 dB)

Source: DIN 4150-3, Structural Vibration, Part 3: Effect of vibration on structures

[26] short-term vibrations are defined as those that do not occur often enough to cause structural fatigue and do not produce resonance in the structure being evaluated and long-term vibrations are all the other types of vibration.

[27] For example, https://www.adb.org/projects/documents/geo-51257-001-eia-0

113. DIN 4150-3 notes that “experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur. If damage nevertheless occurs, it is to be assumed that other causes are responsible. Exceeding the value in the table does not necessarily lead to damage”.

Project Vibration Standards

114. German Standard DIN 4150-3 will be followed during the construction phase.

2.10.5. International Electromagnetic Field (EMF) Standards

115. WBG EHS guidelines for Electric Power Transmission and Distribution refer to International Commission on Non-Ionizing Radiation Protection (ICNIRP), which establish reference and exposure levels for the general public. They set exposure to electric field at 50 hertz as 5 kV/m and for magnetic fields 100 μT.[28] In the United Kingdom, the exposure limit is 360 μT [29] (reference level 100 μT) [30] and according to the United Kingdom Energy Network Association (ENA) no distribution circuit will ever produce fields this high. [31] The typical level of magnetic field and electric fields under a medium / low voltage power line in the United Kingdom are shown in Table 14. Table 14 shows that at voltages below 11/33kV EMF values are well below exposure limits.

Table 14: Typical Ground-level Field Levels from Overhead Power Lines (11 / 33 kV)

Description	Magnetic Field (microteslas)	Electric Field (kV/m)
Maximum field (under lines)	7	0.7
Typical Field (under line)	0.2 – 0.5	0.2
Typical field (25m to side)	0.01 – 0.05	0.01 – 0.02
Typical Field (100m to side)	Less than 0.01	Less than 0.001

Source: Electric and Magnetic Fields – The Facts. Energy Networks Association. 2012

116. Typical ground level field levels from overhead HV power lines in the United Kingdom are illustrated in Table 15 and show that at 25 meters EMF levels for 275-400kV lines are well below ICNIRP exposure levels for both magnetic and electric fields but within 25 m electric field levels may be exceeded. The detailed design will need to ensure the EMF levels can be complied with at the nearest regularly occupied properties. EMF levels under typical 132kV lines are below ICNIRP exposure levels for both magnetic and electric fields.

Table 15: Typical Ground-level Electric Field Levels from Overhead Power Lines (132 and 275-400kV)

Location	Magnetic Field (microteslas)		Electric Field (kV/m)	
	132kV	275-400kV	132kV	275-400kV
Maximum Field (under line)	40	100	4	**11**
Typical Field (under line)	0.5 – 2	5-10	1-2	3-5

[28] ICNIRP per WBG EHS Guidelines. ICNIRP has more recent 2010 and 2020 guidelines for limiting exposure to electromagnetic fields for low frequencies and up to 300 GHz respectively.

[29] Only where the time of exposure is significant

[30] https://www.energynetworks.org/assets/files/electricity/she/emfs/ENA%20training%20distribution%20EMFs%20v5.pdf

[31] https://www.energynetworks.org/assets/files/electricity/she/emfs/ENA%20training%20distribution%20EMFs%20v5.pdf

Location	Magnetic Field (microteslas)		Electric Field (kV/m)	
	132kV	275-400kV	132kV	275-400kV
Typical Field (25 meters to side)	0.05 – 0.2	1-2	0.1-0.2	0.2 – 0.5
Typical Field (100 meters to side)	0.01 – 0.04	0.05 – 0.1	0.002 – 0.02	0.01 – 0.04

Source: National Grid, 2012 (https://www.nationalgrid.com/sites/default/files/documents/13791-Electric%20and%20Magnetic%20Fields%20-%20The%20facts.pdf

117. Underground cables do not produce external electric fields because they are surrounded by a metal sheath which screens the electric field. A 132 kV below ground cable buried at 1m depth would produce a magnetic field of 72 μT. [32]

118. Corresponding ICNIRP limits for general occupational exposure to electric and magnetic fields are significantly higher at 10 kV/m and 500μT, respectively, for 50 hertz. In the United Kingdom, the occupational exposure limits (high action level) are 6000 μT and 20 kV/m and 1000 μT and 10 kV/m (low action level). For trained employees, the minimum working clear hot stick distance for 2.1-15 kV is 0.6m, for 15.1 to 35 kV is 0.71m, and so on based on the WBG EHS guidelines.

2.11. Company Administration, Guidelines and Procedures

119. PTCUL management have adopted a comprehensive Code of Practice for Safety (September 2021) which is followed by the company and its staff. UPCL also have a company safety manual.

120. PTCUL and UPCL have no E&S or H&S units and it is the individual engineers who are responsible to be aware of and comply with the EHS law and regulation with no corporate oversight as far as has been shown as part of this assessment.

2.12. International Best Practice

121. WBG EHS General Guidelines (30 April 2007) will be applicable for the Project, especially Section 4 on Construction and Decommissioning. In addition, the WBG EHS Guidelines for Electric Power Transmission and Distribution (30 April 2007) also need to be considered while designing the substations and power lines. It requires consideration of terrestrial and aquatic habitat alteration, electric and magnetic fields, hazardous materials, occupational health and safety and community health and safety. The project is required to comply with these guidelines regarding assessment of potential impacts and management measures, performance indicators and monitoring guidelines. UPCL and PTCUL shall follow the WBG EHS Guidelines for this project and shall also ensure that all appointed EPC Contractors and their subcontractors follow them.

2.13. International Agreements and Conventions

122. International agreements pertinent to the project components include multilateral environmental agreements (MEA) and conventions of the International Labor Organization (ILO) related to worker safety and welfare. India is a party and signatory to several international and regional environmental treaties, agreements, and conventions, to which the

[32] http://www.emfs.info/compliance/public/

MoEF&CC is the national focal point. Table 16 provides the key international agreements that India is a signatory with potential applicability to the Project. Of note, in relation to the occupational health and safety of labour, India is not a signatory to Occupational Health and Safety Convention of the ILO and several other ILO conventions related to the health and safety of workers.[33]

Table 16: List of Relevant International Agreements

#	Name	Date of Ratification	Applicability	Remarks
1	Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat, 1971	1 February 1982	No substation is within 10km of the Ramsar Asan Conservation Reserve site (located in Dehradun district). The nearest substation Rudrapur is 17.5 km	Deals with conservation and sustainable use of wetlands
2	Convention for the Protection of the World Cultural and Natural Heritage, 1972	14 December 1977	Two UNESCO World Heritage Site are present in Uttarakhand: i. Nanda Devi National Park (nearest substation Sairaghat is about 50km) and ii. Valley of Flowers (nearest substation Sairaghat is about 200km).	Addresses nature conservation and preservation of cultural properties
3	Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973	20 July 1976	Risk of illegal wildlife activities by workers outside of working hours.	Deals with protection of endangered species from illegal trade
4	Convention on the Conservation of Migratory Species of Wild Animals, 1979	1 November 1983	Impacts to migratory wildlife including birds, elephants and other special status species.	Aims to conserve migratory species in their range
5	Basel Convention on The Control of Transboundary Movements of Hazardous Wastes	24 June 1992	Not applicable as the treaty regulates the movement of hazardous	There are 25 units in Uttarakhand to whom authorization for collection/transportation/disposal of hazardous waste is issued by

[33] https://www.ilo.org/dyn/normlex/en/f?p=1000:11210:0::NO:11210:P11210_COUNTRY_ID:102691

#	Name	Date of Ratification	Applicability	Remarks
	and Their Disposal, 1989		waste between countries	UKPCB
6	Convention For the Protection of the Ozone Layer, 1985	18 March 1991	Servicing and refilling of fire extinguishers and air conditioning during construction and operation, ensure that use of ozone depleting substances is prohibited	Lists the various ozone depleting substances and steps for reducing their production
7	Montreal Protocol on Substances That Deplete the Ozone Layer, 1987	19 June 1992		
8	Rio de Janeiro Convention on Biological Diversity, 1992	18 February 1994	Applicable as loss of natural flora due to tree felling is envisaged	Deals with biodiversity conservation, sustainable usage of natural resources and habitat preservation.
9	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, 1998	24 May 2005	Transformers and other equipment procured must be PCB free. Usage of PCBs in transformers and other equipment procured will be prohibited as per the Regulation of Polychlorinated Biphenyls Order, 2016	Promotes the sharing of responsibilities related to import of hazardous chemicals including PCBs.
10	United Nations Framework Convention on Climate Change, 1992	1 November 1993	It is applicable as Sulphur Hexafluoride (SF6) is present in gas insulated circuit breakers in the existing Sahastradhara, Hathibarakala, Rudrapur, Lamgarah, Sairaghat, Pines and Talla Ramgarh substations. The gas has possibly escaped from the Pines substation. New GIS will contain SF6. New circuit breakers in AIS, CSS and RMU may also contain SF6 although solid dielectric (Hydrophobic	Deals with reductions of greenhouse gases (GHG) to achieve 1.5°C target.
11	Kyoto Protocol to the United Nations Framework Convention on Climate Change, 1997	19 August 2002		
12	Paris Agreement under the United Nations Framework Convention on Climate Change, 2015	2 October 2016		

#	Name	Date of Ratification	Applicability	Remarks
			Cycloaliphatic Epoxy (HCEP)) could be used in place of SF6 gas as an insulating medium.	
13	Stockholm Convention on Persistent Organic Pollutants, 2001	13 January 2006	Transformers and other equipment procured must be PCB free. Existing transformers and other oil containing equipment may be contaminated with PCBs which must be removed by 31st December 2025 to comply with the Stockholm Convention	Lists PCBs as one of the pollutants. Implemented in India in part by the Regulation of PCBs Order, 2016.
14	International Labor Organization (ILO) Fundamental Conventions:[34] Forced Labor, Equal Renumeration, Abolition of Forced Labor, Minimum Age, Worst Forms of Child Labor	30 November 1954 25 September 1958 18 May 2000 13 June 2017	Construction and operation will involve workers whose fundamental rights per the ILO need to be protected.	Labor laws of India are compliant to the ILO conventions that India is a signatory of.

GHG = greenhouse gas, ILO = International Labor Organization, PCB = polychlorinated biphenyls

2.14. Asian Development Bank Safeguard Policy Statement 2009

123. ADB has three safeguard principles and requirements (environment, involuntary resettlement and indigenous peoples) under its Safeguard Policy Statement 2009 that seek to avoid, minimize, or mitigate adverse impacts of projects on the environment and affected people. The Project requires the application of environment and involuntary resettlement safeguard requirements. As there are no impacts to Indigenous Peoples therefore no further actions relating to this safeguard requirement are required.

124. ADB's prohibited investment activities list will also apply. Thus, any use of CFCs, PCBs, and asbestos containing materials will be prohibited. In relation to child labor, considering capacity for supervision, no under 18s will be permitted to work on the construction site or operational areas due to the hazardous nature of work involved.

<u>Safeguard Requirements 1: Environment</u>

[34] https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:11200:0::NO::P11200_COUNTRY_ID:102691

125. The objectives are to ensure the environmental soundness and sustainability of projects, and to support the integration of environmental considerations into the project decision-making process. Environmental safeguards are triggered if a project is likely to have potential environmental risks and impacts. Eleven 'Policy Principles' have been adopted as part of the ADBs Safeguard Policy Statement (SPS 2009). These are as follows with a note on the gap analysis compared to national requirements:

126. Use a screening process for each proposed project, as early as possible, to determine the appropriate extent and type of environmental assessment so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks. (**Power line and substation projects are not listed under the schedule of the EIA Notification as environmental sensitive projects. Though there is no requirement to screen the project under national requirements, the Project was screened by the ADB and classified as a Category B project**).

127. Conduct an environmental assessment for the proposed project to identify potential direct, indirect, cumulative, and induced impacts and risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence. Assess potential transboundary and global impacts, including climate change. Use strategic environmental assessment where appropriate. (**Though there is no requirement to assess the project under national requirements, the IEE herewith provides the environmental assessment for the Project in accordance with ADB's Safeguard Policy Statement 2009 and having cognizance of national environment, health and safety laws and regulations. Transboundary impacts are not applicable**).

128. Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and document the rationale for selecting the particular alternative proposed. Also consider the no project alternative. **(Though there is no requirement to consider alternatives under national requirements, alternatives have been considered in this IEE, including the 'no project' alternative).**

129. Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts by means of environmental planning and management. Prepare an environmental management plan (EMP) that includes the proposed mitigation measures, environmental monitoring and reporting requirements, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators. Key considerations for EMP preparation include mitigation of potential adverse impacts to the level of no significant harm to third parties, and the polluter pays principle. **(Though there is no requirement to prepare an EMP under national requirements, an EMP has been prepared for the Project in accordance with ADB's Safeguard Policy Statement 2009 and having cognizance of national environment, health and safety laws and regulations).**

130. Carry out meaningful consultation with affected people and facilitate their informed participation. Ensure women's participation in consultation. Involve stakeholders, including affected people and concerned nongovernment organizations, early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment. Establish a grievance redress mechanism to receive and facilitate resolution of the affected

people's concerns and grievances regarding the project's environmental performance. **(Though there is no requirement to conduct consultation or establish a GRM under national requirements, meaningful consultations were held to discuss environmental issues. The findings of the consultations (and a description of the Project grievance redress mechanism) are presented in this IEE).**

131. Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders. **(Though there is no requirement to disclose the environmental assessment under national requirements, this IEE and its EMP will be disclosed on the ADB website, they will also be locally disclosed by PTCUL and UPCL on their websites and at the construction site offices).**

132. Implement the EMP and monitor its effectiveness. Document monitoring results, including the development and implementation of corrective actions, and disclose monitoring reports. **(There is no requirement to monitor the EMP or disclose monitoring reports under national requirements. Therefore, the IEE and its EMP outline a plan to monitor the implementation of the EMP and the institutional responsibilities for monitoring and reporting throughout the Project lifecycle).**

133. Do not implement project activities in areas of critical habitats, unless (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function, (ii) there is no reduction in the population of any recognized endangered or critically endangered species, and (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional programs to promote and enhance the conservation aims of the protected area. In an area of natural habitats, there must be no significant conversion or degradation, unless (i) alternatives are not available, (ii) the overall benefits from the project substantially outweigh the environmental costs, and (iii) any conversion or degradation is appropriately mitigated. Use a precautionary approach to the use, development, and management of renewable natural resources. **(Biodiversity and, in some cases, critical habitat areas are found outside the legally protected area system of India wherein some endangered or critically endangered species may be present. Indian regulations have no provisions for protecting biodiversity from power line and substation projects in this event as such projects do not fall under the EIA Notification 2006. However, the IEE includes a biodiversity assessment including consideration of natural and critical habitats and legally protected areas to ensure that this principle is complied with).**

134. Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines. Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phase-outs. Purchase, use, and manage pesticides based on integrated pest management approaches and reduce reliance on synthetic chemical pesticides. **(Limiting value of some pollutants specified in the Indian regulatory standards are different than those specified in WBG EHS guidelines and hence those that are applicable to the project need to be established. Indian**

regulations have no provisions for ensuring pollution control is considered at project planning stage unless projects fall under the EIA Notification or require a CTE/CTO from SPCB. However, the IEE includes an assessment of pollution impacts and risks, and the mitigation plan of the EMP includes the measures to be followed to comply with this principle).

135. Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities. **(Both the Safeguard Policy Statement 2009 and Indian regulations require safe work areas, the use of safety equipment and personal protective equipment etc. However, the enforcement of national requirements can be weak. The IEE and its EMP outline the requirement for specific occupational and community health and safety plans, monitoring and supervision).**

136. Conserve physical cultural resources and avoid destroying or damaging them by using field-based surveys that employ qualified and experienced experts during environmental assessment. Provide for the use of "chance find" procedures that include a pre-approved management and conservation approach for materials that may be discovered during project implementation. **(Indian regulations have no provisions for protecting physical cultural resources that are not nationally or state protected from power line and substation projects at planning stage in the event projects do not fall under the EIA Notification 2006. However, the IEE includes a PCR assessment to ensure that this principle is complied with. A chance find procedure is provided in this IEE).**

Safeguard Requirements 2: Involuntary Resettlement.

137. The objectives are to avoid involuntary resettlement wherever possible; to minimize involuntary resettlement by exploring project and design alternatives; 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. The safeguard requirements underscore the requirements for undertaking the social impact assessment and resettlement planning process, preparing social impact assessment reports and resettlement planning documents, exploring negotiated land acquisition, disclosing information and engaging in consultations, establishing a grievance mechanism, and resettlement monitoring and reporting.

138. The involuntary resettlement requirements apply to full or partial, permanent or temporary physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) resulting from (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. Resettlement is considered involuntary when displaced individuals or communities do not have the right to refuse land acquisition that results in displacement. **(A Resettlement Plan (RP) has been prepared for the Project according to the requirements of ADB and is summarized in this IEE).**

Safeguard Requirements 3: Indigenous Peoples.

139. The objective 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.

140. To achieve the desired results, safeguard requirements are built into the process which needs to be realized during the processing and implementation of the projects that ADB shall finance.

141. Table 17 presents a comparison and gap analysis of ADB's SPS 2009 and Indian Requirements.

Table 17: ADB SPS 2009 and Government of India Environmental Requirments Gap Analysis

Project Stage	Indian Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
Screening and Categorization	• EIA Notification of 2006 and its amendments list the types of projects to be screened and categorized and sets criteria to classify such new and expansion projects based on potential environmental impacts as either category A, B1 and / or B2. • The category of the project shall determine the level of environmental assessment. • EIA is mandatory for project activities that satisfy the defined threshold limits for category A • EIA is also mandatory for certain category B project activities that are within 10km of (i) Protected Areas notified under the Wild Life (Protection) Act, 1972, (ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time, (iii) Notified Eco-sensitive areas, (iv) inter-State boundaries and international boundaries • Category B projects will be screened and categorized by SEIAA as either B1 or B2 by Government of India, those categorized B1 require EIA before the granting of prior environment clearance whereas those categorized as B2 will not require EIA. • For building and construction projects, if more than 20,000 square meters in footprint area and more than 150,000 square meters of built-up (floor) area these are classified under Category B and Prior Environmental Clearance is required from SEIAA.	• As per ADB's Safeguard Policy Statement (2009) screening and categorization is required for all projects • Assigns categories based on potential impacts into either: i. Category A - EIA required (significant irreversible, diverse, or unprecedented adverse environmental impacts) ii. Category B – IEE required iii. Category C – no environmental assessment required but a review of environmental implications iv. Category FI – Environmental and Social Management System required	• Power line and substation projects are not listed under the schedule of the EIA Notification as environmental sensitive projects. Therefore, screening and categorization are not required by Government of India except for when building and construction components of a certain size are involved. • Based on the size of buildings proposed at the substations none trigger the building projects criterion and required prior environment clearance. • Under ADB's Safeguard Policy Statement (2009) the project including all the outputs is categorized as B as the project components are unlikely to have significant irreversible, diverse, or unprecedented adverse environmental impacts this IEE has been prepared to address their potential impacts/risks and mitigation measures required.

Project Stage	Indian Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
Environmental Assessment	• No assessment required for power line or substation projects or small-scale building and construction	• Identify potential impacts on physical, biological, physical cultural resources and socioeconomic aspects in the context of project's area of influence (i.e., primary site and related facilities, associated facilities etc.) • Assess potential transboundary and global impacts, including climate change.	• Major gap since as per Indian regulations power line and substation projects are not listed as environmental sensitive projects, building sizes are also below the threshold to require prior environment clearance, and hence no environmental assessment is required. • However, to comply with ADB's Safeguard Policy Statement (2009) an IEE has been prepared.
Analysis of Alternatives	• No analysis of alternatives required for power line or substation projects or small-scale building and construction	• Category A (projects with significant impacts) are required to carry out alternative analysis. • Alternatives to the project's location, design, and technology are to be examined and rationale for selecting the project location, design, and technology to be documented. • Also "no project" alternative must be assessed.	• No gap as project components are unlikely to have significant irreversible, diverse, or unprecedented adverse environmental impacts but consideration has been given to alternatives as part of the IEE.
Environmental Planning and Management	• No environmental planning and management required for power line and substation projects or small-scale building and construction	• Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts • Key considerations include mitigation of potential adverse impacts to the level of "no significant harm to third parties", the polluter pays principle, the precautionary approach, and adaptive management. • Prepare EMP addressing the potential impacts and risks identified by the environmental assessment which should include the proposed mitigation measures, environmental monitoring and reporting requirements, emergency response procedures, related institutional or organizational	• Major gap but this IEE including an EMP has been prepared to meet ADB's Safeguard Policy Statement (2009) requirements

Project Stage	Indian Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
		arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators.	
Meaningful Consultation	• No formal public consultations / public hearing is required for power line or substation projects or small-scale building and construction	• Meaningful consultation starts early and continues during implementation phase. It is undertaken in a conducive atmosphere and is inclusive of gender, vulnerable and indigenous groups such that the project incorporates all relevant views and concerns of affected persons and other stakeholders.	• Major gap but meaningful consultations have been undertaken as part of the IEE
Information Disclosure	• Power line or substation projects or small-scale building and construction projects do not require any information disclosure	• ADB will post in its website the following: a. Draft IEE prior to appraisal b. Final or updated IEE upon receipt c. Environmental monitoring report submitted by borrowers upon receipt • Local disclosure is also required	• Major gap but environment safeguard documents prepared under the project shall comply with the requirements of ADB's Safeguard Policy Statement (2009) and shall be disclosed on the ADB website and locally
Grievance Redress Mechanism (GRM)	• GRM is not required	• Establish GRM to facilitate resolution of grievances or complaints received in the project	• Major gap exists but GRM to be established as per the requirements of ADB's Safeguard Policy Statement (2009)
Monitoring and Reporting	• No monitoring and reporting are required for power line and substation projects or small-scale building and construction	• Borrowers are required to prepare and regularly submit periodic monitoring reports on the progress of EMP implementation to ADB for review and disclosure • Prepare and implement corrective action plan if non-compliance is identified	• Major gap exists but monitoring measures in accordance with ADB's Safeguard Policy Statement (2009) are proposed
Biodiversity	• Wildlife Protection Act, 1972 and amendments provides the procedures and guidelines for siting of projects within protected areas and their ESZ. Projects within protected areas involve lengthy permission procedures. Projects obtaining	• ADB's Safeguard Policy Statement 2009 requires that the borrower assess the significance of project impacts and risks on biodiversity and natural resources as an integral part of the environmental assessment process.	• Biodiversity and, in some cases, critical habitat areas are found outside the legally protected area system of India wherein some endangered or critically endangered species may be present.

Project Stage	Indian Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
	permissions are mainly linear projects of national importance and are permitted with mitigation measures. • Indian Forest Act, 1927 and the Forest (Conservation) Act, 1980 and its subsequent amendments set procedures for diversion of forest land for non-forest activities. The procedure is also time consuming especially for cases involving diversion >5 ha. Any diversion of forest land involves compensation of land and plants that shall be felled. For central government projects there are some relaxations related to compensation of land. • Most, but not all, critical habitat or areas inhabited by endangered species (under schedules of the Wildlife Protection Act, 1972 and amendments) are protected under either the Wildlife Protection Act or the Forest Act	• It also requires that the assessment focus on the major threats to biodiversity including destruction of habitat and introduction of invasive alien species, and on the use of natural resources in an unsustainable manner • Borrowers are required to avoid, minimize, or mitigate potentially adverse impacts and risks and, as a last resort, propose compensatory measures, such as biodiversity offsets, to achieve no net loss or a net gain of biodiversity. • ADB's Safeguard Policy Statement 2009 also lays down procedures for implementing projects in natural habitats, critical habitats, and Legally Protected Areas	• Indian regulations have no provisions for protecting biodiversity in this event at project planning stage unless projects fall under the EIA Notification 2006. • Gaps persist especially as prior EC is not required for power line or substation projects or small-scale building and construction projects; there is no mechanism for this type of project outside of protected areas or forest areas to assess impacts on biodiversity and natural resources. In ESZ, undergrounding of distribution lines is encouraged but as power line works do not require EC there no mechanism to consider site-specific biodiversity impacts involved. • However, to comply with ADB's Safeguard Policy Statement (2009) an IEE has been prepared considering biological impacts.
Pollution	• The Environment (Protection) Rules, 1986 and various legislations address aspects such as air, noise, water pollution, hazardous substance management etc. • National Ambient Air Quality Standards have been specified as per MoEF&CC notification General Statutory Rules (GSR) 826(E) dated 16.11.2009 in compliance with the Air (Prevention and Control of Pollution) Act, 1981(Amended 1987) and Air (Prevention and Control of Pollution) Rules 1982 • Noise Standards has been specified as per the Noise Pollution (Control and Regulation) Rules, 2000 (Amended 2002).	• Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phaseouts. • Refers to WBG EHS Guidelines for international good practice standards and measures for pollution control and prevention. If national regulations differ, more stringent will usually be followed.	• Limiting value of some pollutants specified in the Indian regulatory standards are different than those specified in World Bank Group (WBG) EHS guidelines and hence those that are applicable to the distribution components need to be established. • The guideline values of the five WHO air pollutants referred to by the WBG EHS guidelines in the absence of national standards are more stringent than the Indian standards. National Ambient Air Quality Standards (NAAQS) list 12 pollutants along with their

Project Stage	Indian Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
	• Water quality standards have been specified as per MoEF&CC notification No. GSR 742(E), Dt: 25.09.2000 and in compliance with the Water (Prevention and Control of Pollution) Act 1972 (Amended 1988) and Water (Prevention and Control of Pollution) Rules 1974. • Standards applicable to the project components are provided in this chapter of the IEE.	If less stringent levels are appropriate in view of specific project circumstances, provide full and detailed justification.	permissible concentrations. The major pollutant that is listed in the Indian standard but not by the WHO to which the WBG EHS guidelines refer is Carbon Monoxide (CO) although the WHO introduced one in their latest 2021 update of the guidelines. Also, the NAAQS are for two types of land uses – (a) industrial, residential, rural and others and (b) ecologically sensitive areas notified by Government of India whereas WHO make no distinction on land use. • Ambient noise limits for industrial receptors are lower as per the WHO community noise guidelines to which the WBG EHS guidelines refer than the Government of India standard, whilst at residential receptors they are similar, but differ for silent and commercial zones. The Government of India introduces an additional receptor type not considered by the WBG EHS guidelines (WHO) namely silence zone (hospitals, educational institutions, courts, religious places and '*any other area which is declared as such by the competent authority*') • National ambient surface water quality standards exist as well as drinking water standards (ISO 10500) • The guideline values for treated sanitary wastewater discharges referred to by the WBG EHS guidelines in the absence of

Project Stage	Indian Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
			national standards are the same or more stringent than the general effluent quality standards as set under the Environmental Protection Rules 1986. Sector specific Indian CPCB standards for effluent quality exist, although not for power lines and substations. • Indian regulations have no provisions for ensuring pollution control is considered at project planning stage unless projects fall under the EIA Notification or will require a CTE/CTO from SPCB. • However, to comply with ADB's Safeguard Policy Statement (2009) an IEE has been prepared considering impacts related to pollution risk.
Health and Safety	• Occupational health and safety standards included in various Indian labour laws and codes • Community health and safety of distribution projects is covered by CEA regulations including requirement to maintain vertical and horizontal safety clearances	• Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. • Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities. • Refers to WBG EHS Guidelines for the occupational health and safety guidelines to be followed	• No major gaps with respect to occupational health and safety as both the WBG EHS guidelines and Indian regulations require safe work areas, the use of safety equipment and personal protective equipment (PPE) • Some gaps with respect to community health and safety as there are no standards for EMF
Physical Cultural Resources	• The procedures for obtaining permissions for siting of projects in the vicinity of a protected monument are laid in the various acts related to ancient monuments • National legislation prohibits projects that are within 100m of protected monuments. For projects within 300m, permissions are	• ADB's Safeguard Policy Statement (2009) states that the borrower is responsible for siting and designing the project to avoid significant damage to physical cultural resources. It requires that such resources that may have direct, indirect, cumulative, and induced impacts are identified and assessed by	• Some gaps persist for locally important physical cultural resources especially where prior environmental clearance is not required under the EIA notification and impacts are not required to be assessed.

Project Stage	Indian Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
	first to be obtained from the competent authorities. • Chance finds as per Indian regulations are to be handed over to the authorities who shall inspect / assess the chance finds. • Only rarely are protected physical cultural resources removed unless a project is of national importance and the resources are of minor importance and, in such cases, it is handled by the specialist from the Archaeological department. In most cases of conflicts, the project proponent is advised to relocate their project site.	qualified and experienced experts using field-based surveys. If such resources are impacted consultations with affected communities shall take place to identify the importance and to incorporate the views of the affected communities besides consultations with relevant national or local regulatory agencies. Appropriate mitigation measures ranging from avoidance to full site protection to selective mitigation, including salvage and documentation be provided in case of impacts. • For projects that are located where physical cultural resources are expected to be found as per the environmental assessment, procedures for chance finds shall be included in the EMP and such finds shall not be disturbed until assessed by a competent specialist • Movement of physical cultural resources shall be done only when no alternatives exist, overall benefits of the project substantially outweigh the anticipated cultural heritage loss and the removal is in accordance with relevant national and international laws and uses the best available techniques	• However, to comply with ADB's Safeguard Policy Statement (2009) an IEE has been prepared considering impacts on all physical cultural resources.

III. DESCRIPTION OF THE PROJECT

3.1. Introduction

142. This section of the report presents the project description for all project components involving physical works, including the design, construction and operation and maintenance aspects of the Project.

143. None of the works require shutdown of the electricity system causing outages. Any existing infrastructure will be removed only after the new infrastructure like UG cabling in Dehradun is commissioned. Hence there is no electricity system shut down required. There may be some instances where they may outages for a few minutes (30-60 minutes) to make the new connections required, but alternate feeding of power to these locations will normally be arranged.

3.2. Project Overview and Location

144. The Project comprises three core components involving physical works, and their sub-activities summarized as followed:

Output 1, Component 1: High Voltage (HV) Power

a) Sub-activity 1.1. New overhead HV power lines 132kV, 220kV and 400kV (mainly Aluminum Conductor Steel Reinforced (ACSR) line in – line out (LILO) connecting substations to existing power lines– 59.78 km.

b) Sub-activity 1.2. Construction of eight new substations

c) Sub-activity 1.3. Second circuit stringing of an existing HV ACSR power line at 132 kV – 39.33 km

d) Sub-activity 1.4. Underground XLPE HV cabling (LILO) 132kV and 220kV – 4.3km

Output 1, Component 2: Medium and Low Voltage (MLV) Power

a) Sub-activity 2.1. New / Conversion of 33kV lines to UG cable. Conversion of 11kV line to UG cable. Conversion of 0.4kV Low Tension (LT) line to UG cable – 381 km 33/11kV + 150km 0.4kV

b) Sub-activity 2.2. Capacity enhancement and upgradation of existing 33/11kV substations (25 substations).

c) Sub-activity 2.3. Construction of three new 33/11kV substations

d) Sub-activity 2.4. Construction of additional two 33kV OHL and one 33kV UG cable – 24km

Output 3, Component 3: Gender equality and social inclusion awareness raising, and energy-based livelihood activities promoted

145. The project will engage at least 2500 local community members (50% women and 30% from poor and vulnerable communities) from 250 selected women self-help groups (SHGs) groups in seven hilly districts gaining access to renewable energy and energy efficient equipment to enhance their income. The envisaged activities also include (i) training for at 400 local community members

(at least 50% women) in renewable energy technology, energy conservation, management, business skills, marketing, and leadership; (ii) conducting awareness campaign and providing learning opportunities covering at least 600 university and higher secondary school students (at least 30% girls) in STEM streams on the energy sector career path; and (iii) engaging local nongovernmental organizations to support the implementation and monitoring for the intervention to SHGs.

146. Output 3 will have minimal or no adverse environmental and social impacts apart from some minor waste management and occupational and community health and safety issues relating to roof-top solar installation, like a typical rooftop solar installation at a residential home. These issues can be managed via compliance with national regulations for waste management and health and safety. Accordingly, this IEE does not include Component 3 within the impact assessment itself but does provide standard good practice measures in a separate EMP for UREDA to include in its bid and contract documents.

3.3. Contracting Arrangement

147. Component 1 of the Project will be implemented in 6 contract packages. Component 2 will be implemented in 2 contract packages. Table 18 summarizes the packages and their status in terms of bid and tender dates. There will also be one contract package for Output 3.

Table 18: Project Contracting Arrangements

Package	Sub-activities included	Tender Status	Notes
1 (2 lots)	• 132/33 kV, (2X40 MVA), GIS Substation, Dhaulkhera • Construction of 220 , (2X50 MVA), GIS Substation, Selaqui, Dehradun • Construction of 132/33 kV, (2X20 MVA), GIS Substation, Lohaghat • Construction of 132/33 kV, (2X40 MVA), GIS Substation, Araghar • 132/33 kV, (2X40 MVA), Khatima-II Substation	Technical bid evaluation in progress	EMP included in bid documents. Final updated EMP will need to be followed by EPC Contractor.
2	• 220/132/33 kV, Manglore Substation	Technical bid evaluation in progress	EMP included in bid documents. Final updated EMP will need to be followed by EPC Contractor.
3 (2 lots)	• 220 kV Roorkee – Nara • 132 kV Manglore-Asahi • 132 kV Kathgodam – Rudrapur • 132 kV Khatima - Sitarganj • 132 kV D/C HV power line on Panther conductor from existing Pithrogarh (PGCIL) SS – proposed project Champawat (Lohaghat) SS	Tendering in progress	EMP included in bid documents. Final updated EMP will need to be followed by EPC Contractor.
4 (2 lots)	• 220 kV Khodri-Jhajra Line • 132 kV Majra-Laltappar Line	Tendering in progress	EMP included in bid documents. Final updated EMP will need

Package	Sub-activities included	Tender Status	Notes
			to be followed by EPC Contractor.
5	• 400 kV Kashipur-Puhana • 220 kV Manglaur – Nara • 400/220 kV GIS Substation Landhora	For advertisement in Q3 2023	EMP included in bid documents. Final updated EMP will need to be followed by EPC Contractor.
6	• 132 kV Kashipur – Mahuakheraganj • 132 kV D/C HV line from 220 kV SS Mahuakheraganj to 132 kV SS Jaspur • 132 kV, (2X40 MVA), AIS Substation, Sarvarkhera	For advertisement in Q3 2023	EMP included in bid documents. Final updated EMP will need to be followed by EPC Contractor.
7 (3 lots)	• Underground cabling, enhancement and upgradation of existing 33/11kV substations	Technical bid evaluation in progress	EMP included in bid documents did not reflect existing SS requirements. Final updated EMP reflecting all components will need to be followed by EPC Contractor.
8 (2 lots)	• Construction of three new 33/11kV substations, additional two 33kV OHL and one 33kV UG cable	Technical bid evaluation in progress	EMP included in bid documents did not reflect OHL requirements. Final updated EMP reflecting all components will need to be followed by EPC Contractor.

Source: PTCUL, 2023 and ADB Procurement Plan

3.4. Output 1, Component 1: HV Power

148. This component comprises four sub-activities summarized as follows:

3.4.1. Sub-activity 1.1 – New Overhead HV Power Lines

149. Seven line-in, line-out (LILO) HV overhead lines will be constructed and connected to existing or proposed project substations (SS). Table 19 provides an overview of the LILO lines under this sub-activity. Their locations within Uttarakhand are shown in

150. Land Area within Right of Way (RoW) and its Impact

151. The RoW width is 46m for 400 kV, 35m for 220 kV, and 27m for 132 kV power line. The total area which will come under the power line corridor is 176.98ha. Out of this 8.11ha of land will fall under the tower bases. The remaining 168.87ha of land will come under imposition of RoW restrictions. The owners of these private lands will have restrictions on use of this land for construction and restriction of growing tall trees to maintain the safety clearances which will be an economic impediment. The affected landowners will receive compensation as per MOP Guidelines of 2015 and 2020 following the Resettlement Plan.

Temporary Impact

152. The EPC contractor will require additional land for the construction period to set up a construction camp to store material, equipment and workers for a temporary period. The shorter lines with 10-15 towers may not require setting up of separate construction camps. For longer lines with more towers, the EPC contractor will obtain the required land on lease from private owners on a mutually acceptable lease rate determined through negotiation. The nature of the land procurement is not considered involuntary. (sub-activity specific maps are shown in

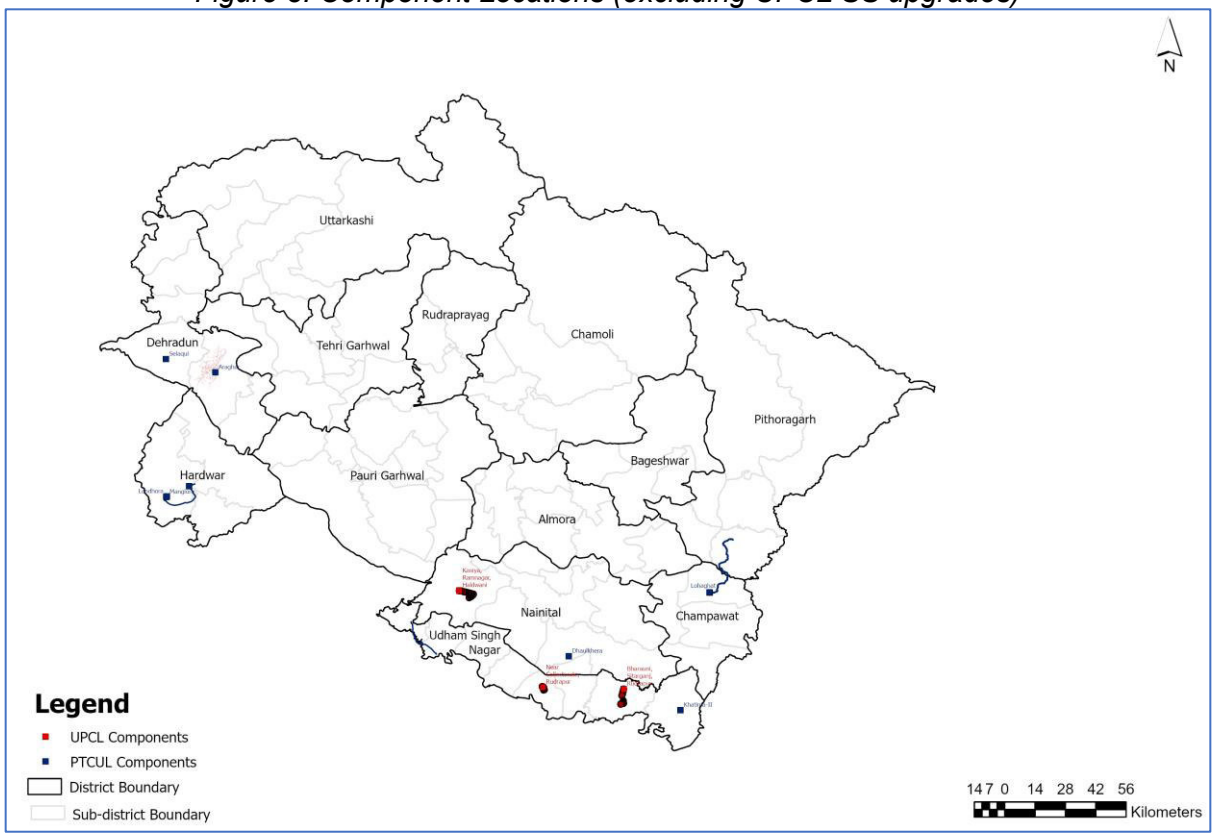
153. Figure 59 to

154.

155. Figure *66*). One other non-LILO OHL is included as part of Component 1 linking two substations (

156. Table 20).

Figure 3: Component Locations (excluding UPCL SS upgrades)



Source: PTCUL / UPCL

Table 19: Proposed Overhead HV LILO

#	LILO	Connecting Substation	Length	No. of Towers[35]	Contract Package/Lot
1	220 kV Roorkee – Nara	Proposed project 220 kV SS Manglore	0.8km	6	3
2	132 kV Manglore-Asahi	Proposed project 132 kV SS Manglore	0.1km	4	3
3	132 kV Kathgodam – Rudrapur	Project project 132 kV SS Dhaulakhera (Haldwani)	0.3km	4	3
4	132 kV Khatima – Sitarganj	Proposed project 132 SS Khatima-II	1.0km	6	3
5	400 kV Kashipur-Puhana	Proposed project 400 kV SS Landhora	2.48km	12	5
6	220 kV Manglaur – Nara	Proposed project 220 kV SS Landhora	25.0km	80	5
7	132 kV Kashipur – Mahuakheraganj	Proposed project 132 kV SS Sarverkhera[36]	10.0km	16	6
Total			**39.68km**	**128**	

Source: PTCUL

[35] *Based on an average span of 200m*
[36] *The land for this substation has not yet been acquired*

Table 20: Proposed Overhead HV Power Lines

#	Line	Length	No. of Towers	Contract Package/Lot
1	132 kV D/C HV line from 220 kV SS Mahuakheraganj to 132 kV SS Jaspur	20.1	86	6

Source: PTCUL

Footprint

157. The sub-activity "footprint' is the total estimated physical area of land required by the sub-activity. The routings used in this IEE are indicative and will be finalized by the EPC contractor after the detailed survey – at which point the IEE will need to be updated if the routing changes from that currently assessed.

Land Under Tower Bases

158. The area required for the tower base depends on the type of tower and other design features. The EPC contractor will determine the tower design after the detailed survey. In general, the maximum tower base area required is 450sqm for a 440 kV line, 400sqm for a 220 kV line, and 350sqm for a 132 kV power line. [37] Accordingly, 8.1 hectares of land will be required for the towers listed in Table 19 and

[37] Source: Project Resettlement Plan, 2023

159. Table 20. Out of the 216 towers, only 3 towers are located on public land. No additional permanent land is required for substations as all work will be completed within the boundary of the existing or proposed project substation sites.

Land Area within Right of Way (RoW) and its Impact

160. The RoW width is 46m for 400 kV, 35m for 220 kV, and 27m for 132 kV power line. The total area which will come under the power line corridor is 176.98ha. Out of this 8.11ha of land will fall under the tower bases. The remaining 168.87ha of land will come under imposition of RoW restrictions. The owners of these private lands will have restrictions on use of this land for construction and restriction of growing tall trees to maintain the safety clearances which will be an economic impediment. The affected landowners will receive compensation as per MOP Guidelines of 2015 and 2020 following the Resettlement Plan.[38]

Temporary Impact

161. The EPC contractor will require additional land for the construction period to set up a construction camp to store material, equipment and workers for a temporary period. The shorter lines with 10-15 towers may not require setting up of separate construction camps. For longer lines with more towers, the EPC contractor will obtain the required land on lease from private owners on a mutually acceptable lease rate determined through negotiation. The nature of the land procurement is not considered involuntary.

162. The transportation of construction materials to the tower locations will be done through small trucks and tractor trolleys which can use existing farm tracks where there is no road access. Hence, it is assumed that no additional land will be required for access routes. There may be chances of one-time damage to crops and farm bunds due to transportation. Such damages will be recorded and one time compensation for this will be paid by the EPC contractor as per provisions under the Electricity Act 2003 following the Resettlement Plan. The number of affected persons and magnitude of the damage will be reduced by scheduling the construction activity post-harvest and off-season for agricultural operations in project area.

163. The impact on the agricultural land and damage to the crops will be at two stages. The first stage impacts will be associated with construction of towers. The impact of the tower construction will not be restricted to the tower base area only. Hence, an additional area of 225 sqm per tower is considered for estimating the total area for anticipated crop damage. The estimated damage to crop area for construction of towers is 12.97ha. The impact on agricultural land and damage to crops is also anticipated to be caused during stringing of conductors between towers. The damage to crops due to stringing is not expected to be caused for the whole width of the ROW. It is presumed that the maximum affected crop area will not be more than 50% of the total estimated agricultural land within ROW. Thus, the estimated maximum affected crop area due to stringing will be 84.65ha. [39]

Design

164. The project components will be designed, fabricated, tested, and installed following national and international electricity regulations, standards, guidelines, and best practices. This includes the Bureau of Indian Standards (BIS), Central Board of Irrigation and Power (CBIP), Central Electricity Authority (CEA), International Energy Commission (IEC), and Institute of Electrical and Electronics Engineers (IEEE) guidelines.

[38] A Resettlement Plan (RP) has been prepared according to Indian laws and ADB's SPS (2009).
[39] Source: Project Resettlement Plan, 2023

165. HV towers will be constructed following CEA standards. Final routing and selection of tower design to be made by the EPC Contractor during design. Some important elements of the design which are incorporated into this Project (and included in the Project EMP) include:

- To the extent possible routings will avoid large habitations, densely populated areas, scheduled areas, forest/national park/wildlife infringement/GIB area/Animal/Bird sanctuary, infringement of endangered species habitat, vicinity to civil and defense Airports, major river/sea crossings, coal/ mineral mining areas, oil pipeline/underground pipe line/land slide prone areas, firing range, coastal regulation zones, inflammable pipe lines etc.

- Routings should have minimum crossings of major rivers, railway lines, National/State highways, overhead power lines and communication lines.

- The number of angle points shall be kept to a minimum.

- Marshy and low-lying areas, riverbeds and earth slip zones shall be avoided to minimize risk to the foundations.

- Areas requiring special foundations and those prone to flooding should be avoided.

- It would be preferable to utilize level ground for the alignment.

- Crossing of power lines shall be minimum. Alignment of a HV power line with respect to existing line shall be kept considering RoW and pole falling distance.

- Crossing of communication lines shall be minimized and it shall be preferably at right angle. Proximity and parallelism with telecom lines shall be eliminated to avoid danger of induction to them.

- Areas subjected to flooding such as nalah shall be avoided.

- All alignments should be easily accessible both in dry and rainy seasons to enable maintenance throughout the year.

- Certain areas such as quarry sites, tea, tobacco and saffron fields, rich plantations, gardens and nurseries which may present problems in acquisition of right of way and way leave clearance during construction and maintenance, should be avoided.

- For river crossings or power line crossings (66kV or above), railways or road crossings (express way, national highway and state highway) minimum two sets of long rod insulators or two sets of disc insulator strings per phase shall be used.

- Approval from Railway Authorities shall be obtained before proceeding with work of railway crossings.

- Barbed wire or spike type anti-climbing device shall be provided and installed by the Contractor for all pole structures. The height of the anti-climbing device shall be provided approximately 3 m above ground level.

- Each pole shall be fitted with a number plate, danger plate and a set of phase plates per circuit.

- To prevent birds perching immediately above the suspension insulator strings (I-Type/V-Type) and fouling the same with droppings, suitable bird guards shall be provided at cross-arm tips of

all suspension poles. Saw type bird guard conforming to IS: 5613 or other bird guard as approved by PTCUL shall be provided. The bird guard arrangement shall be such that it shall either prevent bird from perching in position where they are liable to cause damages or ensure that if birds do perch, droppings will fall clear of the insulator string. Suitable provision of cleat/plate to be provided on all suspension poles facilitating installation of bird guard after stringing.

- The day and/or night visual aids and markers for denoting HV power line or structures as per requirements of Directorate of Flight Safety or International Civil Aviation Organization shall be provided.

- Unnecessarily large quantities of excavation resulting in placement of large volumes of concrete, payment of concrete should be avoided.

166. For HV power lines in areas where RoW constraint is encountered, appropriate technology options such as use of steel pole structure, narrow based lattice towers, multi-circuit and multi-voltage towers, lattice / steel pole structure with one side stringing, XLPE cable or Gas Insulated Line, compact towers with insulated cross arm, and Voltage Source Converter based HVDC on overhead line or underground cable shall be adopted. [40]

167. The following figures provide design specifications for HV towers currently used by PTCUL.

[40] Draft Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2021

Figure 4: 4DD Tower Design

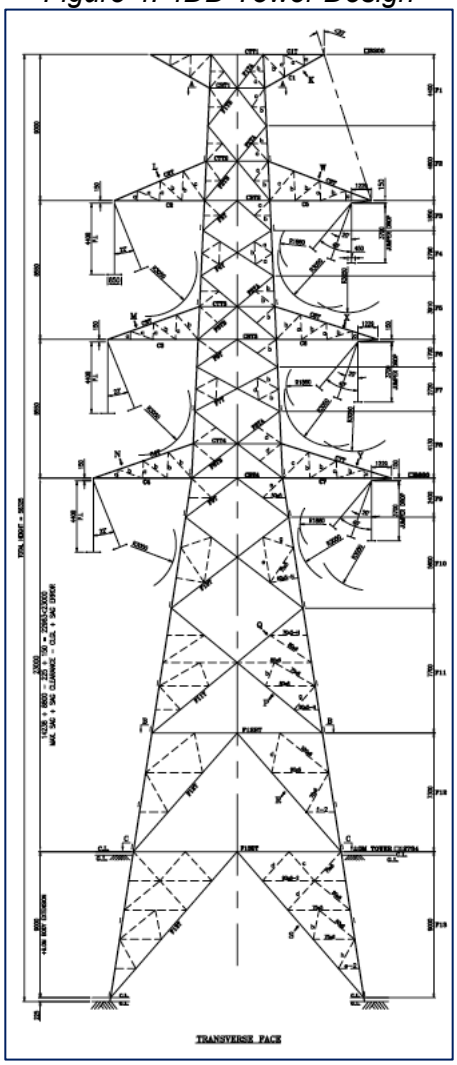
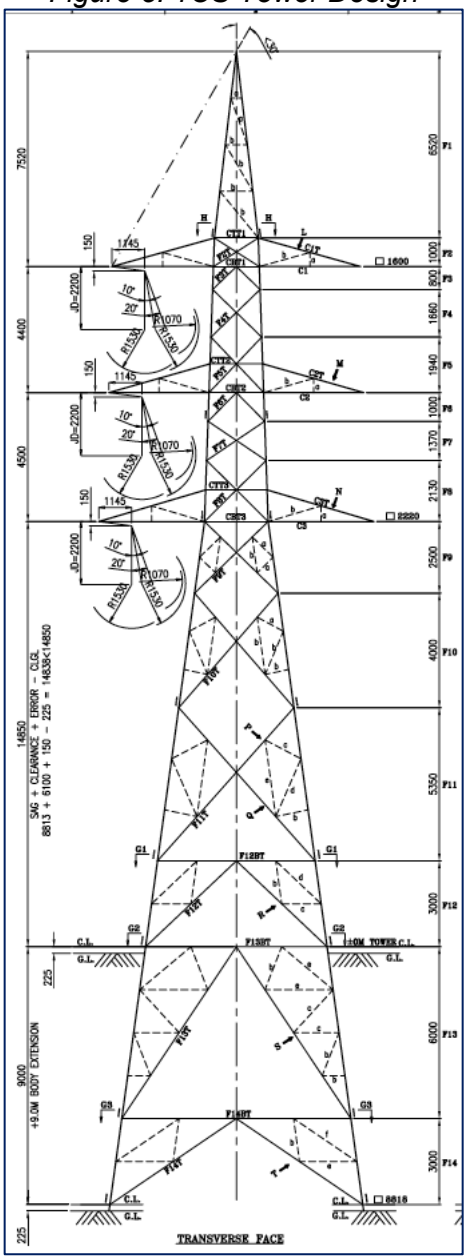


Figure 5: 1CS Tower Design



Source: PTCUL

Construction

168. The following is a sequential description of the potential activities associated with the construction of the OHL.

169. *Surveying the Centerline, Other Project Features and Work Areas* - Ground survey and staking will be performed to locate tower centers, right-of-way boundaries, overland access, and temporary work areas. Sensitive receptors that need to be avoided during construction will also be marked. Flagging and where necessary, fencing will be maintained until final cleanup and/or restoration is completed, after which they will be removed. The EPC Contractor will be required to keep within the designated footprint. A record will be made of the condition of construction camps, laydown and offloading areas and any special features in the Project alignment before construction to inform the reinstatement works.

170. *Land Acquisition* - PTCUL will be responsible for the timely implementation of the RP prior to the start of construction.

171. *Upgrading or Construction of Temporary and Permanent Access Roads* - Existing paved and unpaved roads will be used for the initial transportation of materials and equipment from the staging and storage areas to locations where they will be needed along the HV line right-of-way.

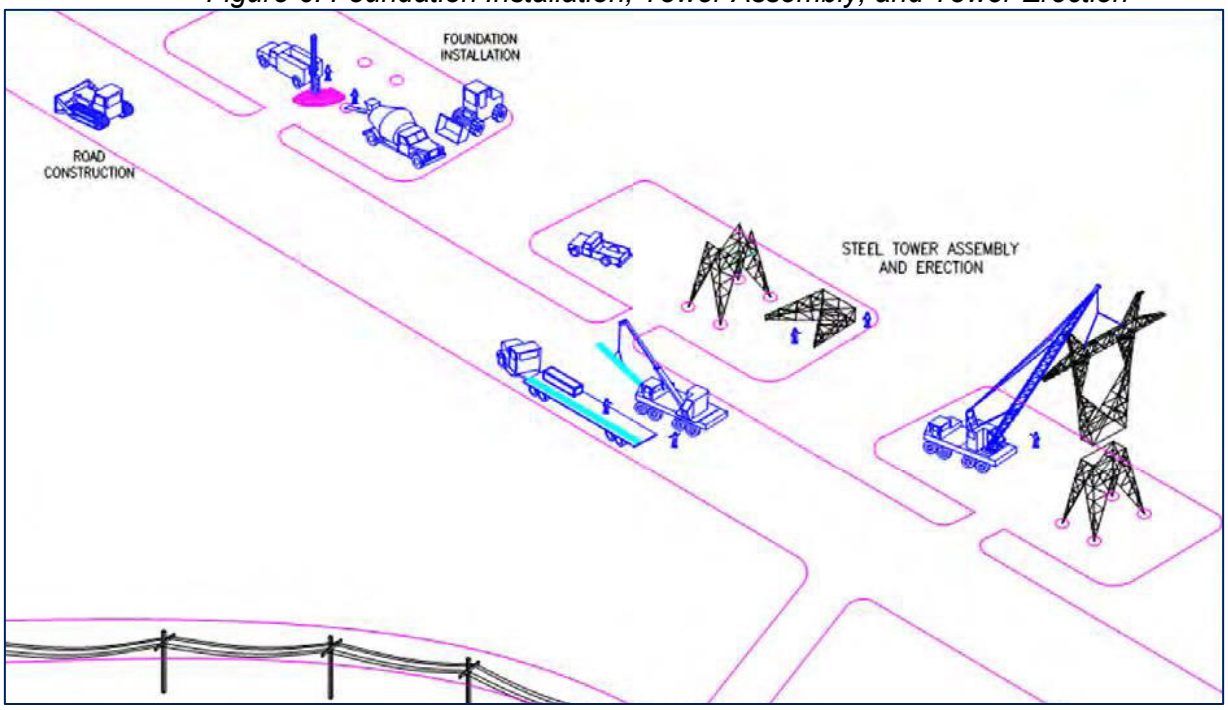
172. During construction, dust control measures will be implemented on all roads within 250m of residential / sensitive receptors.

173. *Clearing and Grading Activities for the Right-of-Way, Tower Sites and Camps* - Clearing of vegetation may be required for construction purposes. Vegetation will be selectively removed under or near the towers and conductors to provide adequate electrical clearance as required by national standards. Camp sites shall be selected to avoid the cutting of mature vegetation.

174. *Excavating and Installing Foundations* - Tower sites will be constructed as necessary to prevent erosion. Natural flows will be diverted around the site and the site protected by grading, placing rip-rap, or other erosion control measures. Vertical excavations for foundations will be made with powered equipment. Where soils permit, a vehicle-mounted power auger or backhoe will be used. In rocky areas, the foundation holes will be excavated by drilling or installing special rock anchors. Pre-cast footings will be installed.

175. *Assembling and Erecting Towers with Temporary and Permanent Pad Sites* - Bundles of steel members and related hardware will be transported to each tower site by truck. Wood blocking is hauled to each location and laid out, then the tower steel bundles are opened and laid out for assembly by sections and assembled into subsections of convenient size and weight. Typically, the leg extensions for the structures are assembled and erected by separate crews with smaller cranes to make ready for setting of the main structure assembly. The assembled subsections are then hoisted into place by means of a large crane and fastened together to form a complete tower. A follow-up crew then tightens all the bolts in the required joints.

Figure 6: Foundation Installation, Tower Assembly, and Tower Erection



Source: Consultants Illustration

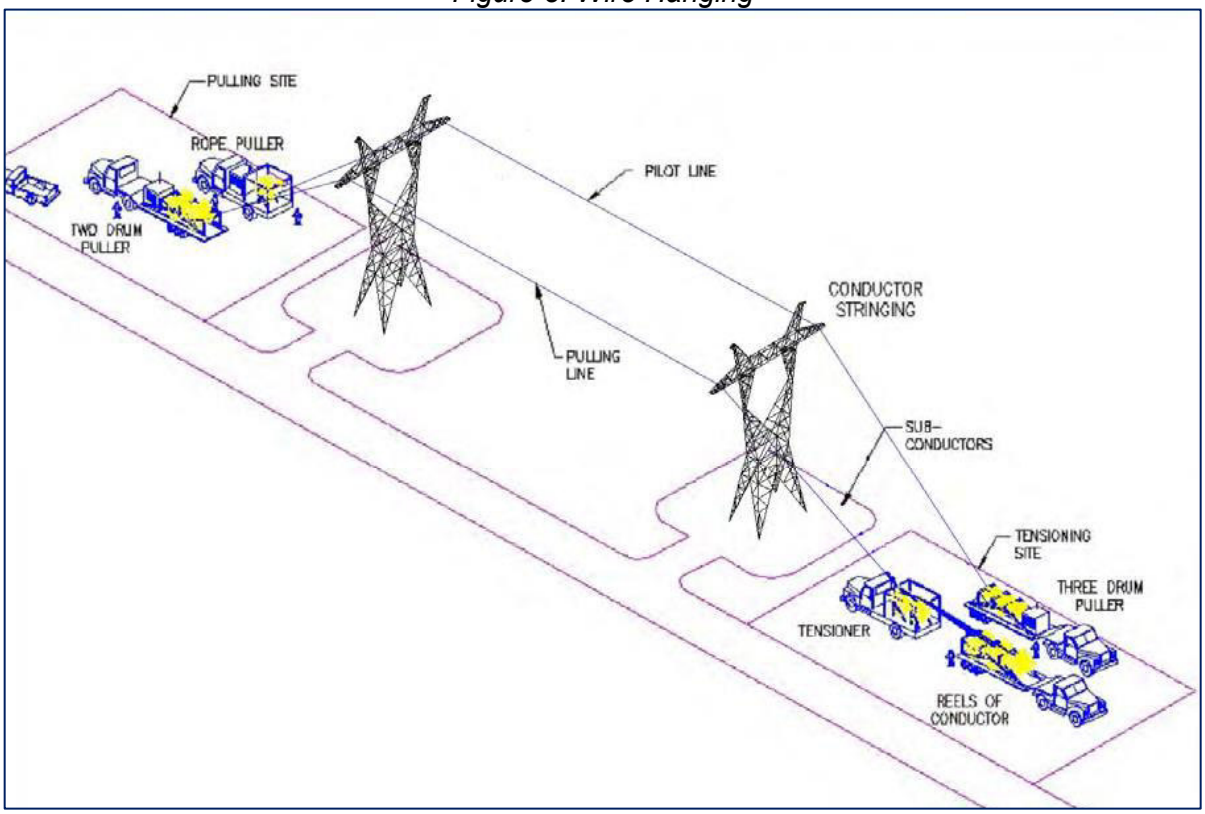
Figure 7: Typical Construction Zone for Installation of New Towers

Source: Consultants own photo. Stockholm, March 2020.

176. *String Conductors, Ground Wires, and Fiber Optic Cable* - Insulators, hardware, and stringing sheaves will be delivered to each tower site. The towers will be rigged with insulator strings and stringing sheaves at each ground wire and conductor position. Pilot lines will be pulled (strung) from tower to tower by land operated equipment and threaded through the stringing sheaves at each tower. Following pilot lines, a stronger, larger diameter line will be attached to conductors to pull them onto towers. This process will be repeated until the ground wire or conductor is pulled through all sheaves.

177. For protection of the public during wire installation, guard structures will be erected over highways, railroads, power lines, structures, and other barriers according to national standards. Guard structures will consist of H-frame wood poles placed on either side of the barriers or by using boom trucks raising a guard cross beam. These structures will prevent ground wires, conductors, or equipment from falling across obstacles. Equipment for erecting guard structures will include augers, backhoes, line trucks, boom trucks, pole trailers, and cranes. Guard structures may not be required for small roads. In such cases other safety measures such as barriers, flagmen, or other traffic control will be used. Following stringing and tensioning of all conductors, the guard structures will be removed, and the area restored.

Figure 8: Wire Hanging



Source: Consultants Illustration

178. Ground wires, fiber optic cable and conductors will be strung using powered pulling equipment at one end and powered braking or tensioning equipment at the other end of a conductor segment. Sites for tensioning equipment and pulling equipment will be approximately two to three kilometers apart as determined by the EPC Contractor. Tensioners, pullers, line trucks, wire trailers, dozers, pickups and tractors needed for stringing and anchoring the ground wire or conductor will be located at these sites. The tensioner, in concert with the puller, will maintain tension on the ground wire or conductor while they are fastened to the towers. Tension will be maintained on all insulator assemblies to assure positive contact between insulators, thereby avoiding sparking. Caution also will be exercised during construction to avoid scratching or nicking the conductor surface, which may provide points for corona to occur.

179. *Installing Counterpoise (Tower Grounds) Where Needed* - Part of standard construction practices prior to conductor installation will involve measuring the resistance of the ground to electrical current near the tower structures. If the measurements indicate a high resistance, counterpoise will be installed, which will consist of trenching in- ground wire to a depth of 12 inches in non-cultivated land and 18 inches in cultivated land, with a ground rod driven at the end. The counterpoise will be contained within the limits of the rights- of-way and may be altered or doubled back-and-forth to meet the requirements of the projects. Typical equipment used for installing ground rods includes line trucks, backhoes and trenchers, etc.

180. *Clean-up and Restoration of Affected Areas* - Construction sites, material storage yards, and access roads will be kept in an orderly condition throughout the construction period. Refuse and trash will be removed from the sites and disposed of in an approved manner (e.g., in a suitably licensed engineered landfill). In remote areas, trash and refuse could be removed to a construction staging area and contained temporarily until such time as it could be hauled to an approved site. No open burning of construction trash will be permitted. Contaminants such as oils, hydraulic fluids, antifreeze and fuels will not be dumped on the ground, and all spills will be cleaned up.

181. *Schedule and Staffing* - Construction of each overhead HV power line will take place simultaneously and each sub-activity will engage multiple construction crews working in parallel along the alignment. The size of each construction crew depends upon site conditions and techniques used, but typically 5-10 (2-3 skilled and remaining unskilled) workers will be employed and around 3-4 weeks of construction activity will be needed to construct 1 km of overhead HV line. Several crews of up to approximately 10 workers each will be required at each construction area, each crew will be responsible for a specific construction assignment including laying the foundations for the towers, assembling the towers on the ground, raising the towers, installing the wires, etc. These crews will be engaged sequentially at each construction area as the construction of each length of HV power line proceeds. No blasting is foreseen by PTCUL. However, it may be possible that some piling works will be required in locations close to rivers and marshy areas (cast in-site concrete).

Operation and Maintenance

182. During the operation and maintenance phase, regular activities that will be implemented include routine monitoring and inspection by PTCUL O&M staff to check the condition and integrity of poles and lines and that the required right of way is being maintained. Maintenance activities will include replacement of missing or corroded parts, repairing any breaks in the system, and the trimming of trees and vegetation if required. The clearing of vegetation will be done manually without the use of heavy equipment and herbicides.

3.4.2. New HV Substations

183. Eight HV sub-stations will be constructed under this sub-activity as shown in Table 21.

Table 21: Proposed New HV Sub-stations

#	Project Details	Location details	District	Type of Land	Land Area (In Ha)	Contract Package/Lot
1	132/33 kV, (2X40 MVA), GIS Substation, Dhaulkhera	At UPCL 33 kV SS premises, Dhaulkhera, approximately 80 meter from Bareilly-Haldwani Highway, Near IOC Plant, Haldwani	U.S. Nagar	UPCL Land (Proposed to be transferred to PTCUL – land transfer still not complete)	0.272	1
2	132 kV, (2X40 MVA), AIS Substation, Sarvarkhera	Located at 7 km stone Moradabad-Kashipur road at Village Hariyawala Tehsil Jaspur.	U.S. Nagar	Private Land (Proposed to be Purchased – purchase not yet complete)	2.44	6
3	Construction of 220 , (2X50 MVA), GIS Substation, Selaqui, Dehradun	At UPCL 33 kV Substation premises, Industrial Area, Selaqui	Dehradun	SIDCUL Land (Transferred to PTCUL)	0.2955	1
4	Construction of 132/33 kV, (2X20 MVA), GIS Substation, Lohaghat	Village Dasaili, Near Lohaghat Degree College, Champawat	Champawat	GoU Land (Already allotted to PITCUL)	0.802	1

#	Project Details	Location details	District	Type of Land	Land Area (In Ha)	Contract Package/Lot
5	Construction of 132/33 kV, (2X40 MVA), GIS Substation, Araghar	At UPCL 33 KV Substation premises, Araghar, Dehradun	Dehradun	UPCL Land (Proposed to be transferred to PTCUL – land transfer still not complete)	0.4935	1
6	132/33 kV, (2X40 MVA), Khatima-II GIS Substation	At Jhankaiyya, Khatima Melaghar Road, U. S. Nagar	U. S. Nagar	GoU Land (however, some issues relating to existing land users and infrastructure on the site need to be resolved, see RP for details)	1.170	1
7	400/220 kV GIS Substation Landhora	At Main Haridwar - Mujjafarnagar NH-58, opposite underpass of village Khatka, Roorkee	Haridwar	GoU Land	3.845	5
8	220/132/33 kV, Manglore AIS Substation	Village Kurdi, at Manglore - Jhabrera road, Manglore	Haridwar	Private Land (Already possessed by PTCUL)	2.696	2

Source: PTCUL

Footprint

184. The physical footprint of each substation is shown in Figure 46 to

185.

186.

187. *Figure 53*. A total of 12.02 hectares of land will be required for the 8 substations.

188. While identifying the sites PTCUL gave first preference to use unutilized land available with PTCUL or with UPCL. The next in priority was to approach GoU to provide vacant government land on lease. Hence, most of the sub-station sites are on government land or will be on vacant land already in possession of PTCUL or UPCL. For only two substation sites (Sarvarkhera SS and Manglore SS), where no suitable government land was available, PTCUL will purchase the land from private landowners. The procurement of land for Manglore SS is completed through a sale deed executed between PTCUL and the landowner. The negotiation with the landowner for the Sarvarkhera SS is under process and if negotiation fails, PTCUL will identify another willing seller. In this case, the IEE will need to be updated to reflect the change in the substation site as well as the connecting power line. PTCUL will not use compulsory land acquisition for any SS site where land belongs to a private owner.

Design

189. Design of HV substations shall follow the Draft Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2021. Relevant environmental considerations from the regulations are as follows:

a) The substation or switchyard shall be constructed above the highest flood level and, wherever required, flood protection walls shall also be provided.

b) The substation shall be designed for seismic requirement of the site as per relevant IS.

c) Gas insulated substation (GIS) shall be constructed in seismic prone areas, coastal areas, high altitude areas, very heavily polluted areas and for locations where space is major constraint.

d) The separation walls or fire barrier walls shall be provided between the transformers / reactors or between transformer / reactor and nearby building as per Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations.

e) Soak Pit and Oil collecting pit:

1) An oil soak pit shall be designed and provided below each oil filled transformer / reactor to accommodate at least 150% of total quantity of oil contained in the transformer / reactor with minimum 300 mm thick layer of gravels / pebbles of approximately 40 mm size (spread over a steel iron grating / trans rack) providing free space below the grating.

2) Alternatively, an oil soak pit shall be provided below each transformer or reactor, to accommodate one third of total quantity of oil contained in the transformer / reactor with minimum 300 mm thick layer of gravels/ pebbles of approximately 40 mm size (spread over a steel iron grating/ trans rack) providing free space below the grating provided a common remote oil collecting pit of capacity at least equal to oil quantity in the largest size transformer or reactor is provided for a group of transformers or reactors and bottom of the soak pit below the transformer or reactor shall be connected to the common remote oil collecting pit with a drain pipe of minimum 150 mm diameter with a slope not less than 1/96 for fast draining of oil or water through gravity from soak pit to the common remote oil collecting pit.

3) Every soak pit below a transformer or reactor shall be designed to contain oil dropping from any part of the transformer or reactor.

4) The common remote oil collecting pit and soak pit (when remote oil collecting pit is not provided) shall be provided with automatic pumping facility, to always keep the pit empty and available for an emergency.

5) The disposal of transformer oil shall be carried out in an environmentally friendly manner.

f) Fire Detection, Alarm and Protection System for Substation and Switchyard:

1) A comprehensive fire detection, alarm, as well as fire protection system shall be installed in conformity with relevant IS. In addition, all buildings shall conform to National Building Code.

2) All buildings inside the substation or switchyard such as control room building, GIS hall, relay room etc., shall be provided with fire detection and alarm system based on smoke

detectors and/or heat detectors. The fire alarm system shall conform to relevant IS or /IEC standards.

3) Water hydrant system shall be provided for the following areas in the substations and switchyards:

   a. Reliable Standby Power Supply system area

   b. Auxiliary power supply system area

   c. Stores

   d. Firefighting pump house

   e. Transformers or reactors

4) All transformers of 10MVA or reactors of 10 MVAR and above rating shall be provided with High Velocity Water Spray System as per IS 15325 or High-Pressure Water Mist System as per NFPA 750 or compressed air-foam system as per NFPA.

g) Lighting:

   1) Adequate indoor and outdoor lighting including street lighting shall be provided for the substation and switchyard.

   2) Adequate normal and emergency AC and DC lighting shall also be provided in the control room and other identified locations of the substation or switchyard.

   3) Energy conservation measures and energy efficient lighting devices shall be adopted, while designing the lighting system.

   4) Average illumination levels shall be maintained as per relevant standard.

h) Oil tanks of adequate capacities for storage of pure and impure transformer oil shall be provided.

i) SF6 filling, evacuation, filtering, drying and recycling plant with adequate storage capacity shall be provided at a substation or switchyard or for a cluster of substations and switchyards along with trolley for filling or evacuation of SF_6 circuit breaker or gas insulated switchgear (in case of GIS installation) and to monitor the purity, moisture content, decomposition product etc. of SF_6 gas.

190. For new bore wells for operational water supply at substations, (if required) approvals shall be obtained from authorities before they are installed. Treatment system will be provided to ensure all drinking water meets Government of India drinking water standards.

Construction and Operation

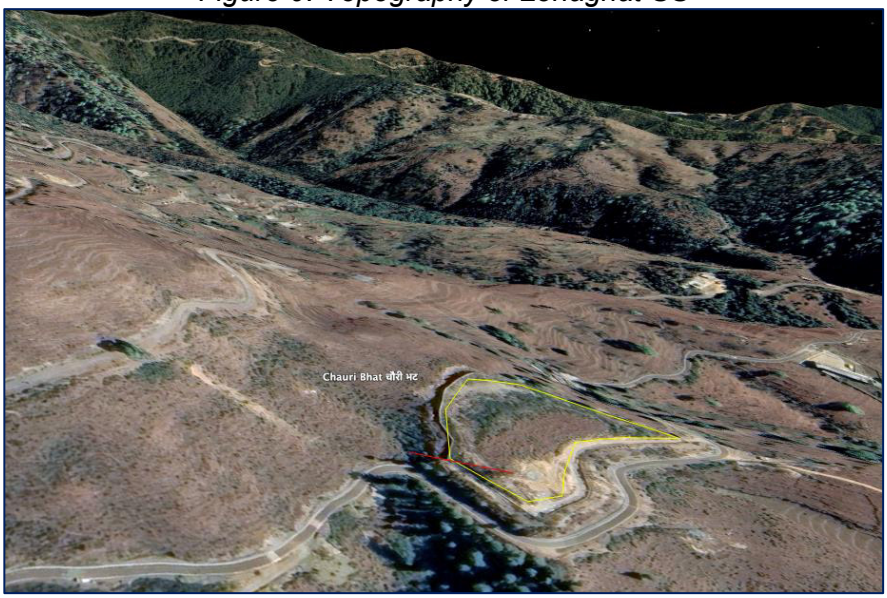
191. Construction at each substation will take place simultaneously with each substation site employing around 20-30 (5-10 skilled and remaining unskilled) workers; it will take approximately 9 months for each new substation to be constructed.

192. When the design of the substations is finalized and approved, the construction activities commence with the clearing of obstructions and vegetation. The boundary wall of the substation property is fenced to avoid unauthorized entry into the site. Post award the EPC contractor shall set

up temporary construction facilities including material storage areas and camps for workers as laid out in the Environment Management Plan.

193. Some substations may require cutting and backfilling, specifically Lohaghat SS (0.8 ha) due to the hilly topography, to create a level construction platform or elevate the site; soil is graded and compacted.[41] The foundation for the substation structures, transformer pads, cable trenches, rails, and other equipment will be constructed in accordance with the approved detailed design. Once all civil works are completed, the installation, erection, testing and commissioning of equipment follows in accordance with the prescribed specifications. No piling or blasting is required at any of the substations.

Figure 9: Topography of Lohaghat SS



Source: Google Earth

194. Araghar and Selaqui SS will be located on existing UPCL SS land. Inspection of these areas indicated that these sites are currently full of UPCL equipment (new, decommissioned and for storage), Figure 10. Most of the materials stored at the sites were conductors, and other metals. New transformers and old transformers were also located in the area on bare ground. It is possible that leaks from old transformers could be occurring on the site. UPCL have the responsibility to clear the sites prior to construction of the substations and that includes the requirement to dispose of waste in-line with national standards. Soil sampling around the areas where old transformers are stored has been completed as part of this IEE. Results show no traces of PCBs, VOCs, TPH or PAH, but some low levels of lead contamination are present (see baseline chapter).

[41] *EPC contractor shall determine the requirement based on detailed design for each substation site.*

Figure 10: UPCL Materials Stored at proposed PTCUL SS - Araghar

Source: Consultants Own Photos

195. During the operation and maintenance phase, regular activities that will be implemented include routine monitoring and inspection by PTCUL staff to check the condition and integrity of transformers and switchgear. Maintenance activities will include replacement of parts and equipment repairs.

3.4.3. Second Circuit Stringing of an Existing HV Power Line

196. Stringing of one additional conductor to an existing tower nearing completion of construction is also required (Table 22). The routing of this existing line is shown in

197. Figure 59. The original tower construction and line stringing was not an ADB funded activity.

Table 22: Second Circuit Stringing Lines

#	Line	Length	Package
1	132 kV D/C HV power line on Panther conductor from existing Pithrogarh (PGCIL) SS – proposed project Champawat (Lohaghat) SS	39.33	3

Source: PTCUL

Footprint

198. An additional conductor will be fitted to an existing HV power line. The sub-activity footprint is limited to the areas required for access to towers and locations to complete the stringing works. Stringing locations can be located at each angle tower.

Design

199. No specific designs are required as the conductor will be fixed to an existing line.

Construction

200. Stringing will be undertaken using the tension method. Using this method, the conductor is kept under tension during the stringing process. The tension method of stringing is applicable where it is desired to keep the conductor off the ground to minimize surface damage or in areas where frequent crossings are encountered. The amount of right-of-way travel by heavy equipment is also reduced. It requires the pulling of a light pilot line into the travelers, which in turn is used to pull in a heavier pulling line. The pulling line is then used to pull in the conductors from the reel stands using specially designed tensioners and pullers. Usually, this method provides the most economical means of stringing conductor. Major equipment required for tension stringing includes reel stands, tensioner, puller, reel winder, pilot line winder and splicing cart. All pulling to create tension in the line will be completed manually.

Existing Line, Environmental Audit

201. All compensation payments for the current works are completed and all payments for forestry clearance finalized. Reforestation will be completed by the Forestry Department. According to the conditions of the forest clearance for the original HV power line, which was recently installed, bird diverters should have been installed on all parts of the first circuit in areas passing through forest land. PTCUL have not yet completed these works and have requested that installation of bird diverters in these areas be part of this Project (in addition to the area of bird diverters recommended in non-forest land as required by this IEE).

202. The line connects to an existing Power Grid Corporation of India (PGCIL) SS. The IEE Consultant, through PTCUL, has attempted to complete an environmental audit of this site, however, PGCIL are unwilling to participate in any environmental audit activities. However, anecdotal information provided by PTCUL suggests that PGCIL substations are, in general, well-maintained sites and no significant environmental and social issues are anticipated at this site that would require major corrective actions.

Operation and Maintenance

203. Completed as per the new PTCUL LILO lines.

3.4.4. Underground LILO cabling

204. Two high voltage underground (UG) LILOs will be constructed at part of Component 1 (Table 23). For information relating to underground cabling footprint, construction and operation, refer to the general procedures for UG cabling for MLV works. The location of these lines is shown in Figure 67 and

205.

206.

207. *Figure 68*. The routings used in this IEE are indicative and will be finalized by the EPC contractor after the detailed survey – at which point the IEE will need to be updated if the routing changes from that currently assessed.

Table 23: UG HV Cabling LILO

#	LILO	Connecting Substation	Length	Contract Package/Lot
1	220 kV Khodri-Jhajra Line	Proposed project 220 kV Substation Selaqui Dehradun	0.7km	4
2	132 kV Majra-Laltappar Line	Proposed project 132 kV Substation Araghar Dehradun	3.6km	4

Source: PTCUL

208. These two lines will involve neither acquisition of land nor imposition of RoW as they follow existing roads. The temporary construction stage impacts are anticipated, and they will be similar to impacts and mitigation measures discussed under the section dealing with underground MLV cable laying by UPCL.

3.5. Output 1, Component 2: MLV Power

3.5.1. Construction of New / Conversion to Underground Cables

209. This sub-component will be undertaken in its entirety within Dehradun and its suburbs. 11kV and 33kV cables will be placed below ground, these will either be new or replacing the existing above ground MLV network in Dehradun and its suburbs. There will also be related 0.4kV (LV) cables installed, likely in the same conduit as the 11kV cables. The routings will be confirmed during project implementation and the avoidance of all environmental and social sensitivities will need to be confirmed during project implementation, checklists included in the EMP are to be completed for each location and, as necessary, the IEE will be updated. Table 24 provides details of the cables to be laid and their related components (Compact Substations (CSS) and Ring Main Units (RMU)) by Package number.

Table 24: MLV Underground Cables and Related LV Power Lines

Type	Length to be Constructed (km)	OHL Length to be dismantled (km)*	Number of CSS	Number of RMUs	Contract Package 7 Lot No.
UG Cable					
11kV	73	28	46	166	1 North & Central
33kV	57	-	-	-	1 North & Central
11kV	106	62	20	117	2 South
33kV	32	-	-	-	2 South
11kV	52	31	33	71	3 Rural
33kV	61	-	-	-	3 Rural
SUB TOTAL	381	121	99	354	-
Related LV					
0.4kV	63	63	-	-	1 North & Central
0.4kV	62	62	-	-	2 South
0.4kV	31	31	-	-	3 Rural
SUB TOTAL	156	156	-	-	-
TOTAL	537	277	-	-	-

* Not part of the Project funded scope. Works will be completed by UPCL independently. However, the impact of these works is considered in the IEE since it will be undertaken because of the project.
Source: UPCL

210. The component includes construction of several critical sub-components:

- Underground Cables
- Compact Substations (CSS)
- Ring Main Units (RMU)

211. The vacant space at the margin of public roads will be used for laying UG cables. These cables do not impose any ROW restrictions on adjacent landowners or users. The UG network will also install 99 CSS and 354 RMUs which will be above ground. These will also be placed on public land and will be mostly on or near the locations where transformers currently exist. Hence, no permanent impact on private property or livelihood is envisaged.

212. **Underground Cabling** – The following section provides an overview of the UG construction process.

213. Route Survey and Site Preparation - while laying underground cables, every precaution has to be made to prevent damage to the cable as such damages may lead to breakdown which causes disturbances to the supply. Unlike overhead lines, it is difficult to repair such damage immediately and hence zero damages to the cable while laying are essential. The proposed cable routes have to be carefully surveyed to identify every possible above and below ground obstacle prior to the excavations. As a part of the route survey work, trial pits (dimensions 600mm by 600 mm by 1000mm) have to be made at an interval of 15-20 m in the proposed cable route so that the soil condition and any buried utility services can be identified. However, it is first essential to contact relevant utility organizations (gas, water, sewers, telephone, etc.) and undertake underground utility scans using a cable avoidance tool or equivalent to identify the existing known and unknown buried service network. Informed by the results the trial pits can then be placed to avoid them, or if is not possible to avoid, then the relevant permits and/or clearances can be obtained in advance.

214. Locally available materials will be purchased from existing licensed local suppliers or sources, while cables and others material which are not locally available will be purchased from licensed manufacturers or suppliers.

215. Methods - Two methods for UG cabling may be employed – however, observations of works currently undertaken in Dehradun indicate that open trench method will be the most used method due to topography and geology constraints minimizing opportunities for horizontal directional drilling. The Project Bill of Quantities (BoQ) indicates that approximately 70% of UG works will be open trench. Open trench works, based on observations of on-going works in Dehradun, require 5-10 workers. HDD works require 3-5 workers.

216. **Open Trench.** Most commonly, a backhoe is used to dig the open trench. The excavation starts with the removal of the topsoil in unpaved areas or the concrete/asphalt in paved areas such as roadways. Encountered rock will be broken-up by pneumatic drill or by hand tools. Trucks will haul away excavated topsoil or subsoil materials to an approved off-site location for disposal, or if appropriate, storage for re-use. For health and safety purposes, trenches

that may be unstable require shoring. Trench size will vary depending on the cable type and voltage. The depth and width of the trench are depending on the type of cable laid in the trench, typically the trench will be no more than 1.5m deep and 1m wide. If groundwater is encountered it will be pumped from the excavation to a suitable adjacent area for sedimentation and infiltration to ground, or, more likely in the urban area, pumped directly into a tanker truck for transport to a suitable location for treatment before disposal since it will be sediment laden. Inspections of current UG works in Dehradun showed that two methods of open trench works were being used by UPCL, 1) open trench with the cables laid within (

217. Figure 11: Open Trench with Buried Pipes, Dehradun

Figure 12: Covered Chamber Construction, Dehradun

218.) in an open trench, and 2) open trench with a covered chamber which can be accessed for cable inspection (Figure 12). Several potential issues relating to the construction methods were identified during site visits. These issues are discussed further in Section 8 as potential impacts and measures are proposed to mitigate these issues.

Figure 11: Open Trench with Buried Pipes, Dehradun

Source: Consultants own photo. 2023

Figure 12: Covered Chamber Construction, Dehradun

Source: Consultants own photo. 2023

219. Open Trench with Buried Cables - Once the trench excavation is completed, the bottom of the trench has to be prepared for cable laying. Once the cable is laid, again a sand layer of 100 mm is applied above the conductor as a back-filling layer. The cable has to be protected from damage in case of any excavations by unknown parties. For that, concrete cable tiles have to be laid on the sand layer to cover the cable from impacts.

220. Once the trench is prepared for cable laying with spreading of sand at the bottom, the cable can be pulled along the trench. For laying the cable, the cable drum has to be placed in a suitable place at the end of the trench and has to be supported by jacks such that the drum can be easily rotated to pull the cable out. The cable has to be pulled out from the top of the drum and not from the bottom. To prevent any damages to the cable and also for the ease of pulling, rollers have to be placed along the route within a gap of 5 m. The correct method of pulling is to use a winch (usually diesel powered, to be mounted on a drip tray) and apply suitable tension which is below the maximum pulling tension specified by the manufacturer. As most of the damages to the sheath occur during the pulling of the cable, the activity has to be completed with extreme care. If multiple cables are laid on the same trench, cables have to be laid in the trench first and each cable has to be adequately separated from each other manually before the backfilling with sand. Generally, it takes some time for completing the end terminations and hence both ends of the cable have to be protected from moisture by properly sealing with end caps. Once completed, the trench is back-filled.

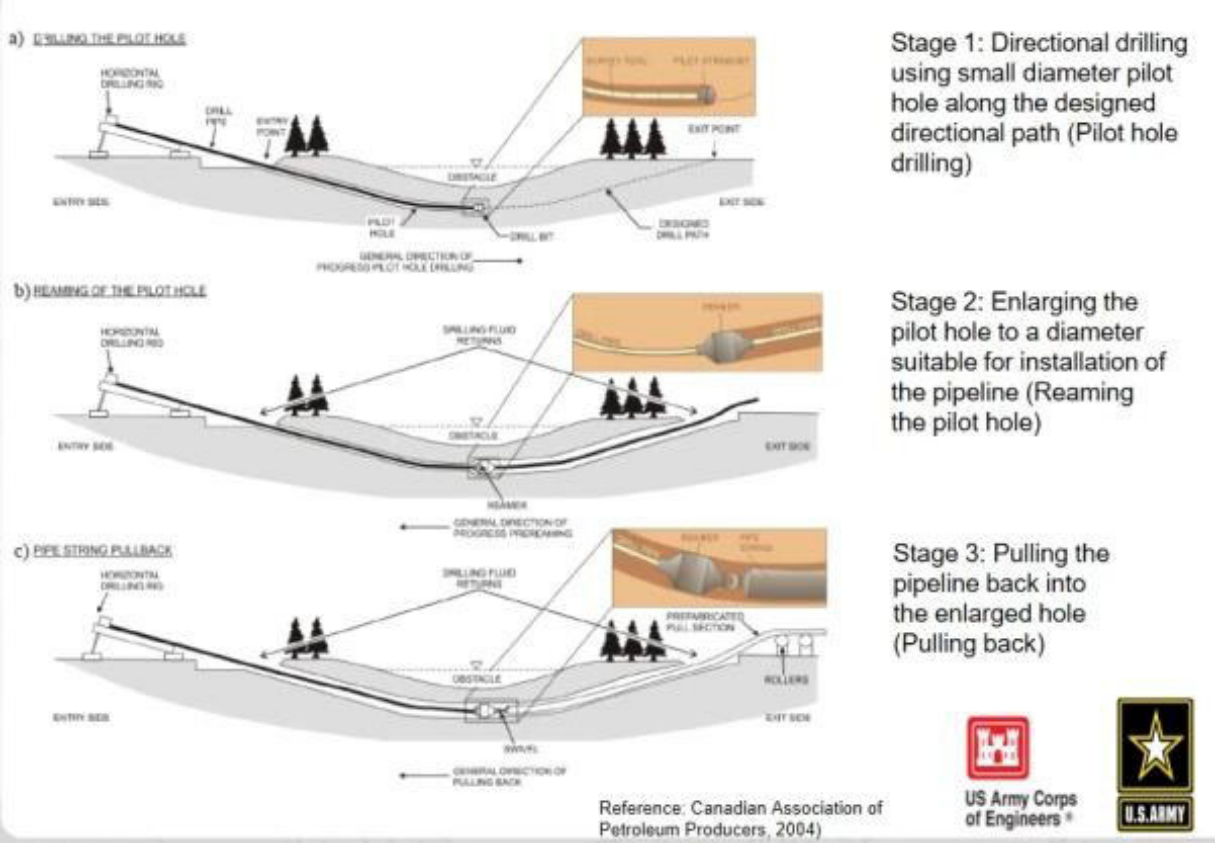
221. **Horizontal Direct Drilling (HDD)** - Instead of open trenching a drilling rig is setup at one end and entry and exit pits excavated, this minimizes the amount of surface level disturbance (Figure 13). First a small diameter (25 to 125 mm) drill penetrates the ground at the entry point at a predetermined angle and drills a hole beneath the above land until it reaches the exit point. Then the duct/cable is pulled through the hole with water used as a drilling fluid to reduce noise and vibration and lubricate the sides of the drill hole. Residual cuttings will need to be disposed and entry and exit points backfilled as with open trench method. The length of cable that can be fed in one go depends on the terrain and alignment but is usually between 100 and 150m. The physical construction footprint is much smaller for HDD, as shown in the photos of on-going HDD works for UPCL in Dehradun (

Figure 15: HDD Drilling Machine, Dehradun

222. *Figure 14: Entry point for HDD, Dehradun*

223. and Figure 15). However, several potential issues relating to the use of HDD were identified during site visits. These issues are discussed further in Section 8 as without adequate mitigation they are considered to represent potential risks during the construction phase of the Project.

Figure 13: HDD Process



224. Spoil Disposal and Site Restoration: open trenching will generate spoil. HDD will also generate some excess spoil. While most of the spoil will be reused in backfilling the remaining excavated spoil which is not suitable for reuse in construction will need to be disposed of off-site to a suitable licensed waste management facility as inert waste.

225. Construction and site restoration for underground cable installation will need to be undertaken on a rolling basis to minimize disturbance. Once construction is completed, all roadways, landscaped areas, and other areas will be restored to their original condition with roadways restored to take running traffic again and landscaped and other areas restored with topsoil that was previously stripped and stockpiled or with new topsoil. Any infrastructure impacted by the construction such as driveways, curbs, and other utilities are restored to their previous function.

226. The physical construction footprint is much smaller for HDD, as shown in the photos of on-going HDD works for UPCL in Dehradun (

Figure 15: HDD Drilling Machine, Dehradun

227. *Figure 14: Entry point for HDD, Dehradun*

228. and Figure 15). However, several potential issues relating to the use of HDD were identified during site visits. These issues are discussed further in Section 8 as without adequate mitigation they are considered to represent potential risks during the construction phase of the Project.

Figure 14: Entry point for HDD, Dehradun

Source: Consultants own photo. 2023

Figure 15: HDD Drilling Machine, Dehradun

Source: Consultants own photo. 2023

229. **Compact Substations** – CSS will be located around the city – but only located on public land on main roads. The specific locations of the CSS are not yet confirmed, and the avoidance of all environmental and social sensitivities will need to be confirmed during project implementation, checklists included in the EMP are to be completed for each location and, as necessary, the IEE will be updated. These small boxes, approximately 3 meters long, two meters wide and two meters high will be connected to the underground cabling and will house the following components (examples of CSS in Figure 16):

- HT Switchgear (comprising Vacuum Circuit Breaker in SF6 insulated enclosure)
- Cast Resin, Dry Type Transformer – no oil insulated transformers will be used
- 433V LT indoor panel with Aluminum Bus bars of suitable size
- Interconnection between HT switchgear and transformer

Figure 16: Examples of Compact Substations

Source: https://www.orecco.com/how-does-compact-substation-work/

230. CSS are prefabricated units and will be delivered to their required locations for installation on concrete pads (constructed accounting for relevant seismic standards). Specific requirements relating to environmental, health and safety included in technical specifications used for bidding include:

- The prefabricated-package substation shall be designed for a) compactness, b) fast installation, c) maintenance free operation, and d) safety for worker/operator and public.

- Labels for warning, manufacturer's operating instructions etc. shall be durable and clearly legible.

Figure 17: New CSS, Dehradun

Source: Consultants own photo. 2023

Figure 18: New RMU, Dehradun

Source: Consultants own photo. 2023

231. **Ring Main Units** – RMUs will also be located across the city. The specific locations of the RMU are not yet confirmed and the avoidance of all environmental and social sensitivities will need to be confirmed during project implementation, checklists included in the EMP are to be completed for each location and, as necessary, the IEE will be updated. These units are also small, prefabricated units connected to the underground cabling and that are located on concrete pads. Specific measures relating to environmental, health and safety included in technical specifications include:

- The SF_6 insulating medium shall be constantly monitored via a temperature compensating gas pressure indicator offering a simple go, no-go indication.

- The RMU should have provision of gas filling at site in case there is some leakage of the gas.

- The RMU shall be designed in accordance with Specification for technical grade sulphur hexafluoride (SF_6) for use in electrical equipment - IEC 60376

- Any accidental overpressure inside the sealed SF_6 chamber shall be limited by the opening of a pressure-limiting device in the enclosure so that the gas will be released away from the operator and to the rear top of the tank without endangering the operator or anyone else in the vicinity of the RMU.

- Design of RMU shall be tamper and arc proof.

- The RMU design shall be such that access to live parts shall not be possible without the use of tools.

- RMU shall be constructed accounting for relevant seismic standards.

3.5.2. Construction of New MLV Substations

232. Three new MLV substations will be constructed. Table 25 provides a summary of their types and locations. The location of these substations is shown in Figure 54, Figure 55 and Figure 56.

Table 25: New MLV Substations

#	SS Name	Division/Sub-Division	Type of SS	Approximate Area (hectares)
	District	US Nagar		
1	Near Collectorate	Rudrapur	2X10MVA, 33/11kV AIS	0.056
2	Bharauni	Sitarganj	2X5MVA, 33/11kV AIS	0.1824
	District	Nainital		
3	Kaniya	Ramnagar	2X5MVA, 33/11kV AIS	0.2
Total				**0.4384 hectares**

Source: UPCL

Footprint

233. The approximate area of each substation is on average 0.15 hectares in size (1,500m^2) – approximately a quarter of the size of a football pitch. As the land parcels for proposed three new UPCL sub-stations were owned by Government and there are no encroachers or squatters on these land parcels, no involuntary resettlement impacts are envisaged.

Design

234. Design of the SS shall follow the Draft Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2021. Substations will also be constructed accounting for relevant seismic standards. Relevant environmental considerations from the regulations are as follows:

235. *Selection of Site* - The selection of the site of the sub-station shall be done based on the following:

- The site shall take into consideration the capacity and location of the feeding grid sub-station, load in the area, spatial load forecast, demographic factors, the existing network configuration, etc. and the economic, and environmental considerations.

- The site shall be near the load center.

- The site shall not be in a low-lying area to avoid flooding during the rains.

- The site for air-insulated sub-station shall be away from garbage dumping ground to avoid vulture faults.
- The land shall be reasonably levelled and shall not have any open drain or nallah or road crossing it.

236. *Batteries* - 24V, 30V, 48V, 110V, 220V DC batteries shall be stationary lead acid or nickel cadmium or lithium-ion type. The batteries shall conform to relevant IS. A separate room for substation batteries will be provided with ventilation and exhaust fan for taking out fume gases and provision of remote monitoring of substation batteries (if not staffed) and exhaust fan will also be made.

237. *Oils and SF_6* - Oil and SF_6 filling, evacuation, filtering and testing plants with adequate storage facilities along with requisite operation and maintenance (O&M) tools and plants shall be provided for a cluster of sub-stations as per requirement. Transformer will comprise a soak pit and oil collecting pit per the specifications above for PTCUL substations.

238. *Safety and Security* - Fencing or boundary wall shall be provided around the sub- station as per CEA (Measures relating to Safety and Electric Supply) Regulations, 2010 as amended from time to time.

239. *Fire Fighting System* - The firefighting system at the substations shall be as per Central Electricity Authority (Measures relating to Safety and Electricity Supply) Regulations, 2010 as amended from time to time. Fire extinguisher used in the firefighting system shall conform to relevant IS.

240. *Circuit Breakers* - Circuit breakers (CBs) shall comply with the relevant IS and shall be SF_6 or vacuum type.

241. *Lighting* - Designs will ensure all lighting is of energy efficient LED type with solar powered LED lighting where practical Use of fluorescent/HPSV lamps will be avoided since they are less energy efficient/classed as hazardous waste for purposes of disposal. Outdoor lighting to be installed will be of low intensity with little or no blue wavelength and operated using passive infrared (PIR) technology movement sensors set at person height so as not to be kept permanently on overnight, it must be directional and shielded, so light does not fall outside substation boundaries.

242. For new bore wells for operational water supply at substations, approvals shall be obtained from authorities before they are installed. Treatment system will be provided to ensure all drinking water meets Government of India drinking water standards.

Construction and Operation

243. Construction and operation per the requirements of the new PTCUL substations described above.

3.5.3. Construction of Additional 33/11 kV Overhead and Underground MLV Power Lines

244. Two additional overhead MLV power lines and one underground MLV cable are planned. The locations of the lines are provided in Figure 69, Figure 70 and Figure 71. The 33kV overhead lines are typically pole structures as shown in Figure 19. The 33kV UG line will be constructed per the UG MLV works in Dehradun and connects to an existing substation which has been audited as part of this IEE. The routings used in this IEE are indicative and will be finalized by the EPC contractor after the detailed survey – at which point the IEE will need to be updated if the routing changes from that currently assessed.

Table 26: 33/11 kV Overhead / UG Lines

#	Connecting Substation	District	Length (km)	Type
1	132/11 kV, (2 X 10 MVA), Near Collectorate	U.S. Nagar	4	OHL
2	132/11 kV, (2 X 5 MVA), Bharauni	U.S. Nagar	10	OHL
3	132/11 kV, (2 X 5 MVA), Kaniya	Nainital	10	UG
Total			24	

Source: UPCL

245. These overhead power lines will be on single poles and double poles (Figure 19) and hence do not cause any major inconvenience or loss of land during their construction process. The RoW restrictions are not put in case of these lines although safety clearances must be maintained. Hence, the land requirements for poles are insignificant. However, there are chances of damage to crop, trees, or other assets during the construction. Such unintentional damages will be compensated as per the provisions of Electricity Act 2003 and the resettlement plan.

Figure 19: Typical 33/11 kV Poles and Conductor Arrangement

Source: https://cea.nic.in/wp-content/uploads/notification/2021/04/Draft%20_Standard_Technical_Specification_for_Steel_Pole_strcutrues.pdf

246. Construction activities for this type of line are much less intrusive that for HV overhead power lines. The following items are typically required for the construction of 33/11kV power lines:

- Concrete Poles
- Support of cross arms
- Cross arms[42]

[42] A cross-arm is secured to a pole and used to mount various types of circuit protection devices and support distribution conductors.

- Post insulators[43]
- 3 Phase disconnector and surge arresters[44]
- Fuses
- Conductor and cable
- Polyvinyl Chloride (PVC) pipe
- Anchors[45] and guy wires[46] / push guys[47]

247. The following equipment is required for the construction phase:

- Truck mounted Auger
- Arial Work Platform 'cherry picker'
- Truck
- Mobile Crane with Claw Arm
- Survey Equipment
- Mobile compactors

248. The key tasks involved in the construction works include:

- Inform local community in advance of works and any potential electricity disruptions.
- Move equipment to site using trucks.
- Prepare worksite, including erection of warning signs and safety fences.
- Drill / dig new footings for poles.
- Erect new poles.
- String lines using cherry pickers.
- Remove any waste materials, such as packaging waste, scrap wires, etc. and restore the site.

249. For new 33 kV and 11kV power lines, the construction for 1 km length shall be approximately 18-21 days (approximately 5 days for digging and erection of poles, 2-3 days for the installation of accessories, 10-12 days for stringing and 1 day for commissioning). Approximately 10 workers will be required.

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[43] An insulator is a material that prevents the flow of an electric current and can be used to support electrical conductors. The function of an insulator is to separate the line conductors from the pole. Insulators are fabricated from porcelain, glass, and fiberglass, treated with epoxy resins and rubberlike compounds.

[44] Transformers and other equipment on pole lines are very expensive to purchase and very time-consuming to install. To keep them in good working order, you must protect them from overcurrent and overvoltage conditions. You do this by installing protective devices.

[45] The anchor is the foundation of the pole line, and its purpose is to take the strain of all the weight of the equipment installed on a pole line. For example, on a straight pole line the strain of equipment, hardware and conductor support devices is distributed evenly along all the poles through the conductors. At the end of a pole line, or wherever the pole line changes direction, the strain is borne by only one pole. If left unsupported, this one pole will slowly be pulled toward the rest of the pole line until it collapses. To prevent this, a guy wire and anchor are installed. The guy wire transfers the strain from the pole to an anchor that is firmly imbedded in the earth.

[46] A guy is a brace or wire fastened to the pole to strengthen it and keep it in position.

[47] A push guy, or a push brace, is used when it is impossible to use down guys. When it is impossible to obtain sufficient right-of-way for a pole guy, the push brace can usually be installed.

Operation and Maintenance

250. During the operation and maintenance phase, regular activities that will be implemented include routine monitoring and inspection by UPCL O&M staff to check the condition and integrity of poles and lines and that the required right of way is being maintained. Maintenance activities will include replacement of missing or corroded parts, repairing any breaks in the system, and the trimming of trees and vegetation if required. The clearing of vegetation will be done manually without the use of heavy equipment and herbicides.

3.5.4. Rehabilitation and Upgrading of Existing Substations

251. 25 existing UPCL substations will be rehabilitated and upgraded. The locations of the substations can be found in the associated environmental audit completed for this activity, Appendix P.

Table 27: Substations to be Upgraded

#	SS Name	Division/Sub-Division	Type of SS
	District	**Dehradun**	
1	Sahastradhara	Sahastradhara, Dehradun (N)	33/11 kV GIS
2	Hathibarakala	Hathibarakala, Dehradun (N)	33/11 kV GIS
3	Sahiya	Sahiya, Vikasnagar, Dehradun Rural	33/11 kV AIS
4	Sawra	Sawra, Vikasnagar, Dehradun Rural	33/11 kV AIS
5	Rudrapur	Rudrapur, Vikasnagar, Dehradun Rural	33/11 kV GIS
6	Ramnagar Danda	Ramnagar Danda, Doiwala, Dehradun Rural	33/11 kV AIS
7	Lal Tappar	Lal Tappar, Doiwala, Dehradun Rural	33/11 kV AIS
	District	**Almora**	
8	Tarikhet	Tarikhet, Ranikhet, Almora	33/11 kV AIS
9	Bajol	Bajol, Ranikhet, Almora	33/11 kV AIS
10	Lamgarah	Lamgarah, Almora, Ranikhet	33/11 kV GIS
11	Sairaghat	Sairaghat, Almora, Ranikhet	33/11 kV GIS
	District	**Nainital**	
12	Kamalwaganja	Kamalwaganja, Haldwani Rural	33/11 kV AIS
13	Transport Nagar	Transport Nagar, Haldwani Rural	33/11 kV AIS
14	Phoolchaur	Phoolchaur, Haldwani Rural	33/11 kV AIS
15	Garampani	Garampani, Nainital, Haldwani	33/11 kV AIS
16	Talla Ramgarh	Talla Ramgarh, Nainital, Haldwani	33/11 kV GIS
17	Sarghakhet	Sarghakhet Mukteshwar, Nainital, Haldwani	33/11 kV AIS
18	Pines	Pines, Nainital, Haldwani	33/11 kV GIS
	District	**US Nagar**	
19	Matkota	Matkota, Rudraur-I	33/11 kV AIS
20	Bhadaipura	Bhadaipura, Rudraur-I	33/11 kV AIS
21	Lalpur	Lalpur, Rudraur-I	33/11 kV AIS
22	Sitarganj	Sitarganj, Rudraur	33/11 kV AIS
23	Jhankat	Jhankat, Khatima, Rudrapur	33/11 kV AIS
24	Kashipur	Kashipur,	33/11 kV AIS

#	SS Name	Division/Sub-Division	Type of SS
25	Doraha	Doraha, Bazpur	33/11 kV AIS

Source: UPCL

Footprint

252. All works will be undertaken within the existing substations.

Design

253. The design of the substation rehabilitation and upgrades will be in accordance with Government of India requirements and international good practice regarding technical and environmental, health and safety performance standards as set out in the WBG EHS Guidelines. Use of PCBs and all asbestos containing materials will be prohibited. Any temporary labor camps will be set up within the substation boundaries except for Hatibarakala, Tarikhet, Lamgarah, Sawra, Sairaghat, Pines, Transport Nagar, and Garampani substations, which have limited available space within project footprint. Time to be taken for construction will be about 6 months for electrical and mechanical upgrading and 12 months with civil works involved requiring about 7 skilled and 12 unskilled workers.

254. Designs will ensure all lighting is of energy efficient LED type with solar powered LED lighting where practical. Use of fluorescent/HPSV lamps will be avoided since they are less energy efficient/classed as hazardous waste for purposes of disposal. Outdoor lighting to be installed will be of low intensity with little or no blue wavelength and operated using passive infrared (PIR) technology movement sensors set at person height so as not to be kept permanently on overnight, it must be directional and shielded, so light does not fall outside substation boundaries.

255. All the 25 substations are in zone IV for seismic activity. New equipment installed in the substations shall be installed on foundations having proper seismic design conforming to IS 1893 for seismic analysis, IS:1893-84 for seismic zone and IS 2.2.4 for seismic acceleration whilst it will need to be confirmed that the existing control rooms of substations have been adequately constructed in the past to meet these requirements.

Construction and Operation

256. The substations shall be upgraded with completely new equipment involving the following construction activities within the existing boundary of the substations and on land owned by UPCL:

- Site survey and design,
- Establishment of construction site, storage area, labor camp,
- Sourcing and transportation of material and equipment,
- Site clearance including dismantling of old foundations and equipment (if required),
- Site levelling and earthworks (if required),
- Foundations with concrete (if required),

- Installation of transformers and electrical equipment,
- Upgradation and modernization of existing control rooms at substations including for staff sanitation and welfare,
- First aid, PPE, and firefighting arrangements,
- Testing and commissioning prior to operation.

Table 28: Summary Features of Upgraded Substation Works Involved

Key Features		Particulars
Land ownership and footprint	Permanent works	• UPCL land, within existing substations and electrical sub-division office, no civil and electrical works are required to take place outside of the existing UPCL boundaries. • No land acquisition involved
	Temporary works e.g., construction camp, material storage site	• UPCL land available within the existing substations areas, except (<10% available space) for Hatibarakala, Tarikhet, Lamgarah, Sawra, Sairaghat, Pines, Transport Nagar, and Garampani substations which will need to find land outside. Hatibarakala is located with the Survey of India, GoI compound and will need permission for construction works within the premises of SOI as well as additional space elsewhere within or outside the premises. There is not much space outside the substation. Tarikhet, Lamgarah, Pines, Sawra and Sairaghat are located on elevated terrain and constrained by space. They will have to set up work camps below the substations. Except for Sawra and Sairaghat, the others have abandoned staff quarters attached to control rooms, which can be utilized after repair and renovations.
Construction	Construction method	• Per the construction method statement of works EPC contractor • Manual construction with the involvement of powered mechanical equipment • Piling and blasting is not envisaged
Access	Access for construction	• Existing road network available at most of the substations, but entry to the **Lamgarah substation needs to be repaired and connected to the access road in front for entry of vehicles**. Substations on high altitudes like Pines, Bajol, Sairaghat, Lamgarah, have elevated and sloping pathways, without steps to enter substation from the access/main road. Vehicle movement will not be possible for Pines substation as it is narrow, very steep and with sharp bends.
	Transportation of materials and equipment	• By existing roads, highways, railways, or combination as per the logistics plan of EPC contractor • High altitude, not well maintained, with sharp bends and turns, and landslide prone roads needs to be covered to reach Sahiya, Sawra, Pines, Tarikhet, Bajol, Lamgarah substations.
Construction	Batching Plants etc.	• Unlikely to be required given small scale of construction works, although it will be for final determination of EPC contractor if they wish to utilize. • Construction plant are only to be set up at site after obtaining Consent to Establish and Consent to Operate from the UPCB
	Equipment	• EPC contractor would bring their own construction equipment and machineries including transport vehicles for workers and

Key Features		Particulars
		equipment, heavy materials handling facilities like mobile crane, forklift, (specially for high altitude substations) etc.
Materials	Cement and steel	• Direct from cement and steel plants (bulk quantity) with valid environmental clearance, CTE and CTO or (if the quantity is less) wholesale distributors in the nearest settlement, source/brand shall be approved by UPCL • Multiple cement plants are operational in Uttarakhand, and can be transported through road to the substation sites
	Sand	• Direct from local approved quarries with valid EC, CTE and CTO
	Stone Aggregates	• Direct from suppliers with valid EC, CTE and CTO for crusher, stone aggregates located in Uttarakhand.
	Electrical, Mechanical and Instrumentation Parts	• Direct from Original Equipment Manufacturers (OEM) or authorized distributors as per the Technical Specifications and as approved by UPCL • Transformers to be installed will all be certified as PCB free
Other Resources	Power	• Temporary diesel generator (DG) set will be required during substation renovation works
	Water	• EPC contractor will determine if they source canned drinking water from an existing supplier (as the preferred option) or provide treated water for workers; all drinking water provided will be regularly tested and confirmed to meet Government of India drinking water standards, if the contractor provides their own supply permissions shall be obtained from authorities (PWD) with the agreement of local communities/village councils. • Other construction water to be obtained from existing local ground / surface water sources depending on site conditions to be determined by the contractor, permissions for which shall be obtained from authorities with agreement of local communities/village council. • For new bore wells for operational water supply at substations, (if required) approvals shall be obtained from authorities before they are installed. Treatment system will be provided to ensure all drinking water meets Government of India drinking water standards
Labor	Workers camps	• Construction labor camps/existing vacant staff quarters, within substations / UPCL land to be determined by contractor (if such land is not available then the contractor to submit all necessary documents demonstrating agreement for temporary land use with a private landowner to UPCL, including land ownership papers etc.) • Per design approved by UPCL and to contain all basic requirements (beds and beddings, mosquito nets, artificial lights, natural lights, windows and ventilation, fans, emergency exits, firefighting equipment, kitchen and dining halls, mobile charging points, toilets and washing facilities, potable drinking water, recreational space). • Design of labor camps shall conform to WBG EHS guidelines, ILO's guidance on worker accommodation[48] and regulations of Government of India

[48] https://www.ilo.org/wcmsp5/groups/public/@ed_emp/@emp_ent/@multi/documents/publication/wcms_116344.pdf

Key Features		Particulars
	Construction staffing	• Most of the works required are manual labour intensive with the involvement of powered mechanical equipment • The exact size of the workforce including the number of unskilled, semiskilled, and skilled shall be determined by the EPC contractor based on the project scheduling which shall be approved by UPCL • For working with electricity and at height only suitably qualified and experience labor will be used • Both local and external laborer shall be utilized for which the contractor shall obtain labor licenses and Workmen Compensation Insurances
Wastes	Specific type of waste generated	• Non-hazardous waste includes all domestic and kitchen waste, packaging wastes including plastics, paper, cardboard, wood, etc. construction waste such as concrete, brick, rubble, iron scrap etc. • E-waste: broken or used electrical equipment • Hazardous waste: used transformer oil, empty metal or plastic fuel/oil/chemical containers, transformer oil or solvent-soaked rags, used batteries etc. • Removed electrical and mechanical equipment will be handed over to UPCL or transported to designated UPCL Zonal/Divisional warehouse as per the direction of UPCL • UPCL will reuse or recycle using UPCB authorized vendors as per the condition of the equipment, if fit for use they will be stored for reuse by UPCL or they will be auctioned off as scrap material • Disposal of old transformers and other hazardous wastes shall be as per the Hazardous and Other Wastes (management and transboundary movement) Rules, 2016, Government of India. • Other wastes will be recycled using UPCB authorized vendors or suitably engineered and licensed waste management facilities for inert or solid waste

CTE = Consent to Establish, CTO = Consent to Operate, EHS = environmental, health and safety, IFC = International Finance Corporation, OEM = Original Equipment Manufacturers, UPCB = Uttarakhand Pollution Control Board, UPCL = Uttarakhand Power Corporation Limited

257. During the operation and maintenance phase, regular activities that will be implemented include routine monitoring and inspection by UPCL staff to check the condition and integrity of transformers and switchgear. Maintenance activities will include replacement of parts and equipment repairs.

3.6. Component 3 – Gender- and Socially Inclusive Energy-Based Livelihood Activities

258. This component involves installation of roof-top solar in seven hilly districts. Minimal or no adverse impacts are anticipated from this activity. However, an EMP for this component has been prepared specifically relating to management of waste and health and safety during installation of the equipment (**Appendix S**).

3.7. Construction Camps

259. Construction camps (including equipment and materials storage areas) will be established for some of the Project sub-activities. The location of the camps will be determined by the EPC Contractor and no specific location for any camp site has been provided to date by PTCUL/UPCL, nor any specific plans for the number of camps required to cover the Project. However, siting of any camp will consider the sensitive site restrictions provided in this IEE, e.g., not locating within 50m of a water course or within 500m of residential areas.

260. In rural areas overhead LILO lines, Second Circuit Stringing and new PTCUL substations will need construction camps to be established. Camps will generally be no bigger than two hectares in size and will probably be arranged to group several sub-activities within the camp. For example, Khatima-II SS and Khatima-Sitarganj LILO are related works, so only one camp will be needed for this location serving both sub-activities. Sub-activities in towns, such as UG LILO cables and MLV UG cables, will not require camp sites with accommodation, as workers can be accommodated in existing housing. However, areas for storage of materials and equipment will be required for these works. Use can be made of available space at existing PTCUL / UPCL sites.

261. As noted above, some locations will need to carefully consider the topography of the sites and the potential to be affected by landslides. These issues, and those relating to water use, waste management, etc., and the requirements for the preparation of camp management plans prior to the start of construction are discussed further in the impact assessment section of this IEE.

3.8. Manpower and Equipment

262. Construction and installation works will be undertaken by dedicated teams consisting of specialized units. The following tables provide the estimate manpower and equipment requirements for the various stages of HV power line construction, UG cabling and substation construction.

Table 29: Estimated Manpower and Equipment – Overhead HV Power Line

#	Activity	Equipment	Manpower	Timescale
1	Surveying the centerline	• 2 Pick-up trucks	4 people	4 weeks
2	Clearing and grading activities	• Grader • Bulldozer (20t) • Pick-up truck	4-8 people	2 days per tower
3	Excavating and installing foundations	• Excavator (22t) • Bulldozer (20t) • 2 Backhoe (8t) • 2 pick-up trucks • 2 lorries (4 axle) • Pneumatic Tools • Piling equipment (if necessary)	6-8 people	4 day per tower
4	Assembling tower	• 2 pick -up trucks • 1 mobile crane • 2 lorries (4 axle)	10 people	10 days per tower
5	Erecting Tower by crane	• 1 crane • 2 pick -up trucks	6-9 people	2 days per tower

#	Activity	Equipment	Manpower	Timescale
		• 2 lorries (4 axle)		
6	Stringing conductors (including layout of equipment, unfolding of wires and raising and stringing)	• 1 crane • 2 pick -up trucks • 2 lorries (4 axle) • Mobile Bull wheel tensioners • Mobile Winch	10 people	2 to 3 days per tower
7	Earthing Tower	• 1 pick -up trucks • 1 Backhoe (8t) • Auger drill	4 people	2 days per tower
8	Cleanup and reclamation of affected areas	• Bulldozer (20t) • Backhoe (8t)	6 people	2 days per tower

263. Several crews of up to approximately 10 workers each will be required at each construction area for HV OHL, each crew is responsible for a specific construction assignment including laying the foundations for the towers, assembling the towers on the ground, raising the towers, installing the wires, etc. These crews will be engaged sequentially at each construction area as the construction of each length of HV power line proceeds. No blasting is foreseen by PTCUL. However, it may be possible that some piling works will be required in locations close to rivers and marshy areas (cast in-situ concrete). 132 kV D/C Power line on Panther conductor from Pithoragarh (PGCIL) – Champawat (Lohaghat) will use manual labour to string the second circuit. Discussions with PTCUL have indicated that between 100-200 people will be required for this activity.

Table 30: Estimated Manpower and Equipment – Substations (Construction)

#	Activity	Equipment	Manpower	Timescale
1	Surveying the site	• 2 Pick-up trucks	4 people	2 week
2	Clearing and grading activities	• Grader • Bulldozer (20t) • Pick-up truck	4-8 people	3 weeks
3	Transporting materials to the site	• 2 Pick-up truck • 2 Lorry (4 axle)	8-10 people	3 weeks
4	Construction of substation buildings	• 2 pick-up trucks • 2 lorries (4 axle) • 1 mobile crane • Pneumatic Tools	10-15 people	6 months
5	Installation of electrical equipment	• 2 pick -up trucks • 1 mobile crane • 2 lorries (4 axle)	10 people	4 months
6	Cleanup and restoration of affected areas	• Bulldozer (20t) • Backhoe (8t)	6 people	1 month

Table 31: Estimated Manpower and Equipment – UG cabling

#	Activity	Equipment	Manpower	Timescale
1	Surveying the site	• 2 Pick-up trucks	10 people	4 weeks
2	Clearing for trench excavation, CSS and RMUs	• Excavators • Lorries (4 axle)	20 people	Throughout construction phase
3	Excavating and installing foundations, CSS and RMUs	• Excavator • Backhoe • Pick-up trucks	20-30 people	Throughout construction phase

#	Activity	Equipment	Manpower	Timescale
		• Lorries (4 axle) • Pneumatic Tools		
4	Pipelaying and installation of electrical equipment	• Backhoe • Pick-up trucks • Lorries (4 axle) • HDD Machine	15 people	Throughout construction phase
5	Clean-up of affected areas	• Bulldozer (20t) • Backhoe (8t)	6 people	1 month

3.9. Cost and Schedule

264. The total investment cost of the project is estimated at $252 million (of which $200 million will be funded by ADB), including physical and non-physical components. The cost of the HV Power component 1 is expected to be approximately $136 million and the MLV Power component 2 approximately $113 million. Component 3 is estimated to cost $2 million and will be funded by JFPR. The actual completion of the project is expected to be completed within 5 years of project commencement.

Table 32: Proposed Project Schedule

Description	Indicative Timeframe			
	Packages 1-4	Packages 5 and 6	Package 7	Remaining Packages
Bidding Documents	March 2023	July 2023	October 2022	August/September 2023
Procurement	September / October 2023	December 2023 / January 2024	August 2023	March 2024
Construction Commencement	December 2023	March / April 2024	November 2023	June 2024
Project Completion	November 2026	March 2027	October 2026	May 2027
Defects Liability Period	October 2027	February 2028	September 2027	April 2028

3.10. Associated Facilities

265. There are no associated facilities for the Project. Components 1 and 2 will only provide system strengthening for the power system in Uttarakhand. New power lines and substations will be connected to the existing power system. PTCUL/UPCL is not constructing any dedicated power line/substation for a new power generation plant, and Component 1 is not dependent on any other projects going ahead. Further, Component 2 will only provide system strengthening for UPCL with underground cables connected to the existing MLV system.

3.11. Prohibited Items and Activities

266. The following items will be prohibited:

- PCBs will not be permitted for use in any equipment in substations. Equipment purchased for use on the Project to be accompanied by a letter from the manufacturer and material safety data sheet for insulating oil used confirming that it is guaranteed PCB free and labelled as PCB free.

- Processes, equipment, and systems are not to use chlorofluorocarbons (CFCs), including halon.

- No asbestos containing materials of any type will be used in the design and construction of project facilities.

- Use of herbicides or burning to clear vegetation is strictly prohibited.

- No forced or child labor to be employed in construction with the minimum age for employment on construction site to be 18 given hazardous nature of works involved.

267. Further, the Project shall not engage in any activities described on the ADB Prohibited Investment Activities List in Appendix 5 of ADB's SPS (2009).

IV. ANALYSIS OF ALTERNATIVES

4.1. General

268. One of the objectives of an IEE is to investigate alternatives to the Project. In relation to a proposed activity "alternative" means different ways of meeting the general purposes and requirements of the proposed activity. The following section provides an assessment of the 'no action' alternative, alternative locations, alternative substation and switchgear technologies, alternative power line types etc.

4.2. 'No Project' Alternative

269. The "No Action" Alternative in this instance is defined as a decision not to undertake the proposed construction of the Project components. The alternative would have no direct negative environmental impacts since no construction works would be involved.

270. However, the energy infrastructure would remain at risk from climate change impacts (discussed below under Impacts and Mitigation, Section 8.2.2). Further, the system will be unable to adequately manage emergency requirements and provide alternate feeding arrangements for high-risk areas. Further, the no project alternative would fail to provide the following benefits envisaged by the project:

- developing women's leadership in the utility; exposing girls and young women to the opportunities in power sector as well as supporting rural women enhance their livelihoods through renewable energy technologies.
- support smart metering and distribution strengthening.
- improve the energy security and quality & reliability of power and help in renewable energy integration.

271. In addition, Uttarakhand, will not be able to cope with the increasing demand and the existing power system will remain over-loaded, line losses will also remain high, and the system reliability will progressively decrease, with increasing pressure on the system. Both utilities, UPCL and PTCUL will also forego the opportunity of increasing its consumers' base as well as revenue associated with the system expansion. In view of the above, the 'no project' option is not a preferred alternative.

4.3. Alternative Locations

4.3.1. HV Power Lines

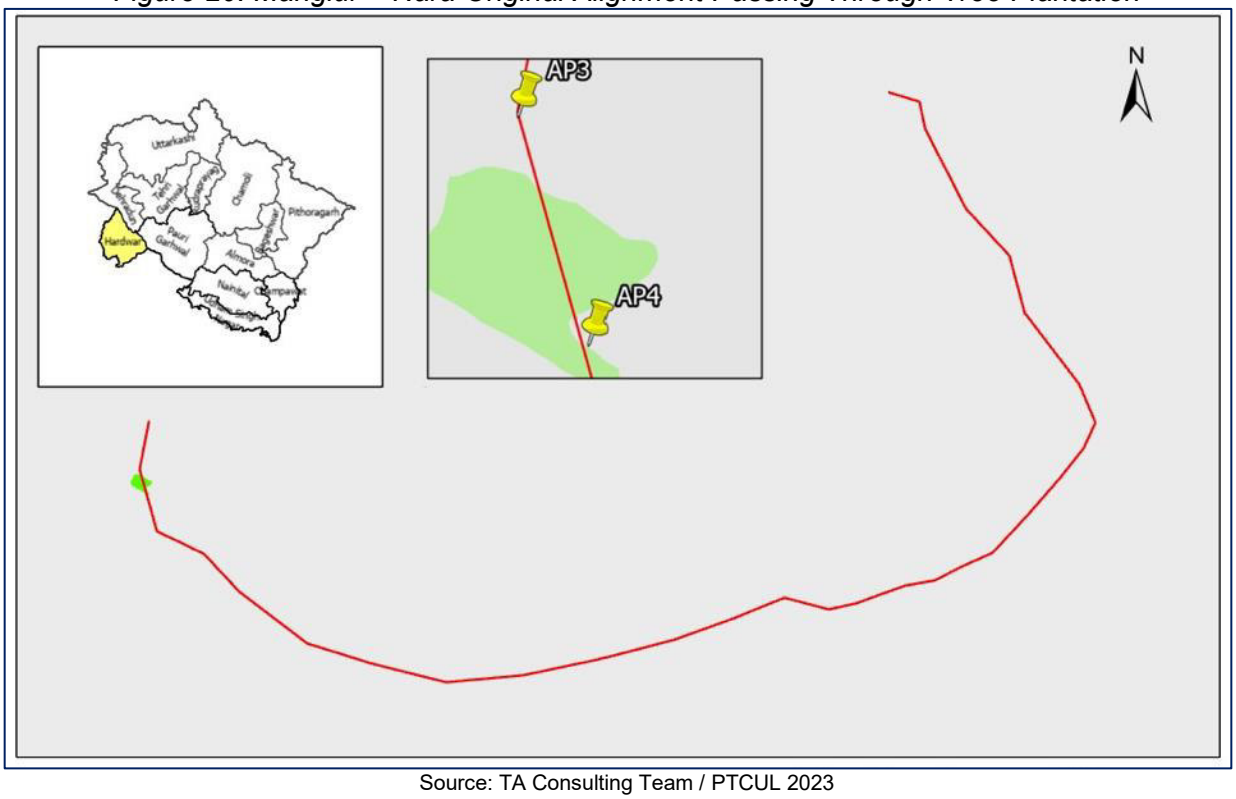
272. The most economical construction options of HV power lines are the options on the straight lines. However, the presence of residential buildings along the alignment, natural obstacles and other utilities along the alignment mean that this is not always possible and at some locations the alignment needs to alter direction slightly. Thus, the selected alignments follow the most direct route between the start and end points of the alignment whilst avoiding these features. No other less intrusive, or more economical alignment is possible given these

considerations. However, this IEE has identified three 'micro-alignment' changes required and agreed with PTCUL:

- Khatima – Sitarganj LILO – end point relocated to avoid reserve forest (not shown).
- Mangalur – Nara LILO rerouted around a tree plantation (Figure 20 and Figure 21).
- Mahuwakheraganj – Jaspur LILO rerouted around a tree plantation (Figure 22 and Figure 23).

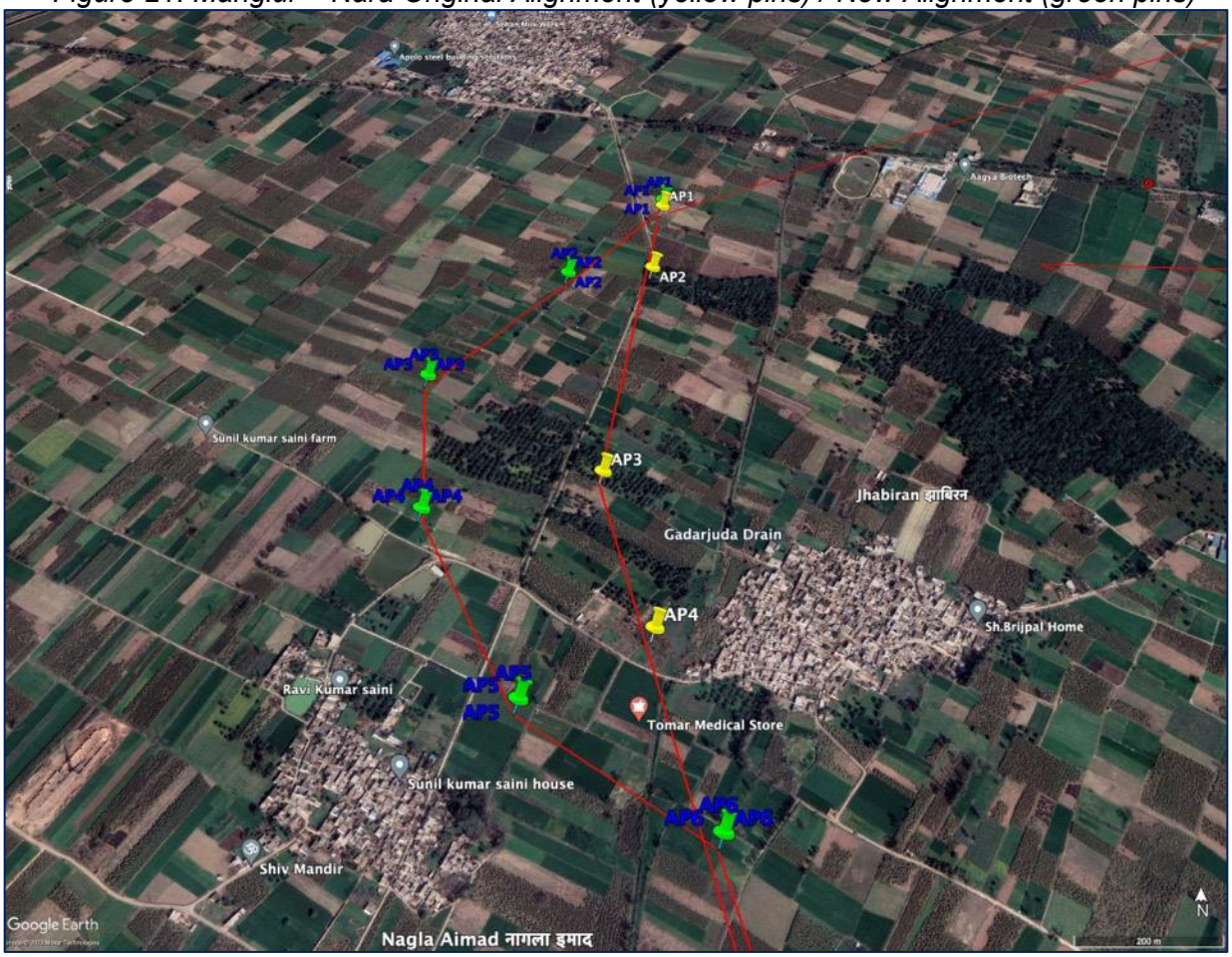
273. Further micro-alignment' changes at some locations may be necessary and will be determined during the detailed design prepared by the EPC Contractor. This IEE will be updated during detailed design considering any of the micro-alignment changes.

Figure 20: Manglur – Nara Original Alignment Passing Through Tree Plantation



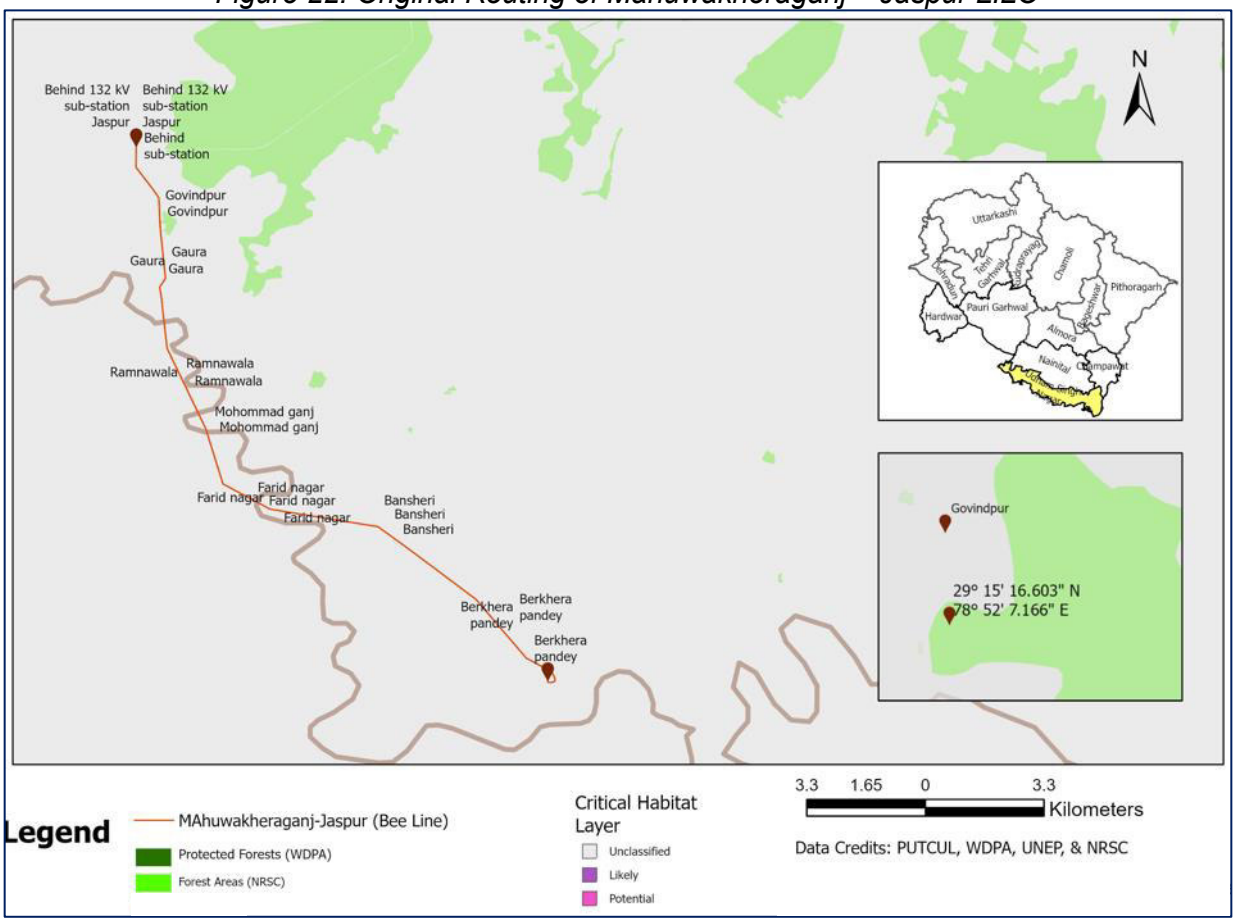
Source: TA Consulting Team / PTCUL 2023

Figure 21: Manglur – Nara Original Alignment (yellow pins) / New Alignment (green pins)



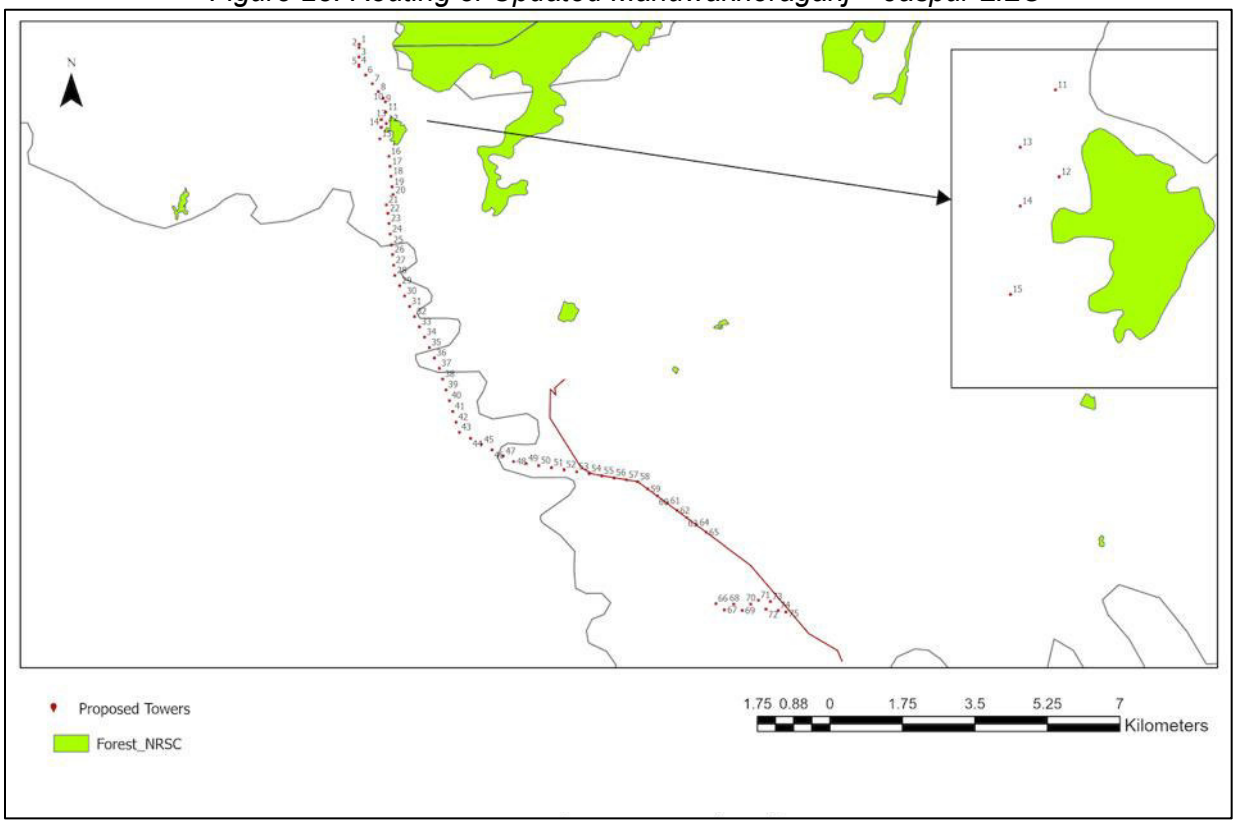
Source: TA Consulting Team / PTCUL 2023

Figure 22: Original Routing of Mahuwakheraganj – Jaspur LILO



Source: TA Consulting Team / PTCUL 2023

Figure 23: Routing of Updated Mahuwakheraganj – Jaspur LILO



Source: TA Consulting Team / PTCUL 2023

4.3.2. MLV Power Lines

274. The MLV UG works in Dehradun will replace existing overhead MLV power lines. No alternative 'location' is therefore considered. However, 'micro-alignment' changes at some locations may be necessary and will be determined during the detailed design prepared by the EPC Contractor. This IEE will be updated during detailed design considering any of the micro-alignment changes.

275. The Project originally intended to include the Kaniya MLV power line as an overhead 11/33kV line. Initial assessment by the Consultant revealed that this line overlaps, or borders with several key biodiversity features, including an KBA and the ESZ buffer zone of Corbett National Park (**Appendix A**). Further, this line is close to tiger and elephant corridors. Subsequently consultations have been undertaken with UPCL to discuss this issue and it has been agreed to underground the entire length of the alignment to limit the potential impacts to sensitive biodiversity features and special status species.

4.3.3. Substations

276. Several new substations (both HV and MLV) are planned. The locations have been selected by PTCUL / UPCL based on several criteria, including land availability and connectivity with the existing network as detailed in Appendix Y. The basic criteria for the selection of a substation are as follows:

- Load demand and power evacuation requirement.
- Site feasibility studies.
- Selection of a site close to the load center to minimize power losses
- Minimum length of power line.
- Selection of voltage level and capacity considering the availability of voltage level and power handling capacity.
- Load flow studies.

277. Selection of land on the basis of site suitability analysis/criteria for selection of land (e.g., size, ownership, number of owners, cost, land type, access, resettlement requirements, drainage, water supply, distance to protected area etc.) and considering environment aspects and technical Aspects as per CBIP Substation Manual (e.g., preference for flat land, not flood prone, avoid protected areas, away from populated areas, in areas of little scenic value etc.).

V. IEE APPROACH

5.1. Assessment Boundaries

278. The boundaries of the assessment (or the project area of influence) have been divided depending upon the specific environmental and social characteristic to be affected and the type of activity. For example, the potential area of impact for operational phase noise around a HV substation will be different to the potential area of impact upon soils which will be confined to the areas within the substation boundary. These boundaries are defined in Section 7 as part of the overall assessment process.

5.2. IEE Methodology

279. The methodology used to prepare this IEE is based on the requirements of ADB's Safeguard Policy Statement (2009) and the joint experience of the consultants involved in the IEE. Specifically, the methodology for this assessment is based on other recent disclosed Category B HV and MLV power projects funded by ADB.

5.2.1. Desk-top Data

280. Background data and information collected by the team was obtained from published and unpublished sources, e.g., on climate, topography, geology and soils, natural resources, flora and fauna, agriculture, and socio-economic data. Review of alignments using google earth was undertaken. References to all sources used is made throughout the report.

5.2.2. Site Surveys and Audits

281. Several site inspections of the Project area were conducted during 2022 and 2023. All substation sites were visited and where practical (due to access constraints and length of the lines), portions of the HV and MLV routes were observed.

282. The potential areas of impact have been inspected by the IEE Consultant during 2022-2023 and areas of potential environmental significance assessed carefully. Baseline ecological walkover surveys in 2022-2023 and instrumental physical environment monitoring (by an accredited laboratory in 2023) has also been undertaken. Socio-economic surveys by the ADB TA Social Safeguards Consultant Team (responsible for preparation of the Project Resettlement Plan) have been completed in 2022-2023 for areas around the new substations and HV / MLV power lines.

Table 33: Physical Monitoring and Surveys Undertaken

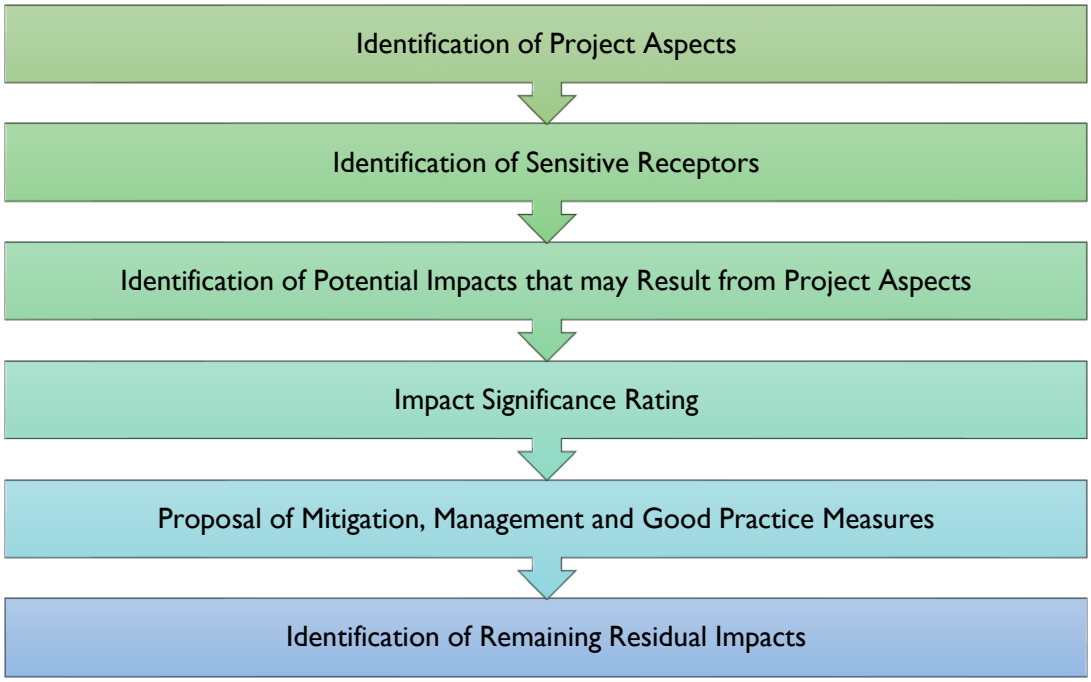
Topic	Survey
Noise	Monitoring of baseline noise conditions at substations
Air	Monitoring of baseline air quality at substations
Water	Monitoring of water quality at or close to substations
Social	Socio-economic Survey and Census
Soil	Monitoring of soil quality and substations
General site visit	To observe flora and fauna, and general site characteristics as well as the immediate areas around substations

283. Environmental audits of the existing substations have also been completed. The environmental audits were completed by the National Environmental Audit Consultant during visits to the substations. The consultant interviewed substation management and staff and inspected the site to observe site conditions and practices. Any 'non-compliances' with national regulations and best practice were recorded and have been added to this IEE as part of a corrective action plan (CAP). The environmental audit can be found in full as Appendix P.

5.2.3. Impact Assessment Methodology

284. This IEE follows a set format during the impact assessment process. As shown in the Table 34 flow chart and described further below.

Table 34: Impact Assessment Process



Project Aspects

285. Firstly, the main environmental aspects of the Project are noted. An environmental aspect is any activity of the Project that interacts with the environment. E.g., an aspect of the Project that may impact upon air quality will be the movement of construction vehicles on unpaved roads through rural settlements.

Identification of Sensitive Receptors

286. Once the main aspects of the Project have been identified any sensitive receptors within the Project area of influence are noted. Examples of sensitive receptors include residents, rivers, groundwater, birds, etc. Identification of receptors is a key part of the impact assessment process as without a receptor there will be no impact. For example, if a substation

generates significant noise but there are no sensitive receptors who can hear the noise, then there will be no noise impact on them.

Identification of Significant Environmental Aspects

287. Thirdly, the potential impacts of the identified aspects are outlined and how they could impact upon the identified receptors, in the case above, this could be the movement of a construction vehicles creating dust on an unpaved road which impacts upon local villagers.

288. The significance of an impact is determined based on the product of the consequence of the impact and the probability of its occurrence. The consequence of an impact, in turn, is a function primarily of three impact characteristics:

- magnitude
- spatial scale
- timeframe

289. Magnitude is determined from quantitative or qualitative evaluation of several criteria including:

(i) Sensitivity of existing or reasonably foreseeable future receptors.
(ii) Importance value of existing or reasonably foreseeable future receptors, described using the following:
  (a) level of public concern.
  (b) number of receptors affected.
(iii) Severity or degree of change to the receptor due to impact, measured qualitatively or quantitatively, and through comparison with relevant thresholds:
  (a) legal or guideline thresholds—established by law or regulation, or international good practice guidelines
  (b) functional thresholds if exceeded, e.g., impacts will disrupt the functioning of an ecosystem sufficiently to destroy resources important to the nation or biosphere irreversibly and/or irretrievably
  (c) normative thresholds – established by social norms, usually at the local or regional level and often tied to social or economic concerns
  (d) preference thresholds—preferences for individuals, groups or organizations only, as distinct from society at large
  (e) reputational thresholds—the level of risk a company is willing to take when approaching or exceeding the above thresholds

290. Spatial scale is another impact characteristic affecting impact consequence. The spatial scale of impacts can range from localized (confined to the proposed project sites) to extensive (national or international extent). They also may vary depending on the component being considered.

291. The impact timeframe is the third principal impact characteristic defining impact consequence and relates to either its duration or its frequency (when the impact is intermittent). Impact duration can range from relatively short (less than a month) to long (beyond the life of the Project). Frequency ranges from high (more than 12 times a year) to low (less than once a year). These timeframes will need to be established for each Project based on its specific characteristics and those of the surrounding environment.

292. Once the impact consequence is described based on the above impact characteristics, the probability of impact occurrence is factored in to derive the overall impact significance. The probability relates to the likelihood of the impact occurring, not the probability that the source of the impact occurs. The characteristics are outlined in Table 35.

Table 35: Characteristics Used to Describe Impact

Characteristic	Sub-components	Terms Used to Describe the Impact
Type		Positive (a benefit), negative (a cost) or neutral
Nature		Biophysical, social, cultural, health or economic Direct, indirect or cumulative or induced
Phase of the Project		Construction and operation.
Magnitude	Sensitivity of Receptor	High, medium or low capacity to accommodate change High, medium or low conservation importance Rare, common, unique, endemic
	Importance or value of receptor	High, medium or low concern to some or all stakeholders Locally, nationally or internationally important Protected by legislation or policy
	Severity or degree of change to the receptor	Gravity or seriousness of the change to the environment Intensity, influence, power or strength of the change Never, occasionally or always exceeds relevant thresholds
Spatial Scale	Area affected by impact – boundaries at local and regional extents will be different for biophysical and social impacts	Area or Volume covered Distribution: Local, regional (within Uttarakhand), transboundary or global
Timeframe	Length of time over which an environmental impact occurs or frequency of impact when intermittent	Short term or long term Intermittent (what frequency) or continuous Temporary or permanent Immediate effect (impact experienced immediately after causative project aspect) or delayed

Characteristic	Sub-components	Terms Used to Describe the Impact
		effect (effect of the impact is delayed for a period following the causative project aspect)
Probability – likelihood or chance an impact will occur		Definite (impact will occur with high likelihood of probability) Possible (impact may occur but could be influenced by either natural or project related factors) Unlikely (impact unlikely unless specific natural or Project related circumstances occur)

Impact Significance Rating

293. The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the approval process; secondly, it shows the primary impact characteristics, as defined above, used to evaluate impact significance. The impact significance rating system is presented in

294. Table 36 and described as follows:

(i) **Part A**: Define impact consequence using the three primary impact characteristics of magnitude, spatial scale and duration.
(ii) **Part B**: Use the matrix to determine a rating for impact consequence based on the definitions identified in Part A; and
(iii) **Part C**: Use the matrix to determine the impact significance rating, which is a function of the impact consequence rating (from Part B) and the probability of occurrence.

295. Using the matrix, the significance of each described impact is rated.

Table 36: Method for Rating Significance

PART A: DEFINING CONSEQUENCE IN TERMS OF MAGNITUDE, DURATION AND SPATIAL SCALE			
Definition		Criteria	
MAGNITUDE		Negative	Positive
	Major	• Large number of receptors affected • Receptors highly sensitive and/or are of conservation importance • Substantial deterioration, nuisance or harm to receptors expected • Relevant thresholds often exceeded • Significant public concern expressed during stakeholder consultation • Receiving environment has an inherent value to stakeholders	• Large number of receptors affected • Receptors highly amenable to positive change • Receptors likely to experience a big improvement in their situation • Relevant positive thresholds often exceeded
	Moderate	• Some receptors affected • Receptors slightly sensitive and/or of moderate conservation importance • Measurable deterioration, nuisance or harm to receptors • Relevant thresholds occasionally exceeded • Limited public concern expressed during stakeholder consultation • Limited value attached to the environment	• Some receptors affected • Receptors likely to experience some improvement in their situation • Relevant positive thresholds occasionally exceeded
	Minor	• No or limited receptors within the zone of impact • Receptors not sensitive to change • Minor deterioration, nuisance or harm to receptors • Change not measurable or relevant thresholds never exceeded • Stakeholders have not expressed concerns regarding the receiving environment	• No or limited receptors affected • Receptors not sensitive to change • Minor or no improvement in current situation • Change not measurable • Relevant positive thresholds never exceeded No stakeholder comment expected
TIMEFRAME		Duration of Continuous Aspects	Frequency of Intermittent Aspects
	Short term / low frequency	• Less than 1 month from onset of impact	• Occurs less than once a year

	Medium term / medium frequency	• Less than 1 year from onset of impact up to end the project implementation (approximately 5 years)	• Occurs less than 12 times a year but more than once a year
	Long term / high frequency	• Impact is experienced during and beyond the project implementation (greater than 5 years)	• Occurs more than 12 times a year
SPATIAL SCALE		Biophysical	Socio-economic
	Small	• Within the defined 'Project area' e.g., footprint	• Within the defined 'Project area' e.g., footprint
	Intermediate	• Within the district in which is the facilities are located	• Within the municipality in which the activity occurs
	Extensive	• Beyond the district in which the facilities are located	• Beyond the municipality in which the activity occurs

PART B: DETERMINING CONSEQUENCE RATING

MAGNITUDE	TIMEFRAME	SPATIAL SCALE		
		Small	Intermediate	Extensive
Minor	Short term / low frequency	Low	Low	Medium
	Medium term / medium frequency	Low	Low	Medium
	Long term / high frequency	Medium	Medium	Medium
Moderate	Short term / low frequency	Low	Medium	Medium
	Medium term / medium frequency	Medium	Medium	High
	Long term / high frequency	Medium	High	High
Major	Short term / low frequency	Medium	Medium	High
	Medium term / medium frequency	Medium	Medium	High
	Long term / high frequency	High	High	High

PART C: DETERMINING SIGNIFICANCE RATING

		CONSEQUENCE			
		Negligible	Low	Medium	High
PROBABILITY (of exposure to impacts)	Definite	**Not Significant**	**Low**	**Medium**	**High**
	Possible	**Not Significant**	**Low**	**Medium**	**High**
	Unlikely	**Not Significant**	**Low**	**Low**	**Medium**
	Negligible	**Not Significant**	**Not Significant**	**Not Significant**	**Not Significant**

Mitigation, Management and Good Practice Measures

296. Wherever the Project is likely to result in unacceptable impact on the environment, mitigation measures are proposed (over and above the inherent design measures included in the Project description). In addition, good practice measures may be proposed however these are unlikely to change the impact significance. In the case of positive impacts, management measures are suggested to optimize the benefits to be gained.

297. The following mitigation hierarchy will be utilized in selecting practical mitigation measures for unacceptable impacts as follows (in order of preference):

- Avoid the impact wherever possible by removing the cause(s).
- Reduce (minimize) the impact as far as possible by limiting the cause(s).
- Ameliorate (mitigate) the impact by protecting the receptor from the cause(s) of the impact.

Residual Impacts

298. Once mitigation measures are declared and committed to, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures.

299. The final step is providing compensatory measures to offset the impact, particularly where an impact is of high significance and none of the above are appropriate, e.g., for impacts to natural and critical habitat.

5.2.4. Stakeholder Consultations

300. According to the ADB Safeguard Policy Statement (2009):

> "*The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation. Meaningful consultation is a process that:*
>
> *(i) Begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle;*
> *(ii) Provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people;*
> *(iii) Is undertaken in an atmosphere free of intimidation or coercion;*
> *(iv) Is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and*
> *(v) Enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.*
>
> *Consultation will be carried out in a manner commensurate with the impacts on affected communities. The consultation process and its results are to be documented and reflected in the environmental assessment report."*

301. PTCUL and UPCL have led stakeholder engagement activities. The stakeholder engagement has been undertaken with the support of the IEE Consultant and the findings presented in this IEE.

VI. DESCRIPTION OF THE ENVIRONMENT

6.1. Introduction

302. This section presents a description of the environmental baseline conditions, firstly at the state level and then at the sub-activity level covering the following topics. Ecological walkovers and socioeconomic surveys were conducted in 2022 and 2023 whilst the water, air, soil and noise data were collected in 2023:

Table 37: Data Types

		Primary Data	Secondary Data
Physical Environment			
1	Topography	No	Yes
2	Geology and Soils	Yes	Yes
3	Geohazards	No	Yes
4	Climate and Climate Change	No	Yes
5	Climate hazards	No	Yes
6	Hydrology, Water Quality and Water Use	Yes	Yes
7	Air Quality	Yes	Yes
Biological Environment			
1	Protected and Notable Ecological Areas	No	Yes
2	Notable Habitat	Yes (walkover)	Yes
3	Notable Species	Yes (walkover)	Yes
Socio-Economic Environment			
1	Administration and Demographics	No	Yes
2	Local Economy	Yes	Yes
3	Tourism	No	Yes
4	Land Use and Landscape	Yes	Yes
5	Infrastructure	Yes	No
6	Noise and Vibration	Yes	No
7	Physical Cultural Resources and Cultural Landscape	Yes	Yes

303. In this section, the environmental setting of the project is discussed first at state and then at the site level, followed by environment baseline monitoring from the substation sub-activity project areas of influence.

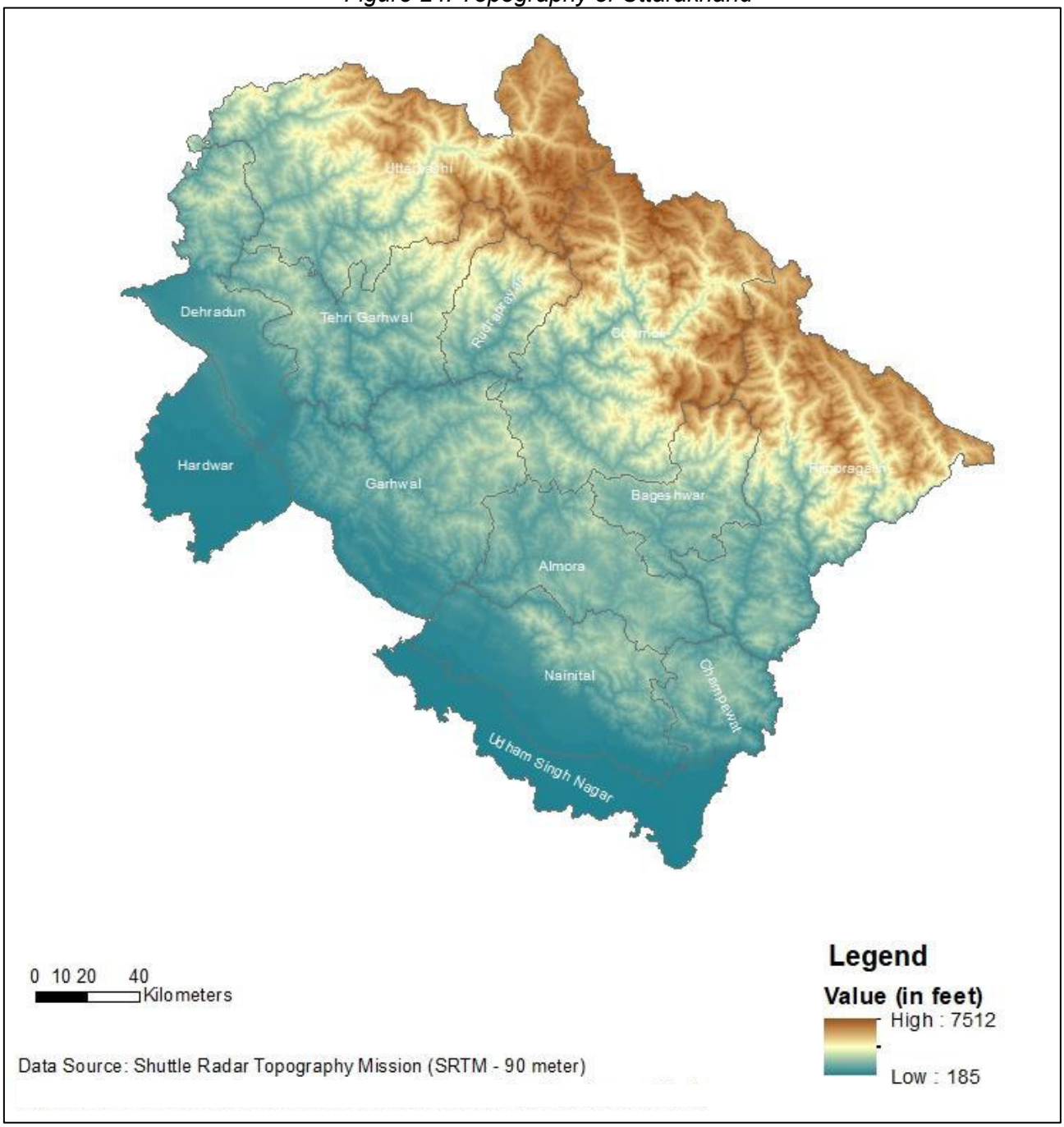
6.2. Uttarakhand Physical Environment

6.2.1. Topography

304. Uttarakhand lies between of 28°43'–31°27'N lat. And 77°34'–81°02'E long in the northern part of India with a total geographical area of 5,348,000 ha. The state can be divided into two distinct physiographic regions, namely the hill region, that covers a major portion, and a narrow belt of Bhabhar and Tarai regions in the foothills of the Himalaya. The elevation of the hilly terrain in the state ranges from 200 masl to a series of snow-covered peaks of more than 6,000 masl.[49]

[49] *Source: Assessment of soil erosion in fragile Himalayan ecosystem of Uttarakhand using USLE and GIS for sustainable productivity*

Figure 24: Topography of Uttarakhand



Source: TA Consulting Team

6.2.2. Geology, Soils and Geohazards

305. Soil resources in Uttarakhand vary from the deep, alluvial and fertile soils of the Tarai tract to the recently laid down alluvium of the dun valley; the thin fragile soil of the Shivalik hills; the black soils of the temperate zone; and the arid, bare soil of the inner dry valleys. Soils in the bottom of valleys are more fertile than those found on the ridge top due to the presence of a large quantity of humus, mineral nutrients and moisture and due to the suitable soil depth. This natural resource is depleting gradually, day by day, as soil erosion in the area is increasing with the increase in deforestation and degradation. Table 38 provides a summary of the soil types found in Uttarakhand and the crops produced in these areas. Sub-activities are located in zones A and B.

Table 38: Altitudinal zones of Uttarakhand, their attributes, major produce and livestock

Zone	Farming Situation	Soil	Rainfall (mm/year)	Districts	Principal Farm Produce and Livestock
Zone A, up to 1,000 m	Tarai irrigated	Alluvial	1,400	U.S. Nagar, Haridwar	Rice, wheat, sugarcane, lentil, chickpea, rapeseed, mustard, mango, litchi, guava, peach and plums. Livestock: Buffalo and cattle.
	Bhabhar irrigated	Alluvial mixed with boulders and shingles	1,400	Nainital, Dehradun and Pauri Garhwal	Rice, wheat, sugarcane, rapeseed-mustard, potato, lentil, mango, guava and litchi. Livestock: Buffalo and cattle
	Irrigated lower hills (600–1,000 m)	Alluvial sandy soil	2,000 – 2,400	Champawat, Pauri, Dehradun, Garhwal, Nainital, Garhwal, Tehri	Rice, wheat, onion, chilies, peas, potato, radish, cauliflower, pulses, oilseeds, soybean, mango, guava, plums and peaches. Livestock: Buffalo and cattle
	Rain-fed lower hills (600–1,000 m)	Residual sandy loam	2,000 – 2,400	Champawat, Pauri Dehradun, Garhwal, Bageshwar, Nainital, Garhwal, Tehri	Finger millet, maize, rice, wheat, pulses, mango, guava, plums and peaches. Livestock: Buffalo, cattle and goat
Zone B, 1,000–1,500 m	Mid hills, south aspect (1,000–1,500 m	Sandy loam	1,200 – 1,300	Champawat, Nainital, Almora, Dehradun, Tehri Garhwal, Bageshwar	Rice, finger millet, wheat, potato, tomato, peas, Cole crops, pulses, peaches and plums. Livestock: Cattle, sheep and goat
Zone C, 1,500–2,400 m	High hills (1,500–2,400 m)	Red to dark	1,200 – 2,500	Pithoragarh, Almora, Chamoli, Bageshwar	Amaranth, finger millet, French beans, ole crops, potato, peas, peaches, plums, pear, apple, stone fruits. Livestock: Cattle, sheep and goat.
Zone D, >2,400 m	Very high hills	Red to black clay	1,300	Pithoragarh, Chamoli, Uttarkashi	Amaranth, buckwheat, peas, cole crops, apple and potato. Livestock: Sheep, goat.

Source: Official Website of State Horticulture Mission Government of Uttarakhand.

306. The geological formation of the entire northern region of India, including Uttarakhand is weak and unstable. Geotectonic movements make the land mass unstable, resulting in landslides and mass movements (Figure 27). The soils of this region are developed on stratified soft sedimentary and tertiary rocks, which are also susceptible to erosion. During monsoon, the incessant rains or

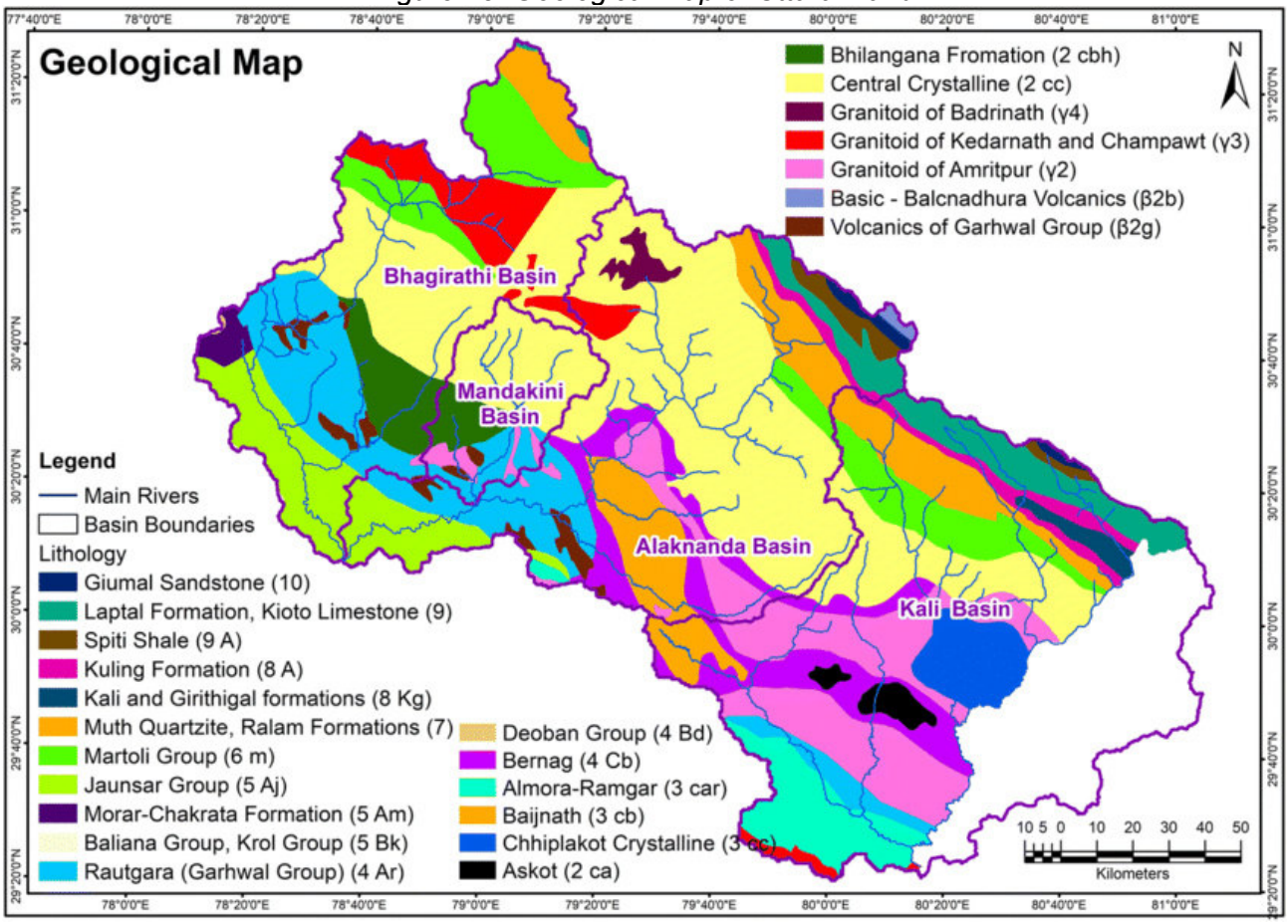
cloud bursts make these soils malleable and easily detachable, resulting in solifluction and sheet erosion down the slopes.[50]

307. Soil erosion due to water runoff is a major concern in all the northern hilly states of India in general and Uttarakhand in particular. The terrain combined with high rainfall pose a serious problem regarding soil erosion both due to anthropogenic activities and natural causes. Soil erosion is continuing over the years with varying intensities. The major causes of erosion in the state could be attributed to weak geological formation, active seismicity, and deforestation. The often-indiscriminate destruction of forests accelerates soil erosion and leads to terrain deformation. Unscientific land use, including shifting cultivation, have also accelerated the process of soil erosion.

308. Seismic mapping by the Uttarakhand State Disaster Management Authority (USDMA) indicates that Uttarakhand is located in seismic zone IV (This zone is called the High Damage Risk Zone) and V (Very High Damage Risk Zone). The last earthquake of note in Uttarakhand was in 2017 in Rudraprayag district. The 5.1 magnitude earthquake injured one person, with many cracks in buildings reported. No major earthquake has occurred in Uttarakhand for over 100 years, however, the risk of a major earthquake cannot be discounted. [51]

309. The geology of the state is shown in Figure 25.

Figure 25: Geological Map of Uttarakhand

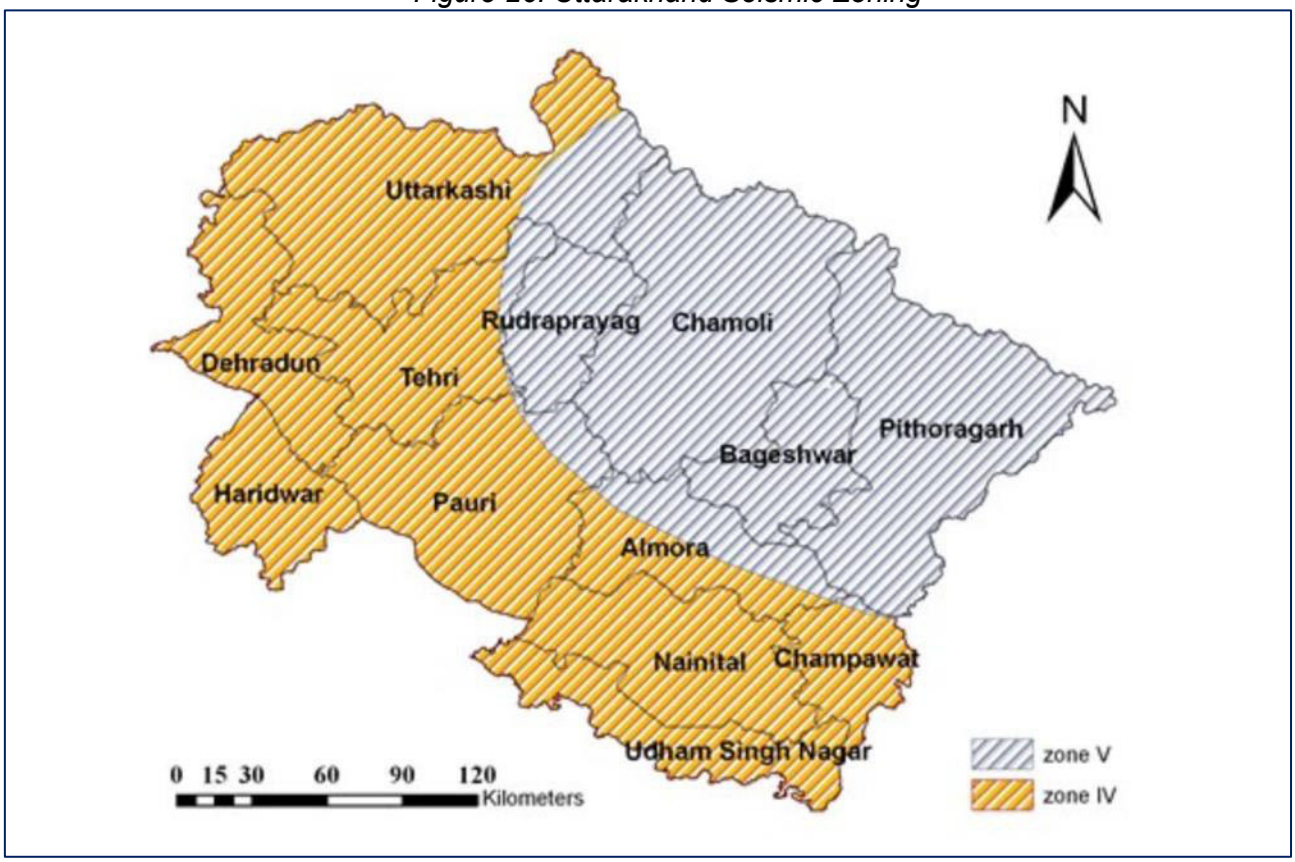


Source: https://www.researchgate.net/figure/Geological-map-of-river-basin-in-Uttarakhand_fig6_335634362

[50] Source: Assessment of soil erosion in fragile Himalayan ecosystem of Uttarakhand using USLE and GIS for sustainable productivity

[51] https://www.hindustantimes.com/cities/dehradun-news/possibility-of-greater-quake-in-uttarakhand-warns-ngri-chief-scientist-101677037958527.html

Figure 26: Uttarakhand Seismic Zoning



Source: Socio-ecological vulnerability: Assessment and coping strategy to environmental disaster in Kedarnath valley, Uttarakhand, Indian Himalayan Region. International Journal of Disaster Risk Reduction. September 2017

310. Mapping provided by Uttarakhand State Disaster Management Authority indicates that generally the state is free of flood risk (Figure 28). Landslides are located mainly in the mountainous areas, although there are localized areas close to Dehradun (Figure 27). Forest fires occur in Uttarakhand and have been mapped by the MoEF&CC as shown in Figure 29.

Figure 27: Landslide Mapping, Uttarakhand

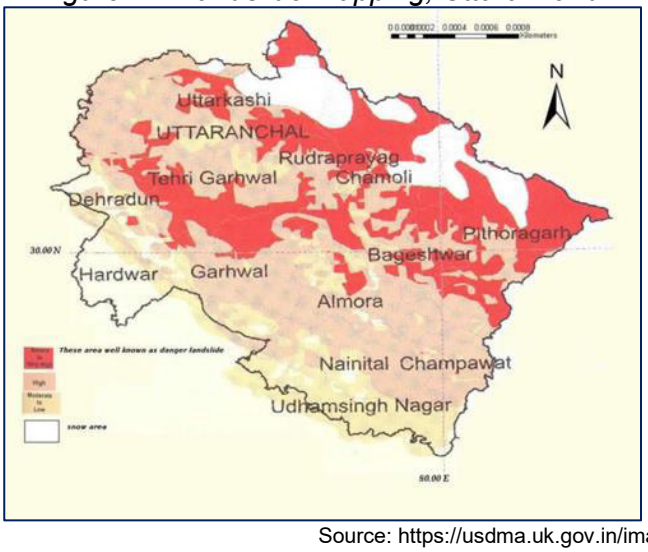
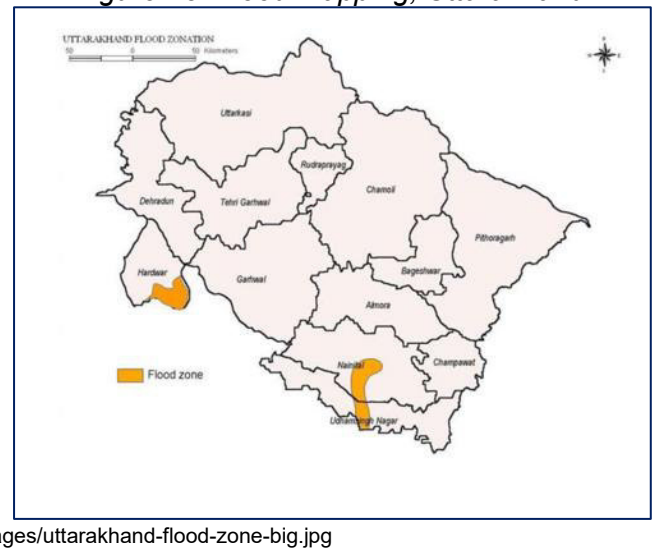
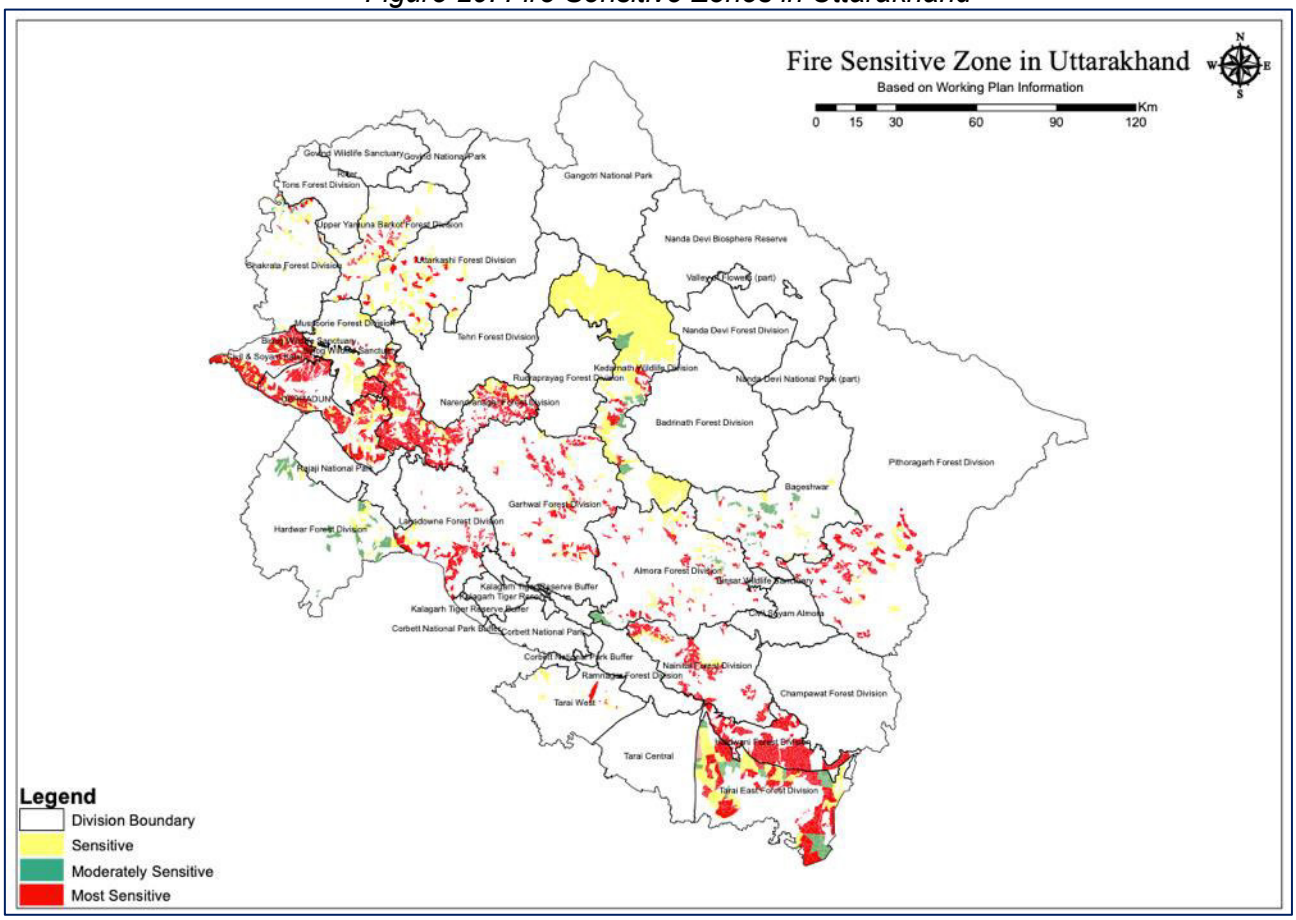


Figure 28: Flood Mapping, Uttarakhand



Source: https://usdma.uk.gov.in/images/uttarakhand-flood-zone-big.jpg

Figure 29: Fire Sensitive Zones in Uttarakhand



Source: http://www.frienvis.nic.in/WriteReadData/UserFiles/file/data/fire_Sensitive_Zone.pdf

311. Tsunami cannot happen in Uttarakhand as it is landlocked.

6.2.3. Climate, Climate Change and Climate Hazards

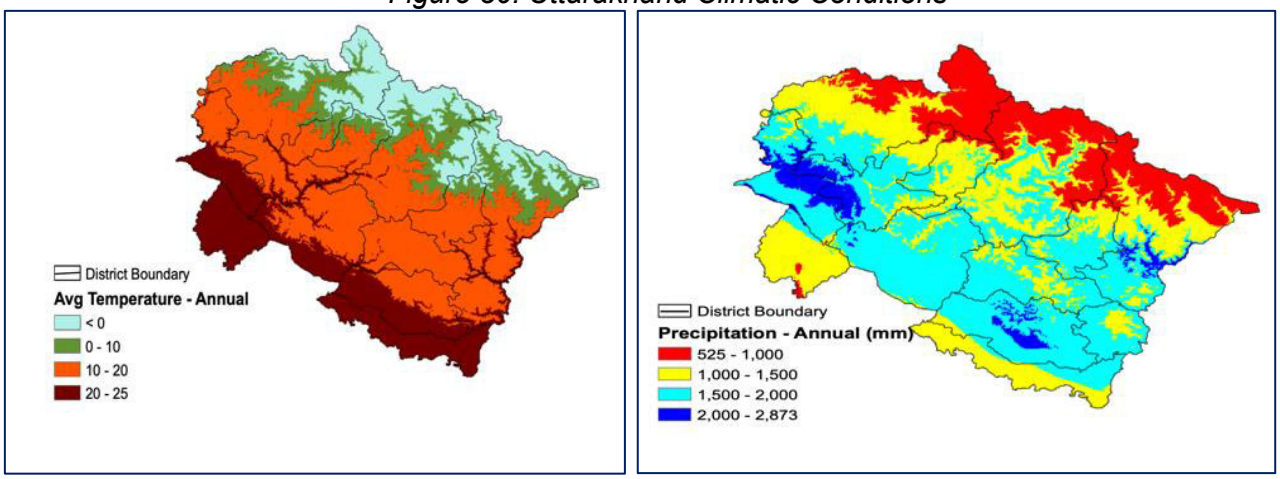
312. Uttarakhand has two distinct climatic regions: the predominant hilly terrain and the small plain region. The climatic conditions of Uttarakhand vary greatly due to variations in altitude and proximity towards the Himalayan ranges. The climatic conditions of the plains are very similar to those in the Gangetic plain, i.e., tropical conditions. Summers are relatively hot and winters are chilly, with temperatures going below 0°C. The lowest temperature recorded is –3.0°C at Mukteshwar and the highest is 43.2°C at Pantnagar. The extremes can further intensify, depending upon the coverage of meteorological observatories.

313. The average rainfall in the state varies from 92 cm, in Srinagar, to 250 cm in Nainital. However, spatial distribution of the rainfall varies, depending upon the geographical location and slope and aspect of the place. The amount of rainfall is generally high in low mountainous regions such as Nainital and Dehradun and it gradually decreases with increasing height. About three-fourths of the total rainfall is confined to the monsoon season and remaining one-fourth occurs in other seasons due to the western disturbances and local orographic effects. The monsoonal activities generally start in the later part of June and pick up in July/August. The temperature and precipitation distributions of the various districts of Uttarakhand are shown in Figure 30.[52] Mapping by World

[52] *Source: Uttarakhand Action Plan on Climate Change. Government of Uttarakhand 2014.*

Resources Institute [53] does not indicate any significant trends in Uttarakhand for groundwater table decline.

Figure 30: Uttarakhand Climatic Conditions



Source: Uttarakhand Action Plan on Climate Change. Government of Uttarakhand 2014.

Table 39: Mean Annual Rainfall

Location	Average Annual Rainfall (cm)
Narendra Nagar	318.0
Mussoorie	242.5
Dehradun	205.0
Nainital	165.0
Almora	136.0
Srinagar	93.0
Tehri	80.0

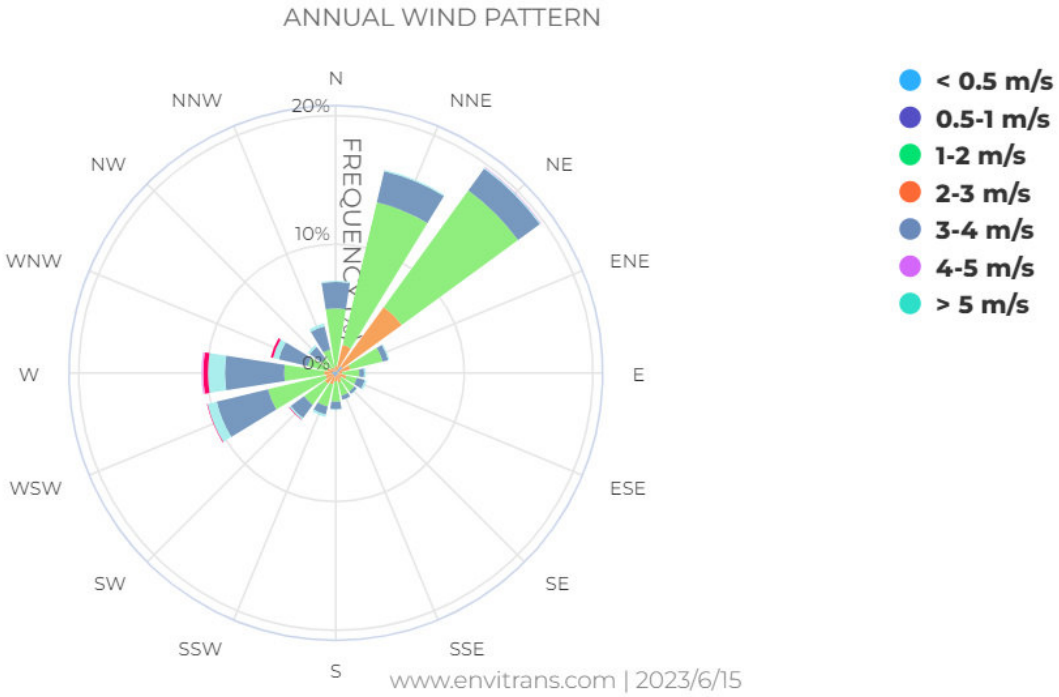
Source: Uttarakhand Action Plan on Climate Change. Government of Uttarakhand 2014

314. Wind patterns in the state are shown in Figure 31: Wind Rose, Uttarakhand. Generally, the state is not impacted directly by cyclones due to is distance from the coast, as illustrated by on line mapping provided by the national remote sensing center of India[54]. Uttarakhand generally belongs to Moderate Damage Risk Wind Zone where basic wind speed can reach up to 39 m/s. However certain areas in southern Uttarakhand in Haridwar and Udham Singh Nargar Districts are classified as high damage risk zone where basic wind speed can reach up to 50 m/s.

[53]https://www.wri.org/applications/aqueduct/water-risk-atlas/#/?advanced=false&basemap=hydro&indicator=gtd_cat&lat=29.180941290001776&lng=79.1015625&mapMode=view&month=1&opacity=0.5&ponderation=DEF&predefined=false&projection=absolute&scenario=optimistic&scope=baseline&timeScale=annual&year=baseline&zoom=6

[54] https://bhuvan-app1.nrsc.gov.in/disaster/disaster.php#

Figure 31: Wind Rose, Uttarakhand



Data Source: Envitrans Met Data Archive

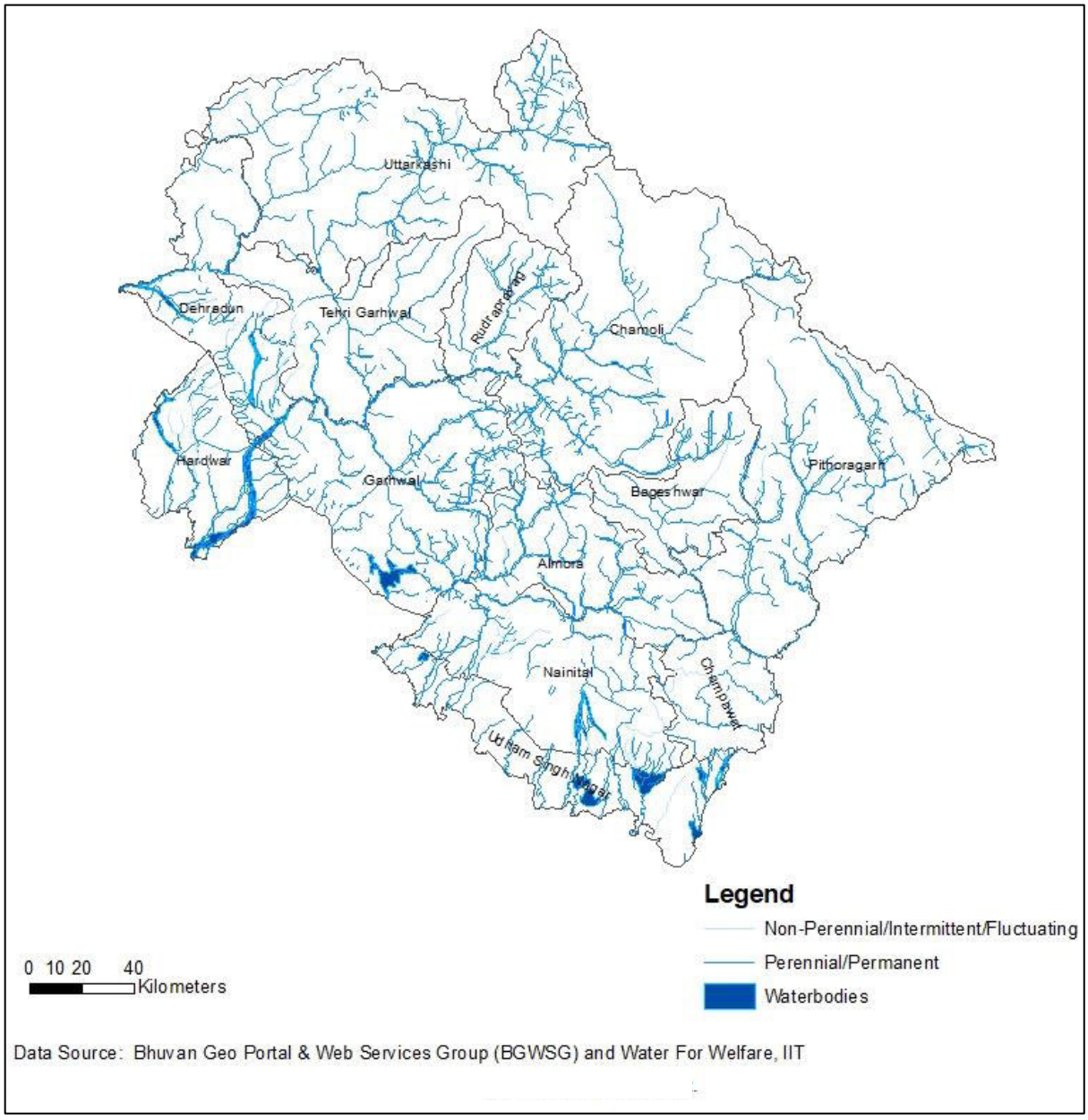
6.2.4. Hydrology, Water Quality and Water Use

315. The main drainage system of Uttarakhand has been grouped into the following six catchments:

316. *Yamuna Catchment.* The Yamuna River originates from the base of Bandarpunch peak. It has carved a deep V-shaped gorge. The Yamuna cuts across the Nag Tibba range and Mussoorie range near a place called Yamuna Bridge. The rivers Tons, Pabar and Aglar are its important tributaries. It passes through the Doon valley at its western boundary.

317. *Bhagirathi Catchment.* This is one of the two rivers that join to form the River Ganga. It originates from the snout of the Gangotri glacier at Gaumukh, which is at the base of Chaukhamba peak. The Bhagirathi River has cut a deep gorge across the granitic rocks of the higher Himalaya of Garhwal. Its main tributaries are the river Janhavi and the Bhilangna.

Figure 32: Uttarakhand Hydrology



Source: TA Consulting Team

318. *Alaknanda Catchment.* The Alaknanda River joins the River Bhagirathi at Devprayag to form the River Ganga. It originates from the eastern slopes of Chaukhamba, from the Bhagirathi Kharak and Satopanth glaciers. The river flows by the side of the Badrinath temple. Its main tributaries are the Khiraonganga, Pindar Dhauliganga, Birahi, Nandakini, Mandakini, etc. It has formed a broad valley at Srinagar (Garhwal).

319. *Mandakini Catchment.* It comes out from the Mandakini glacier near Kedarnath. It cuts through a gorge of glacial debris. The river has formed road terraces at Augustmuni and Tilwara. At Tilwara, it is joined by the River Lastar Gad. The River Mandakini joins the river Alaknanda at Rudraprayag.

320. *Pindar Catchment.* The River Pindar originates from the Pindari Glacier, which is located between Nanda Devi and Nanda Kot peaks. The Sundardhunga River joins the Pindar near Dhakuri. The Pindar joins the River Alaknanda near Karanprayag.

321. *Kali Catchment.* The River Kali forms the boundary between Kumaon and Nepal. The Kali River forms the border between Nepal and the border districts of Pithoragarh and Chamoli. The main tributaries of the Kali are the Ladiya, Sarayu-Ramganga East, Goriganga, Dhauliganga East and Kuti Yangte.

322. The Land Survey Directorate (LSD) has divided Uttarakhand into eight catchments, which are divided into 26 watersheds. These are divided into 110 small watersheds and finally there are 1,110 micro watersheds.

323. Uttarakhand has 31 natural lakes covering an area of about 300 ha. The state is endowed with eight large-sized man-made reservoirs in Tehri and US Nagar districts, covering an area of 20,075 ha. The Tehri dam is the largest dam in Uttarakhand, followed by Sharda Sagar reservoir, with a water area of 6,880 ha and Nanak Sagar reservoir, with a water area of 4,084 ha. These reservoirs are owned by the Irrigation Department. Additionally, there are a total of 1,545 small ponds/tanks covering an area of 604 ha in the state. The reservoirs are generally used for irrigation.

6.3. Uttarakhand Biological Environment

6.3.1. Protected Areas and Notable Ecologically Sites

Nationally Designated Sites

324. 12% of total geographical area in the Uttarakhand state are protected areas which includes six National Parks (NP), seven Wildlife Sanctuaries, four Conservation Reserves and one Biosphere Reserve[55]. NPs in Uttarakhand include the Corbett NP in Nainital District, Rajaji NP, Valley of Flowers NP and Nanda Devi NP in Chamoli District, which together are a UNESCO World Heritage Site.

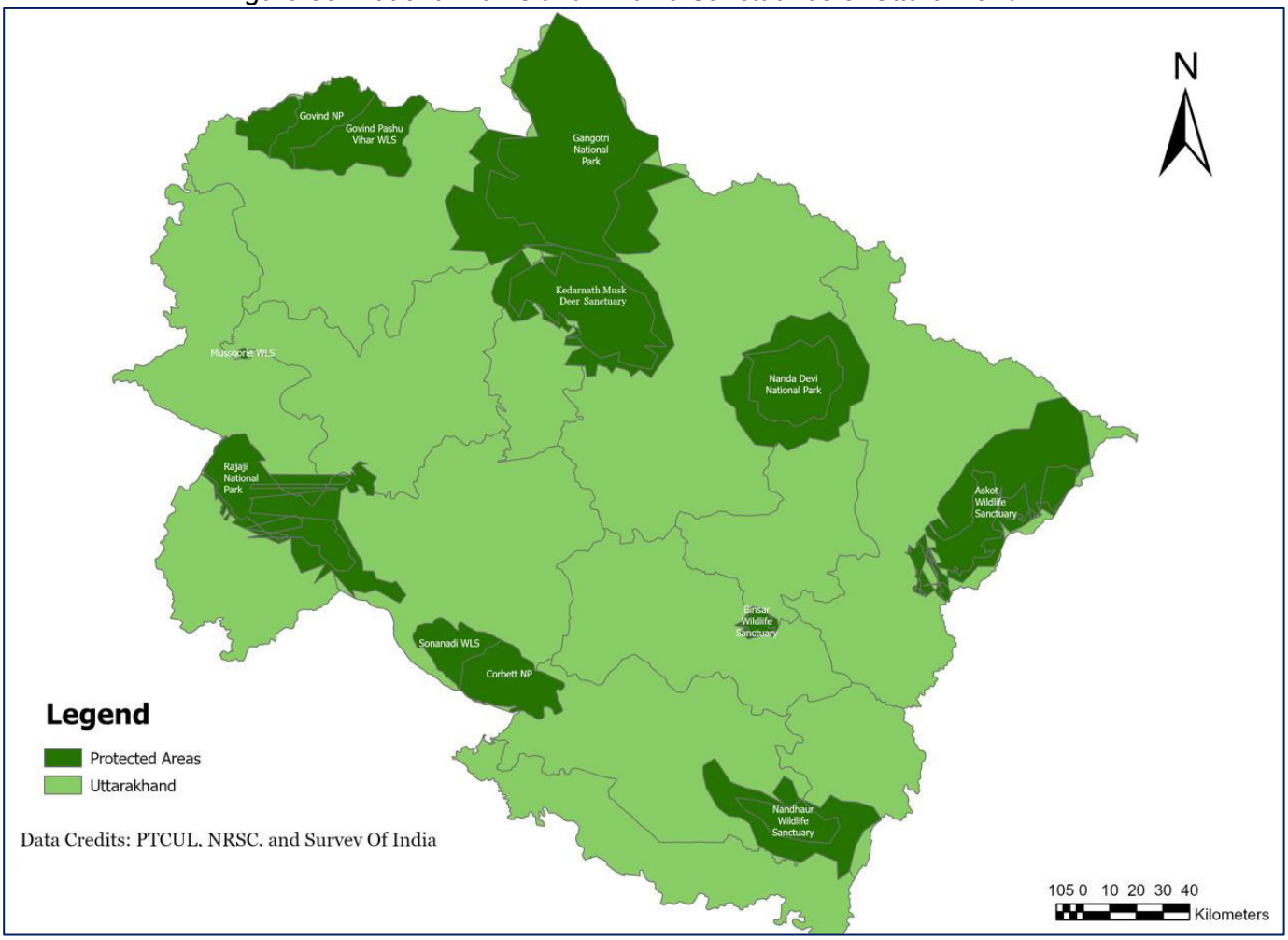
Table 40: Uttarakhand National Parks

#	Protected Area	Area (km^2)	Inauguration Year
1	Corbett National Park	520.82	1936
2	Nanda Devi National Park	624.60	1982
3	Valley of Flowers National Park	87.59	1982
4	Rajaji National Park	820.42	1983
5	Gangotri National Park	2,390.02	1989
6	Govind National Park	472.08	1990
	Total	4,915.44	

Source: https://forest.uk.gov.in/wildlife-management

[55] *https://www.forest.uk.gov.in/wildlife-management*

Figure 33: National Parks and Wildlife Sanctuaries of Uttarakhand



Source: TA Consulting Team

Table 41: Uttarakhand Wildlife Sanctuaries

#	Protected Area	Area (km^2)	Inauguration Year
1	Govind wildlife sanctuary	485.89	1955
2	Kendarnath wildlife sanctuary	975.20	1972
3	Askot wildlife sanctuary	599.93	1986
4	Sonanadi wildlife sanctuary	301.18	1987
5	Binsar wildlife sanctuary	47.07	1988
6	Mussoorie wildlife sanctuary	10.82	1993
7	Nandhaur wildlife sanctuary	269.95	2012

Source: https://forest.uk.gov.in/wildlife-management

Table 42: Uttarakhand Conservation Reserves

#	Protected Area	Area (km^2)	Inauguration Year
1	Jhilmil Jheel Conservation Reserve	37.84	2005
2	Aasan Wetland Conservation Reserve (also a RAMSAR site) [56]	4.44	2005
3	Pawalgarhn Conservation Reserve	5.82	2012
4	Nainadevi Himalayan Bird Conservation Reserve	111.91	2015

Source: https://forest.uk.gov.in/wildlife-management

[56] http://www.wiienvis.nic.in/Database/ramsar_wetland_sites_8224.aspx

Table 43: Uttarakhand Biosphere Reserves

#	Protected Area	Area (km^2)	Inauguration Year
1	Nanda Devi Biosphere Reserve	630	1982

Source: https://forest.uk.gov.in/wildlife-management

325. None of the Project sub-activities are in any of the identified protected areas (**Appendix A and B** for site mapping).

Eco-sensitive Zones

326. Eco-Sensitive Zones (ESZs) are areas in India notified by the MoEF&CC around Protected Areas, notably NPs and Wildlife Sanctuaries. The purpose of declaring ESZs is to create some kind of "shock absorbers" to the protected areas by regulating and managing the activities around such areas. They also act as a transition zone from areas of high protection (core and buffer zones) to areas involving lesser protection. According to the MoEF&CC [57] there are six **notified** ESZ in Uttarakhand:

1) Nandhaur Wildlife Sanctuary. 314. S.O.4695(E) [24.12.2020] Final Notification declaring Eco Sensitive Zone (Figure 36)

2) Nanda Devi National Park. 315. S.O. 5136(E) [04.10.2018] Final Notification declaring Eco Sensitive Zone (Figure 35)

3) Gangotri National Park. 316. S.O. 1927(E) [07.06.2019] Final Notification declaring Eco Sensitive Zone (Figure 38)

4) Binsar Wildlife Sanctuary. 317. S.O.3921(E) [21.09.2021] Final Notification declaring Eco Sensitive Zone (Figure 37).

5) Askot Wildlife Sanctuary. 318. S.O.4929(E) [02.12.2021] Final Notification declaring Eco Sensitive Zone (Figure 34)

6) Bhagirathi (ESZ) (Figure 39)

327. The MoEF&CC have also **notified in draft** the ESZ for three parks and sanctuaries. Until gazetted a 10km buffer applies around the site boundary (same also applies to four other PAs and WLS that do not fall into either of the above categories, including Corbett NP). The three relevant parks are:

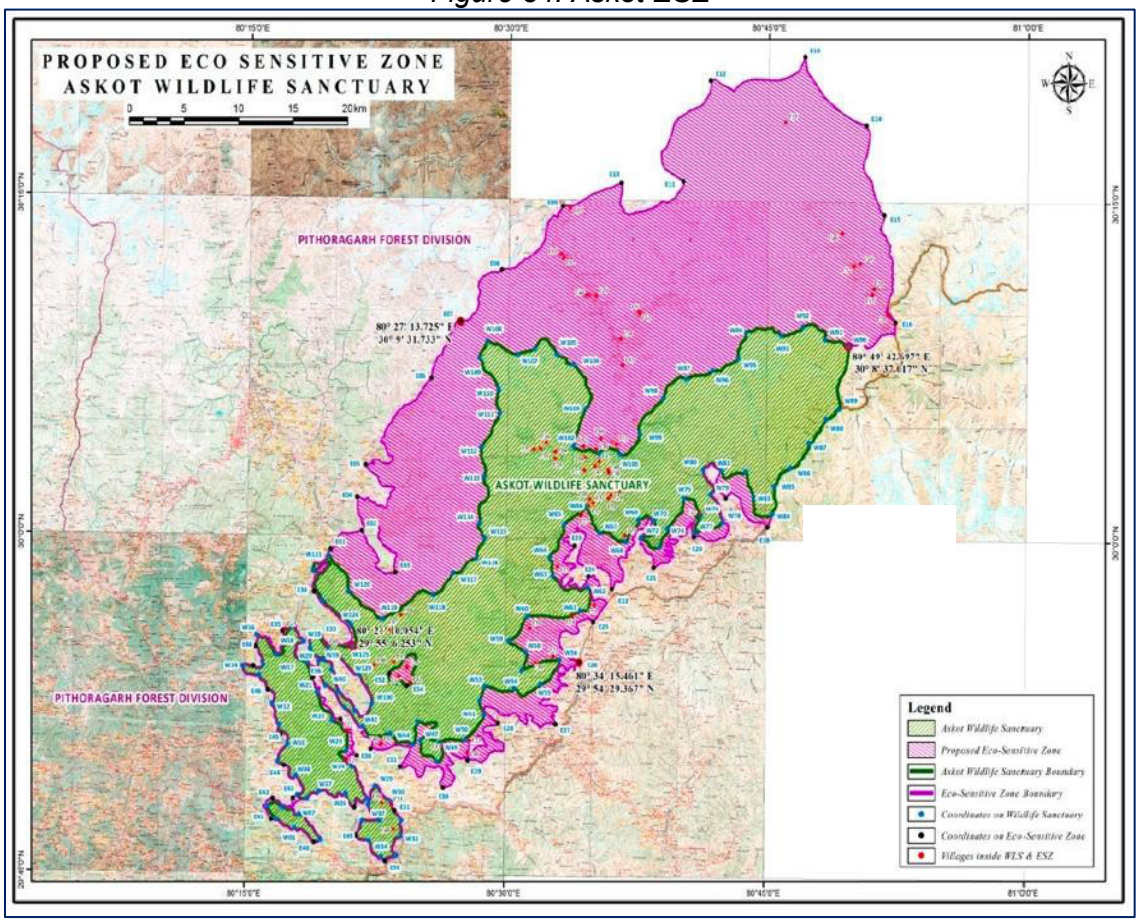
1) Valley of flowers Wildlife Sanctuary. 389. SO 3235(E)[27.11.2015] Draft notification declaring Eco-sensitive Zone.

2) Kedarnath Musk Deer Sanctuary. 392. S.O. 3880(E) [14.12.2017] Draft Notification declaring Eco Sensitive Zone.

3) Rajaji National Park. 394. S.O. 2031(E) [22.05.2018] Draft Notification declaring Eco Sensitive Zone.

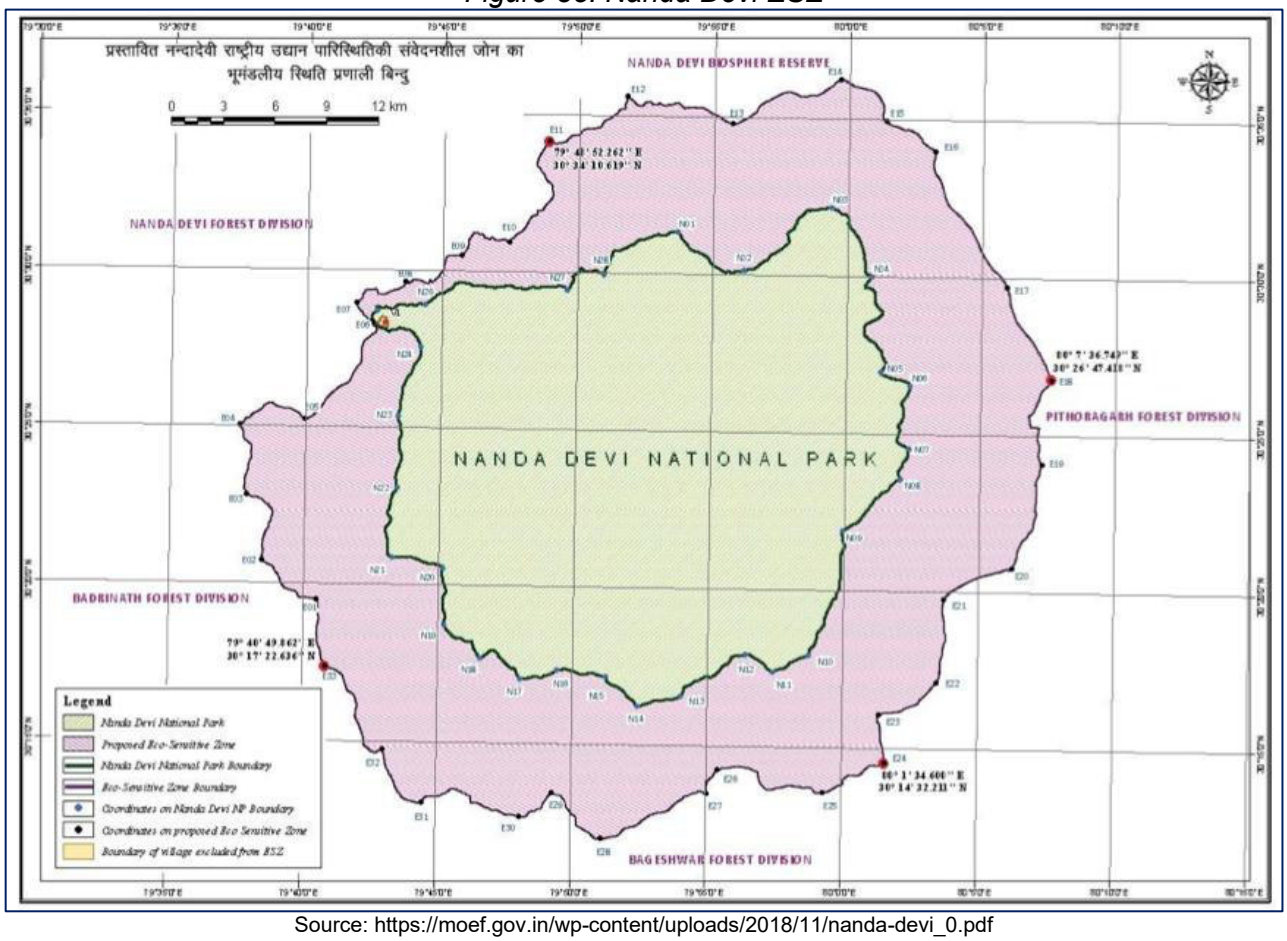
[57] https://moef.gov.in/en/rules-and-regulations/esz-notifications/

Figure 34: Askot ESZ



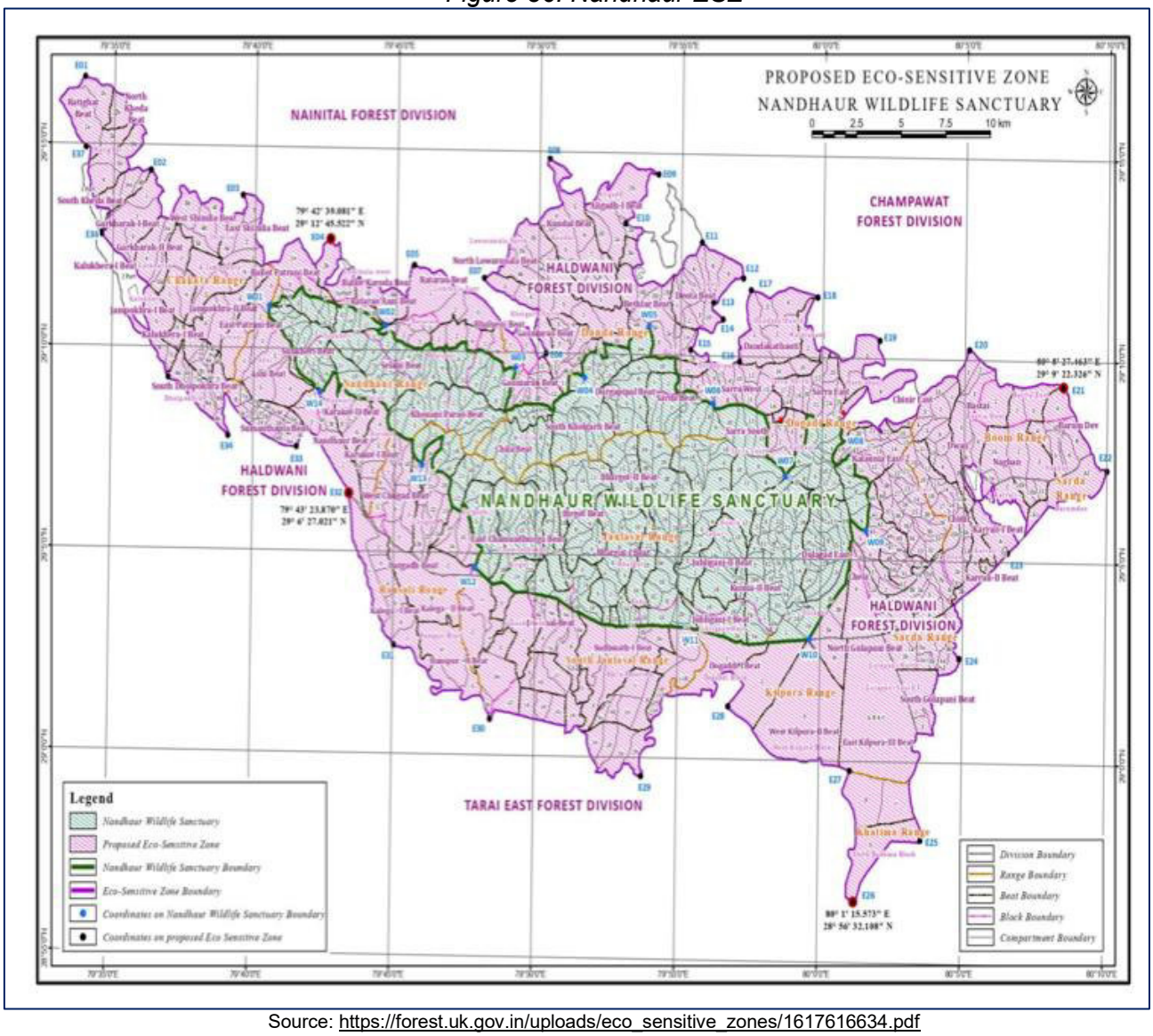
Source: MoEF&CC Notification. 29th January 2019

Figure 35: Nanda Devi ESZ



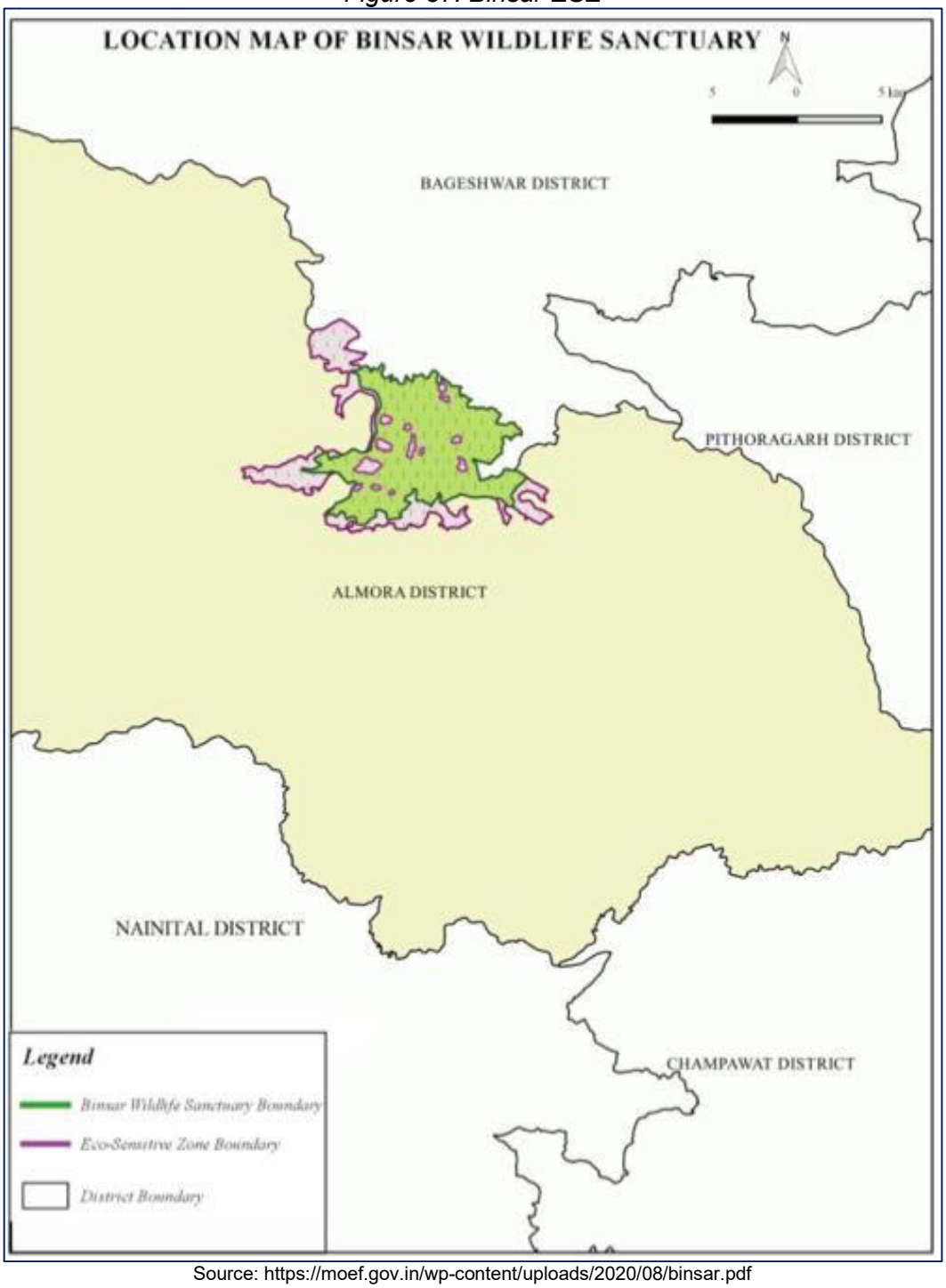
Source: https://moef.gov.in/wp-content/uploads/2018/11/nanda-devi_0.pdf

Figure 36: Nandhaur ESZ



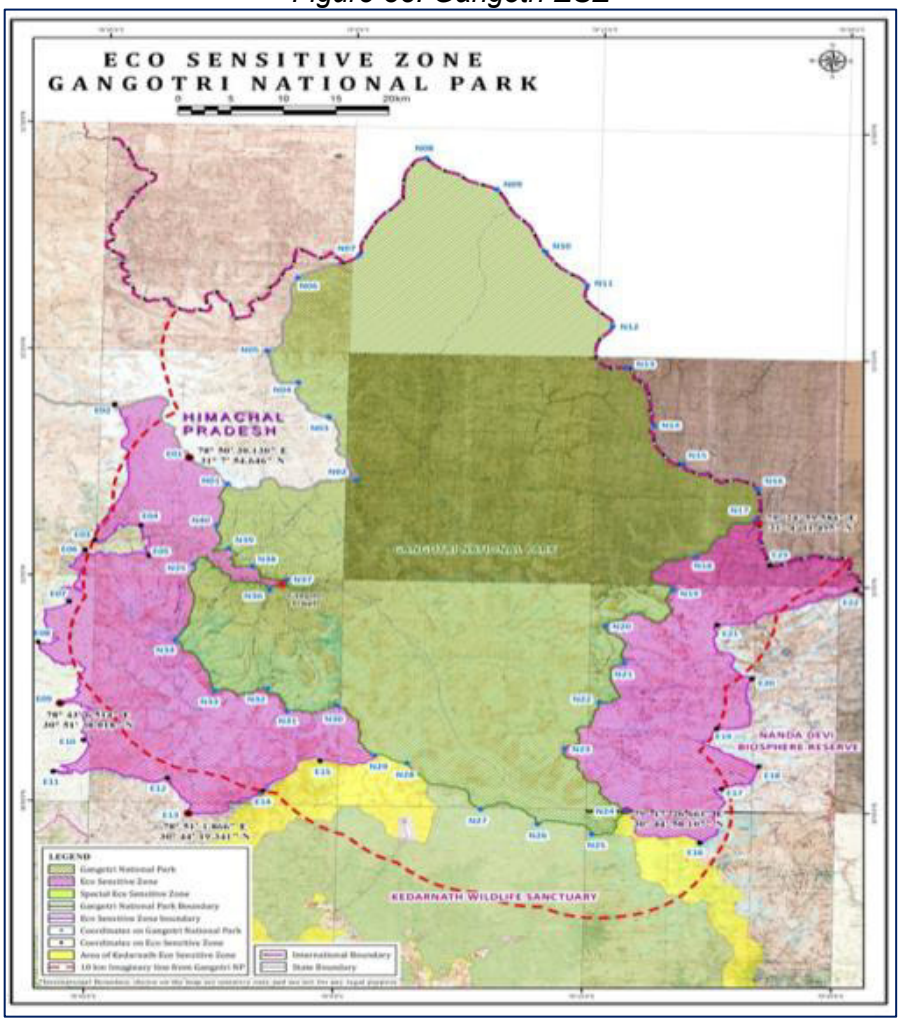
Source: https://forest.uk.gov.in/uploads/eco_sensitive_zones/1617616634.pdf

Figure 37: Binsar ESZ



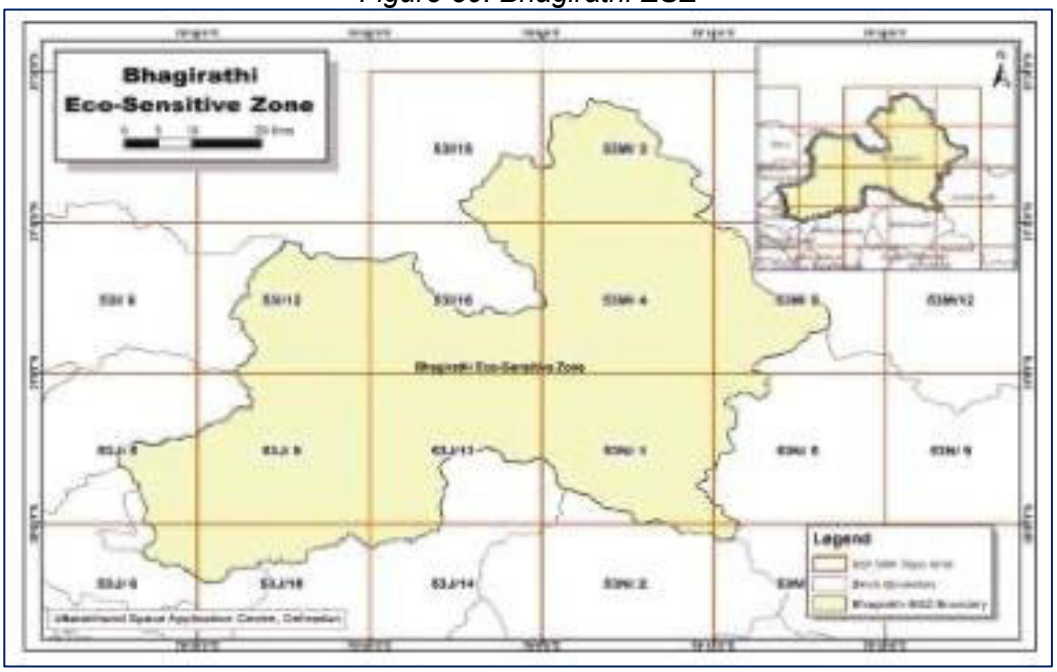
Source: https://moef.gov.in/wp-content/uploads/2020/08/binsar.pdf

Figure 38: Gangotri ESZ



Source: https://moef.gov.in/wp-content/uploads/2019/06/gangotri.pdf

Figure 39: Bhagirathi ESZ



Source: https://moef.gov.in/wp-content/uploads/2022/09/Zonal-Master-Plan-of-Bhagirathi-Ecosensitive-Zone-Report-Part-1-27-September-2018_compressed.pdf

328. According to the Guidelines for Declaration of ESZ Around National Parks and Wildlife Sanctuaries, the following activities associated with the project are prohibited, regulated, and permitted:

- Felling of trees – Regulated (with permission from appropriate authority)
- Setting industries causing pollution (water, air, soil, noise, etc.) – **Prohibited**
- Erection of electrical cables – Regulated (promote underground cabling)
- Widening of Roads – Regulated (through proper EIA)
- Use or production of any hazardous substances – **Prohibited**
- Discharge of effluents and solid waste in natural water bodies or terrestrial area – **Prohibited**

Ecologically Sensitive Areas

329. There is one ecologically sensitive area (ESA) in Dehradun:

a) Doon Valley - covering Dehradun

Internationally Designated Sites

330. Several IBAs/KBAs are found in Uttarakhand. The following sub-section summarizes information from Birdlife International website, with main focus on those closest to the sub-activity sites.

331. **Rajaji National Park (KBA/IBA)** is situated in the Shiwalik hills and outer Himalayas of Uttarakahand state. Its 82,000 ha are spread over the districts of Dehradun, Haridwar and Pauri Garhwal. The tract is mainly hilly, traversed by several alternating steep ridges and valleys. The

River Ganga bisects the Park. Rajaji NP was set up to protect the habitat of the Asian elephant *Elephas maximus* and Tiger *Panthera tigris*. The area north of this ridge slopes gently into the Dehra Dun Valley and is covered with dense Sal *Shorea robusta* forests. The area south of the ridge has a jagged topography with a number of steep ridges which emerge from the main Shiwalik ridge and have narrow valleys between them, which in monsoon turn into swift rivers. The dry riverbeds are locally called Rau. Some areas of the Park are under plantations of *Tectona grandis*, *Ailanthus* excelsa, and *Haplophragma adenophyllum*. The Park has one of the finest examples of the bhabar forest zone in India i.e., the belt between the Himalaya and the terai.

332. *Avifauna:* A total of 312 bird species has been recorded. Of these, 151 are residents, 87 migrants, and 49 are altitudinal migrants, 7 are local migrants, while the status of the remaining 18 is unknown. Rajaji NP is extremely rich in forest birds. For example, it has 11 species of woodpeckers, 5 species of barbets and 3 species of hornbills, including the Near Threatened Great Pied Hornbill. Under the Western Himalayas Endemic Bird Area, Stattersfield et al. (1998) have listed Brooks's Leaf-warbler *Phylloscopus subviridis* and Tytler's Leaf-warbler *P. tytleri* as restricted range species. Both species are winter migrants to the park. There is a barrage on the River Ganga near Haridwar city. The backwaters of the reservoir, as well as a small stretch of the River Ganga, lie in the Rajaji NP. These water bodies attract a lot of resident and migratory waterbirds in winter. Thirteen species of birds have been identified at the reservoir, including Darter *Anhinga melanogaster*, Painted Stork *Mycteria leucocephala*, Black-necked Stork *Ephippiorhynchus asiaticus*, Ferruginous Pochard *Aythya nyroca* and Black-bellied Tern *Sterna acuticauda*, birds considered as Near Threatened by BirdLife International (2001).

333. *Other Key Fauna:* The area is highly important as the western limit of the Asian Elephant *Elephas maximus* and the Tiger *Panthera tigris*. Some other large mammals in Rajaji NP include Leopard *Panthera pardus*, Spotted deer *Axis axis*, Sambar *Cervus unicolor*, Nilgai *Boselaphus tragocamelus* and Goral *Nemorhaedus goral*. The forests east of River Ganga are occasionally visited by Sloth Bear *Melursus ursinus* and Asiatic Black Bear *Ursus thibetanus* in winter.

334. **Askot Wildlife Sanctuary (IBA/KBA)** in Pithoragarh district lies at the junction of the Western and Central Himalayas and covers three biomes: Eurasian High Montane (Alpine and Tibetan) (Biome-5), Sino-Himalayan Subtropical Forests (Biome-8) and Sino- Himalayan Temperate Forests (Biome-7). It has an area of about 59,993 ha, with agricultural land comprising approximately 8,500 ha, 28,943 ha under reserve forests and 22,550 ha comprising forests under the revenue authorities. Askot has two ranges: Askot and Dharchula. About 15,000 ha of the area in Dharchula range along the international border is under the control of the Border Police and Indian Army. Thus, less than 50% of the total area is under the control of the Forest Department. The WLS covers three major watersheds: Kali, East Dhauli and Goriganga. A large part of the Gori valley (total area 224,000 ha), about 143,900 ha or 64.24% of the entire basin, is constituted of village common, land that is administered by village forest councils or Van Panchayats. Another 8% is under reserved forests, which include portions of such valuable protected areas as the Nandadevi National Park (62,500 ha), the core zone of the Nandadevi Biosphere Reserve, a World Heritage Site, and the Askot Wildlife Sanctuary. About 34,700 ha in the Gori basin, that is classified as Civil Benaap, falls under the Askot WLS. In all, these village commons, reserve forests and civil and Soyam land under the Sanctuary area, make almost 88% of the Goriganga basin as protected areas, both by village communities, as well as the State. In about a hundred kilometers from its confluence with river Kali to its source at Milam glacier, the river passes through the Dry Alpine meadows with Trans-Himalayan characteristics to subtropical Sal forests. Thus, exceptional diversity of flora and fauna are encountered in the basin in a short geographical distance. Two of the important areas surrounding Askot are the Kalamuni ridge, and the Athansi, Golpha and Madkani blocks of North Pithoragarh. Athansi, Madkani and Golpha reserved forest blocks of Pithoragarh Forest Division have an area of 1,832 ha, 1,287 ha and 1,365 ha respectively. These are situated north of Munsyari

in Pithoragarh on the slopes of the Panchachuli massif, which rises to c. 7000 m. The Athansi block is located close to the catchment of Ralam Gad (a left bank tributary of Goriganga) while Madkani and Golpha are located east of Athansi block. The three areas are linked by the intermediate alpine zone, which has the administrative status of civil forests. The three forest blocks mentioned above have a range of vegetation communities from Ban Oak (*Quercus leucotrichophora*) forest to alpine vegetation. The Golpha block has a rare vegetation community: the Himalayan Hemlock (*Tsuga dumosa*) forests. This community is also found in the Askot Sanctuary. The area has special conservation value, being the eastern most protected area in the Western Himalayas in India and, it represents the western limits of many eastern floral communities such as *Tsuga* and *Macaranga*. Kalamuni ridge in Pithoragarh Forest Division is a large area of moist temperate and alpine forests. It is known to harbour the Satyr Tragopan *Tragopan satyra*, White-throated Tit *Aegithalos niveogularis* and abundant populations of Himalayan Monal *Lophophorus impejanus*. The forests of Kalamuni ridge are rich in floral and faunal elements. Khulia area has large patches of Birch-*Rhododendron* forests, due to which the area was proposed as a sanctuary. Due to the great altitudinal variation and representaion of nearly all major West Himalayan Forest types, from Sal forests to alpine (sometimes on a single slope, e.g., Chiplakot ridge) there is an abundant representation of Himalayan avifaunal and other faunal elements. This, combined with high contiguity of forest cover, makes Askot one of the most important bird's areas of India.

335. *Avifauna:* A consolidated list of the observations gives a total of 227 (212 breeding, forest dependent) bird species in 30 families and 118 genera, representing more than 45% of the breeding bird diversity of the Western Himalaya and nearly 55% of breeding This assemblage represents 2 out of 11 West Himalayan restricted range species, including globally threatened Cheer pheasant *Catreus wallichii*. Overall, this IBA site has 17 species that are rare or uncommon in the Himalayas. The site has 81 biome species belonging to Biome-5, Biome-7 and Biome-8. These species represent 71% of all biome restricted species recorded in Kumaon.

336. *Other Key Fauna:* The Sanctuary harbors the typical fauna of Himalayan forests as well as alpine pastures. Some of the rare and endangered species found in the Sanctuary are Musk Deer *Moschus chrysogaster*, Snow Leopard *Uncia uncia*, Himalayan Tahr *Hemitragus jemlahicus*, Bharal or Blue Sheep *Pseudois nayaur*, Goral *Nemorhaedus goral*, Serow *Nemorhaedus sumatraensis*, Asiatic Black Bear *Ursus thibetanus* and Brown Bear *Ursus arctos*.

337. **Sonanadi Wildlife Sanctuary (WLS) (IBA/KBA)** is in the Kotdwar tehsil of Pauri Garhwal district of Uttarakhand. It is named after the Sonanadi (river of gold). Deposits of gold have been reported along this river, hence the name. This WLS spans an area of 30,118 ha of prime forest across the Ramganga river, adjoining the famous Corbett National Park. The Shiwalik-Terai is one of the most threatened ecosystems of the country and receives considerable conservation attention. Sonanadi WLS forms a critical part of the habitat of the northwest population of the Asian Elephant *Elephas maximus*. There are three major sub-populations in Corbett-Rajaji NP. Sonanadi is significant in that it constitutes a forest corridor between the Corbett and the Rajaji populations to facilitate their movements. Sonanadi WLS, Corbett NP and its buffer areas together comprise the Corbett Tiger Reserve, which holds the second largest population of Tiger *Panthera tigris* in the world. The greater part of the WLS is covered with Sal *Shorea robusta* forests. *Anogeissus latifolia* can be seen on the slopes, associated with Sal in some places. In earlier days, many parts of the original forest were cleared to raise plantations of *Tectona grandis*, *Ailanthus* excelsa and *Haplophragma adenophyllum*.

338. *Avifauna:* Although no work has been carried out on the bird communities of Sonanadi WLS, its bird life is assumed to be rich as it adjoins Corbett where about 560 bird species have been reported. However, Sonanadi does not have as great a habitat diversity as Corbett. As there is no available checklist for Sonanadi WLS, it is classified here as Data Deficient. Two critically endangered species

of vultures are found here but they are widespread, especially the Oriental White-backed Vulture *Gypsbengalensis*. Very few IBAs have been selected based on only these two species of vultures.

339. Other Key Fauna: Sonanadi has almost all the larger mammals that are found in Corbett and Rajaji National Parks, such as the Asian Elephant (*Elephas maximus)*, Tiger (*Pantheratigris)*, Leopard (*P. pardus)*, Sambar (*Cervus unicolor)*, Cheetal (*Axis axis)*, Barking Deer (*Muntiacus muntjac)*, Nilgai (*Boselaphus tragocamelus)*, Wild Boar (*Sus scrofa)* and Sloth bear (*Melursus ursinus)*. Golden Jackal (*Canis aureus)* and Striped Hyena (*Hyaena hyaena)* are the smaller carnivores. No data are available on reptiles and amphibians.

340. **Corbett Tiger Reserve** (IBA/KBA) is situated in the hilly districts of Pauri Garhwal and Nainital in the northern state of Uttaranchal. It is one of the nine Tiger Reserves created at the launch of Project Tiger in 1973. This Reserve includes Corbett National Park (NP), which was the first Park to be established in India. It was declared in 1936 as Hailey NP with an area of 32,375 ha to which 19,707 ha were added later as Ramganga NP, and finally named as Corbett NP in 1957, in the memory of the legendary hunter turned conservationist Jim Corbett. In 1991, 79,772 ha was added as a buffer area to the Tiger Reserve. Now the total area of Corbett Tiger Reserve is 1,31,854 ha. This is one of the most famous Tiger Reserves in India and is extremely popular with tourists for its history, scenery and the wildlife. The area in the Himalayan foothills wherein the Reserve is situated is known as the South Patlidun, and ranges from 400 m to 1210 m. Corbett includes the foothills of Outer Himalayas in the north and the Shivaliks in the south. The Outer Himalayas form the northern boundary of the Reserve and Kanda, the highest point, with its magnificent panoramic view of the Reserve, is located here. The Ramganga valley, the largest in the Reserve, with its long axis from east to west, lies between the Outer Himalayas and the Shivaliks. Through Ramganga valley, three thickly forested ridge systems run roughly parallel to one another. Small offshoots of these ridges run north to south and the small valleys formed in between are known as sots. Many smaller valleys run from the Shivaliks towards the south and the prominent one is Paterpani sot. Different types of vegetation are found all along the varied topography, which comprises hilly and riverine areas, temporary marshy depressions, plateaux and ravines. Up to 110 species of trees, 51 species of shrubs and over 33 species of bamboo and grass are found here. The Reserve is known for its almost pure stands of Sal *Shorea robusta* in the lower hilly ridges and flat valleys. The chaurs, or savanna grasslands, are covered with a variety of tall grasses such as *Themeda arundinacea*, *Vetiveria zizanioides*, *Cymbopogon jwarancusa* and *Desmostachya bipinnata*. Encroachment on these grasslands, which are vital for species such as Hog deer *Axis porcinus*, by *Cannabis sativa* is a cause for concern. Controlled burning is carried out during winter to prevent woodland encroachment and promote growth of fresh grass.

341. *Avifauna:* Corbett has many attractions for bird watchers. Over 580 species of birds are reported. Of the total 69 species of diurnal raptors reported from the Indian subcontinent, 51 are found in Corbett and of the 26 species of woodpeckers 15 are reported from Corbett. Although Corbett does not have many restricted range species, it has 15 species of Biome-8 (Sino-Himalayan Subtropical Forest). Species from Biome-5 (Eurasian High Montane - Alpine and Tibetan) and Biome-7 (Sino-Himalayan Temperate Forest) are also found here. Among the interesting species is Ibisbill (*Ibidorhyncha struthersii)*, a bird of cold streams and shingle beds of the Himalayas. Brown dippers (*Cinclus pallasii)* is also frequent seen in winter. Thirteen Near Threatened species are also found in this IBA.

342. *Other Key Fauna:* Approximately fifty species of mammals are found in the area. Among the larger mammals, Tiger (*Panthera tigris)*, Leopard (*P. pardus)*, Asian Elephant (*Elephas maximus)*, Sambar (*Cervus unicolor)*, Cheetal (*Axis axis)*, Hog Deer (*Axis porcinus)*, Barking Deer or Indian Muntjak (*Muntiacus muntjac)*, Wild Boar (*Sus scrofa)*, Goral (*Nemorhaedus goral)*, and Golden Jackal (*Canis aureus)* are noteworthy. Serow (*Nemorhaedussumatraensis)* are occasionally seen

in Kanda ridge. Interestingly, in winter the Asiatic Black Bear (*Ursus thibetanus)* visits the northern part of the Reserve and Sloth Bears (*Melursus ursinus)* are resident in the southern portion of the Reserve. Among the reptiles, the two largest Indian species, namely Gharial (*Gavialis gangeticus)* and Marsh Crocodile (*Crocodylus palustris)* are found in the Reserve.

343. In addition to numerous amphibians and lizards, the largest of the poisonous snakes, the King Cobra (*Ophiophagus Hannah)* and *Python* (*Python molurus)* are frequently seen. Some of the best game fish of India, such as Golden Mahseer (*Tor putitora)* and Indian Trout (*Barilius bola)* abound in the waters of Ram Ganga streams which flow through the Reserve.

344. **Sukla Phanta (IBA/KBA)** lies in the extreme southwest of the terai in Kanchanpur district, Nepal. The international border between Nepal and India demarcates the western boundary and also the southern boundary, beyond which lies the Luggabugga Florican Reserve in India. Some 54.7% of the reserve is covered by broadleaved forests of Sal *Shorea robusta* with forests of Sissoo Dalbergia sissoo and Khair Acacia catechu along rivers, and grassland and marsh in the southwest where soils are of recent alluvium. The rest consists of forests of Sal, Sissoo and Khair and savannah, supported by better-drained soils on higher terrain in the northeast. The reserve possesses the largest grassland phantas in Nepal; these are of both national and international importance for birds and other wildlife. There are four small lakes, Rani Tal, Salghaudi Tal, Kalikitch Tal and Shikari Tal, which add significantly to the reserve's biodiversity.

345. *Avifauna:* Around 373 species of birds have been recorded in the reserve, including 50% of Nepal's globally threatened species. Over half of these threatened species frequent grasslands, emphasizing the reserve's importance for this habitat type. The reserve supports by far the largest population of Bengal Florican in Nepal. Sukla Phanta also holds the large majority of Nepal's wintering population of Hodgson's Bushchat *Saxicola insignis* and is the country's only regular wintering site for the species. The reserve is also important for Swamp Francolin, White-rumped Vulture, Slender-billed Vulture, Lesser Adjutant, Bristled Grassbird, Jerdon's Babbler *Chrysomma altirostre* and Finn's Weaver *Ploceus megarhynchus*. The last species, which was previously described as endemic to India, is one of two new bird species for Nepal that were found in Sukla Phanta in 1996 indicating that the grasslands were poorly surveyed at that time. Almost half (11 out of 23) of Nepal's near-threatened birds have been recorded at Sukla Phanta and seven of these are wetland species. The reserve has large areas of grasslands, and dry tropical and dry subtropical forests. These are known to support significant populations of species characteristic of the Indo-Gangetic Plain, Indo-Malayan Tropical Dry Zone and Sino-Himalayan Subtropical Forest biomes respectively.

346. *Non-bird biodiversity:* A total of 30 species of mammals has been reliably reported from here, including the following globally threatened species: Tiger (*Panthera tigris*), Asian Elephant (*Elephas maximus*), Hispid Hare (*Caprolagus hispidus*), Smooth-coated Otter (*Lutrogale perspicillata*), Nilgai (*Boselaphus tragocamelus*), Barasingha (or Swamp Deer) (*Cervus duvaucelii*) and, also, Indian Rhinoceros (*Rhinoceros unicornis*), which has been recently reintroduced. Sukla Phanta supports the largest population of the nominate race of Barasingha Cervus (*duvaucelii duvaucelii*), in the world. Sukla Phanta also has a healthy population of Mugger Crocodile (*Crocodylus palustris*) and Indian Python (*Python molurus*).

347. In addition, the following IBAs / KBAs can be found:

348. **Jhilmil Jheel Conservation Reserve.** Resident species of:

- Black-bellied Tern (*Sterna acuticauda)* (EN)

349. **Amangarh Reserve Forest.** Resident Species of:

- Black-bellied Tern (*Sterna acuticauda)* (EN)
- Great Slaty Woodpecker (*Mulleripicus pulverulentus)* (VU)

350. **Pawalgarh Conservation Reserve.** Resident species of:

- Great Slaty Woodpecker (*Mulleripicus pulverulentus)* (VU)

351. **Naina Devi Himalayan Bird Conservation Reserve.** Resident species of

- Himalayan Quail (*Ophrysia superciliosa)* (CR)
- Cheer Pheasant (*Catreus wallichii)* (VU)
- Grey-crowned Prinia (*Prinia cinereocapilla)* (VU)

352. **Nandhour Wildlife Sanctuary.** Resident species of:

- Great Slaty Woodpecker (*Mulleripicus pulverulentus)* (VU)

353. Screening of the Project sites indicates that generally sub-activities avoid sensitive sites and buffer zones, i.e. not within 10km (Table 44 and Table 45) except for UG cabling in Dehradun and one existing substation located within the notified/draft notified ESZ of protected areas, or Kaniya substation and UG cable and two existing substations in the 10km buffer where the ESZ has not been notified or drafted.

354. Mapping of reserve forest (RF) areas (**Appendix A and B**) indicates that the following sites are in RF:

- Pithrogarh – Champawat (Lohaghat). Written approval for second stringing works has been obtained from the Department of Forests (Appendix W).

355. No other new facilities are located in RF. However, several are located close, as indicated in Table 44.

Table 44: New Facilities Screening

		Within ESZ / ESA	Within ESZ Buffer	PA (within 10km)	IBA / KBA (within 10km)	RF (within 1km)
#	**PTCUL LILO**					
1	Roorkee - Nara					
2	Manglore-Asahi					
3	Kathgodam - Rudrapur					
4	Khatima - Sitarganj				Within 10km	230m
5	Kashipur-Puhana					
6	Manglaur - Nara					
7	Kashipur - Mahuakheraganj					
#	**PTCUL OHL**					
1	Mahuakheraganj - Jaspur				Within 9km	
#	**PTCUL Substations**					
1	Dhaulkhera			Nandadur WLS: 8km		
2	Sarvarkhera					
3	Selaqui					
4	Lohaghat					

		Within ESZ / ESA	Within ESZ Buffer	PA (within 10km)	IBA / KBA (within 10km)	RF (within 1km)
5	Araghar				Within 5km	
6	Khatima-II				Within 10km	120m
7	Landhora					
8	Manglore					
#	**PTCUL Second Stringing Line**					
1	Pithrogarh – Champawat					Within forest land (permission obtained)
#	**PTCUL UG LILO**					
1	Khodri-Jhajra Line					
2	Majra-Laltappar Line				Within 5km	
#	**UPLC UG**					
1	Dehradun	Yes (draft notified ESZ)		In 500m	In 500m	
#	**UPCL OHL / UG**					
1	Near Collectorate					700m
2	Bharauni					
3	Kaniya		Yes	In 500m	In 500m	450m
#	**UPCL New Substations**					
1	Near Collectorate					
2	Bharauni					700m
3	Kaniya		Yes	In 500m	In 500m	450m

Note: Green cells indicate none within 10km

Table 45: Existing UPCL Substation Designated Site Screening

#	UPCL existing substation	ESZ	ESZ Buffer	ESA	PA	IBA/KBA
1	Sahastradhara					IBA A3 Forest Research Institute IBA: 3 km
2	Hatibarakala					IBA A3 Forest Research Institute IBA: 3.5 km
3	Sahiya					
4	Sawra					
5	Rudrapur					
6	Ramnagar Danda					
7	Lal Tappar		Yes (10km buffer for non-notified ESZ		Rajaji NP-2.5km; Category II as per IUCN criteria	A1 KBA due to IBA status
8	Tarikhet					
9	Bajol					
10	Lamgarah					
11	Sairaghat	Yes (Binsar WLS)			Binsar WLS – 2.5km;	A3

#	UPCL existing substation	ESZ	ESZ Buffer	ESA	PA	IBA/KBA
					Category IV as per IUCN criteria	KBA due to IBA status
12	Kamalwaganja					
13	Transport Nagar					
14	Phoolchaur					
15	Garampani					
16	Talla Ramgarh					
17	Sarghakhet					
18	Pines					
19	Matkota					
20	Bhadaipura					
21	Lalpur					
22	Sitarganj					
23	Jhankat					
24	Kashipur		Yes (10km buffer for non-notified ESZ		Corbet NP-9km, Category II as per IUCN criteria[58]	A1 KBA due to IBA status - 9km
25	Doraha					

Note: Green cells indicate none within 10km
Source: UPCL EHS Audit

6.3.2. Habitat

356. The state is represented by biographic zone 2B Western Himalaya and 7B Shiwaliks consisting of Kumaon and Garhwal regions.

357. In Uttarakhand a total of 42 wetlands have been prioritized at state level for conservation based on set parameters. They are as follows - Bara-Dhara Sem, Basuki Tal, Bharadhsar, Devtal, Dodital, Kana Tal, Kanasar, Kedar Tal, Khera Tal (West), Kush Kalyan Kund, Maldaru Tal, Manera Tal, Miali Tal, Nandi Kund, Parvati Kund, Rwesara Tal (Runisara), Satopanth Tal, Thamri Tal, Vasundhara Tal, Tehri Dam, Nanak Sagar, Tumaria, Bagul Dam, Bour Dam, Dhora Dam, Haripura Dam, Sharda Barrage, Jhilmil Jheel, Asan Barrage, Virbhadra Barrage, Dakpathar, Banbasa Barrage, Tadag Tal, Nainital, Bhim Tal, Naukuchia Tal, Sat Tal, Kosi Barrage, Khurpatal, Asan near Kunja Village, Garud Tal and Shymla Tal. None of these wetlands are in the project area of influence, Asan Wetland is more than 14km from Selaqui SS. The area under forest in Uttarakhand is 3.4 million hectares, which constitutes 61.45% of its total land available for utilization. By legal status, reserve forests constitute 71.08%, protected forests 28.51% and unclassified forests 0.41% of the total forest area. The major forest types occurring in the state are Tropical Moist Deciduous, Tropical Dry Deciduous, Sub-tropical Pine, Himalayan Moist Temperate, Sub-Alpine and Alpine Forests. Forests are largely distributed throughout the state, with conifers and Sal being the major forest formation. [59] Forest land (natural habitat) is impacted by the second stringing component but no new trees will be cut

[58] IUCN. 1990. IUCN Directory of South Asian Protected Areas. IUCN, Gland, Switzerland and Cambridge, U.K. xxiv + 294 pp.
https://wedocs.unep.org/bitstream/handle/20.500.11822/8084/IUCN_directory_South_Asian_Protected_Areas.pdf?sequence=3&isAllowed=y

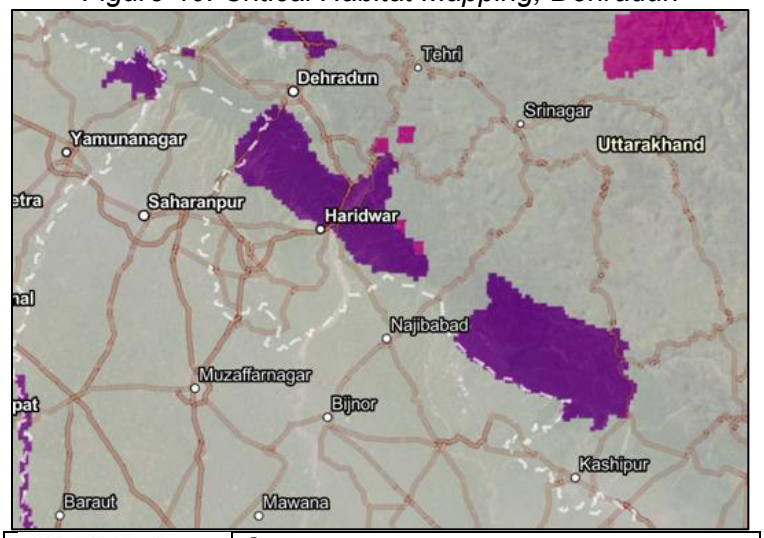
[59] https://forest.uk.gov.in/uploads/climate_change_information/1616764235.pdf

under this component. Other new components are all found in modified habitat e.g., urban and agricultural land.

358. Triggers for potential Critical Habitat under ADB's Safeguard Policy Statement (2006) are the following six (6) criteria. In relation to criterion 1 to 4 the thresholds of the IFC Performance Standard 6 guidelines can be used to determine critical habitat presence when these categories of species have been observed in the study area: (1) Presence of globally or nationally Critically Endangered or Endangered species; (2) Restricted-range or endemic species; (3) Concentrations of migratory species; (4) Concentrations of congregatory species; (5) Unique assemblages, key evolutionary processes or key ecosystem services; (6) Significant social, economic, or cultural importance to local communities.

359. There are some critically endangered/endangered/migratory species which may be found within the project area, as discussed in the following sections and which in relation to the IFC Performance Standard 6 thresholds may trigger critical habitat at the state level. No restricted range/endemic or congregatory species have been identified in the project area that are anticipated to trigger it. Critical habitat mapping by the United Nations Environment Program (UNEP) at https://www.arcgis.com/home/webmap/viewer.html?url=https://gis.unep-wcmc.org/arcgis/rest/services/marine/WCMC_045_GlobalCH_IFCPS6_2017/MapServer indicates that there are several portions of Uttarakhand that are potentially and likely critical habitat, this is based on the presence of protected areas, KBA, IBA etc. Critical habitat around Dehradun is shown in Figure 40. Mapping undertaken as part of this Project does not indicate that any of the Project sites are located within likely or potential critical habitat except for Kaniya SS and OHL (Appendix B).

Figure 40: Critical Habitat Mapping, Dehradun



6.3.3. Tiger Corridors

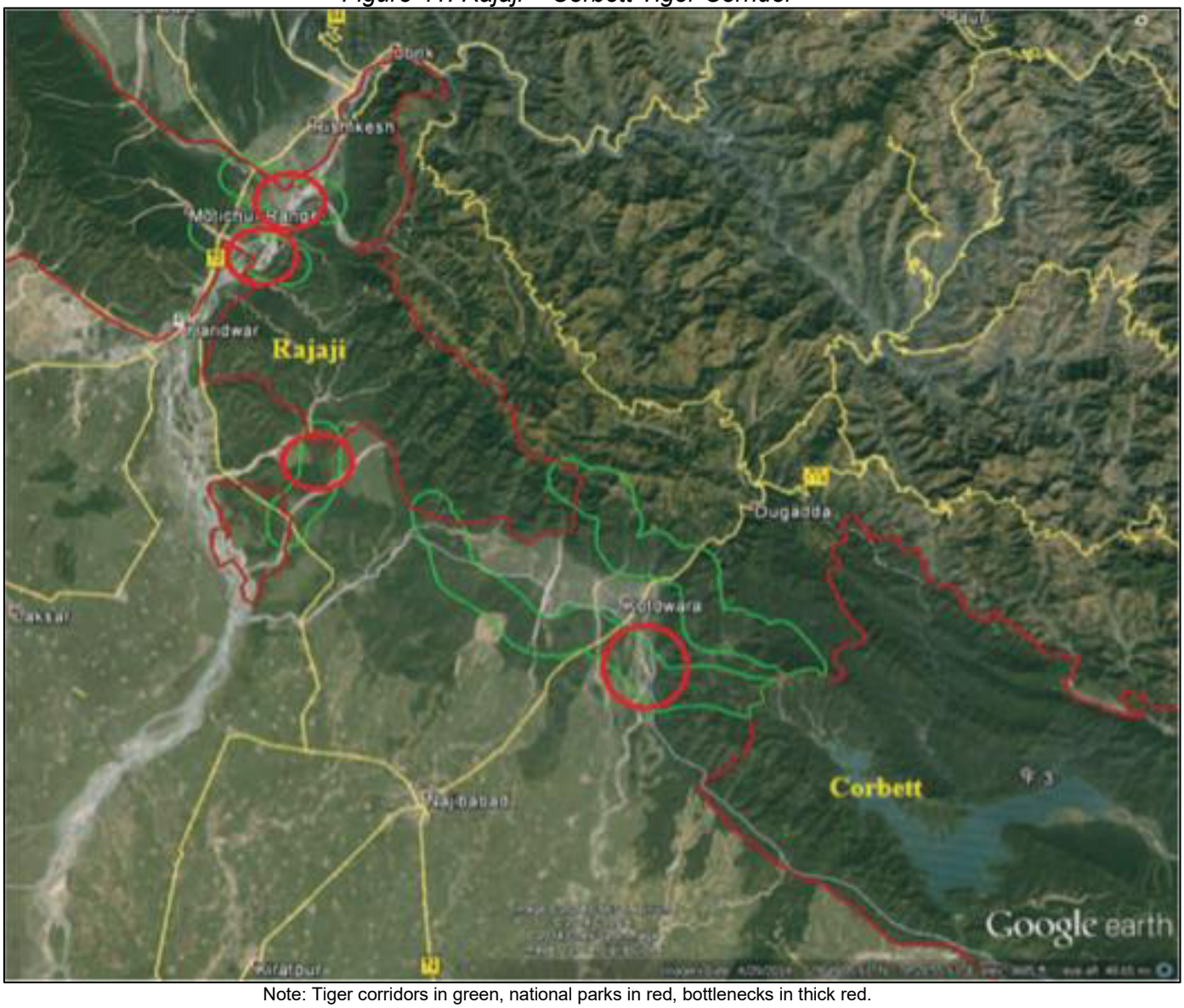
360. There are two tiger corridors in Uttarakhand:

- Rajaji-Corbett

- Corbet-Dudhwa

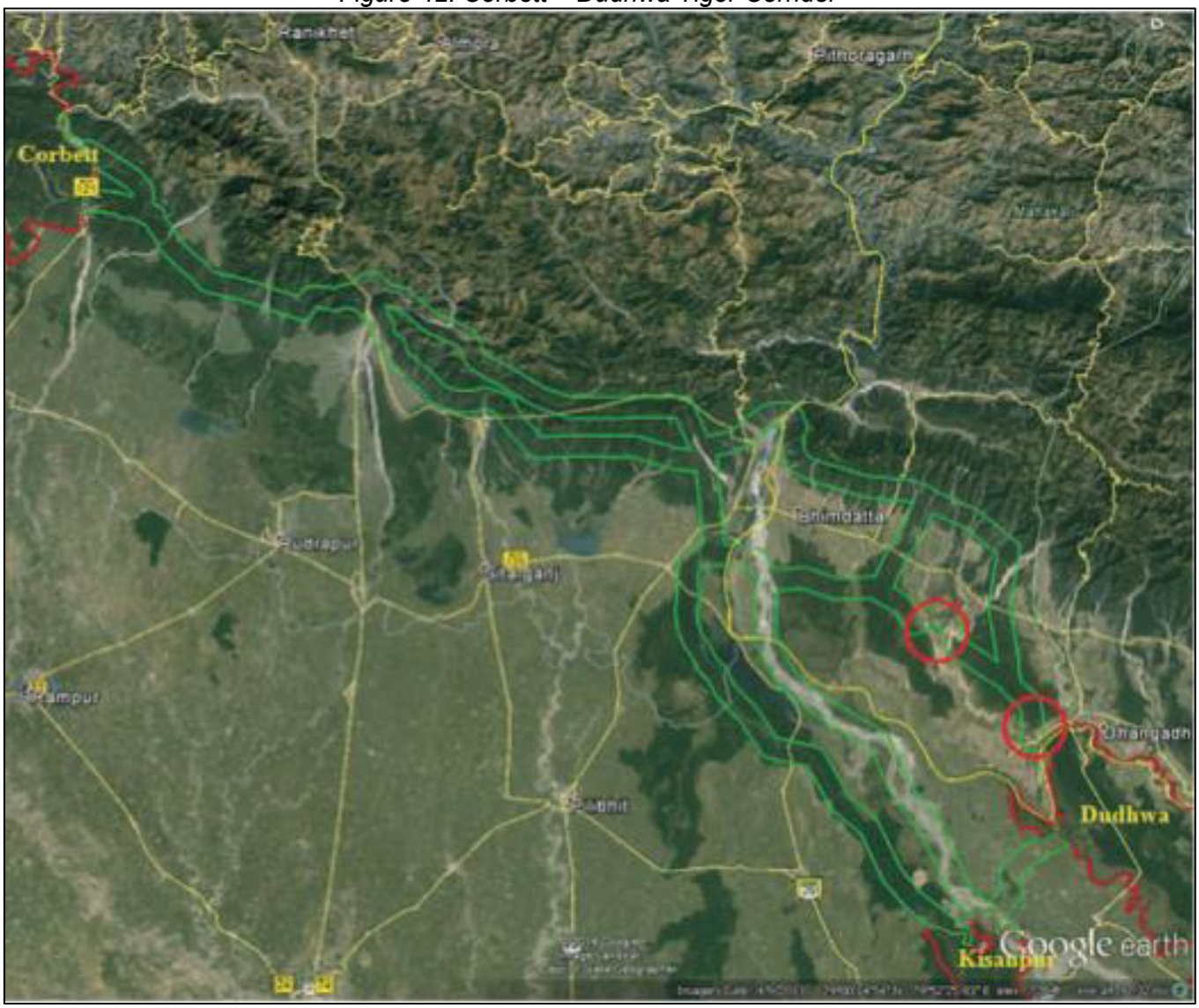
361. The corridors are part of a network of 32 major tiger corridors in India. They are operationalized through a Tiger Conservation Plan mandated under section 38V of the Wildlife (Protection) Act, 1972.

Figure 41: Rajaji – Corbett Tiger Corridor



Note: Tiger corridors in green, national parks in red, bottlenecks in thick red.
Source: Connecting Tiger Populations for Long Term Conservation. National Tiger Conservation Authority & Wildlife Institute of India, Dehradun. 2014

Figure 42: Corbett – Dudhwa Tiger Corridor



Note: Tiger corridors in green, national parks in red, bottlenecks in thick red.
Source: Connecting Tiger Populations for Long Term Conservation. National Tiger Conservation Authority & Wildlife Institute of India, Dehradun. 2014