

TABLE: ENVIRONMENTAL MANAGEMENT PLAN

| Project activity /stage | Potential impact | Proposed mitigation measure | Parameter to be monitored | Measurement and frequency | Institutional responsibility | Implementation schedule | Applicability |
|--|--|---|---|---|------------------------------|--|----------------------------------|
| Pre-construction | | | | | | | |
| Location of transmission towers and transmission line alignment and design | Exposure to safety related risks | Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites. | Tower location and line alignment selection with respect to nearest dwellings | Setback distances to nearest houses - once | POWERGRID | Part of tower siting survey and detailed alignment survey and design | Transmission Line Tower Packages |
| Equipment specifications and design parameters | Release of chemicals and gases in receptors (air, water, land) | PCBs not used in substation transformers or other project facilities or equipment. | Transformer design | Exclusion of PCBs in transformers stated in tender specification - once | POWERGRID | Part of tender specifications for the equipment | Substation Equipment /Packages* |
| | | Processes, equipment and systems not to use chlorofluorocarbons (CFCs), including halon, and their use, if any, in existing processes and systems should be phased out and to be disposed of in a manner consistent with the requirements of the Government | Process, equipment and system design | Exclusion of CFCs stated in tender specification – once | POWERGRID | Part of tender specifications for the equipment | |
| | | | | Phase out schedule to be prepared in case still in use – once | | Part of equipment and process design | |
| Transmission line design | Exposure to electromagnetic | Transmission line design to comply with | Electromagnetic field strength for | Line design compliance | POWERGRID | Part of detailed alignment | Transmission Line Tower |

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| | interference | the limits of electromagnetic interference from overhead power lines | proposed line design | with relevant standards - once | | survey and design | Packages |
| Location of transmission towers and transmission line alignment and design | Impact on water bodies and land | Consideration of tower location at where they could be located to avoid water bodies or agricultural land. | Tower location and line alignment selection (distance to water and/or agricultural land) | Consultation with local authorities and land owners - once | POWERGRID | Part of tower siting survey and detailed alignment survey and design | Transmission Line Tower Packages |
| | Social inequities | Careful route selection to avoid existing settlements | Tower location and line alignment selection (distance to nearest dwellings or social institutions) | Consultation with local authorities and land owners - once | POWERGRID | Part of detailed tower siting and alignment survey and design | |
| | | Minimise need to acquire agricultural land | Tower location and line alignment selection (distance to agricultural land) | Consultation with local authorities and land owners - once | POWERGRID | Part of detailed tower siting and alignment survey and design | |
| Encroachment into precious ecological areas | Loss of precious ecological values/ damage to precious species | Avoid encroachment by careful site and alignment selection | Tower location and line alignment selection (distance to nearest designated ecological protection area) | Consultation with local authorities - once | POWERGRID | Part of detailed siting and alignment survey /design | Transmission Line Tower Packages |

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| | | Minimise the need by using existing towers and RoW wherever possible | Tower location and line alignment selection | Consultation with local authorities and design engineers - once | POWERGRID | Part of detailed siting and alignment survey/design | |
| Transmission line through forestland | Deforestation and loss of biodiversity | Avoid encroachment by careful site and alignment selection | Tower location and line alignment selection (distance to nearest protected or reserved forest) | Consultation with local authorities - once | POWERGRID | Part of detailed siting and alignment survey/design | Transmission Line Tower Packages |
| | | Minimise the need by using existing towers, tall towers and RoW, wherever possible | | Consultation with local authorities and design engineers - once | | | |
| | | Obtain statutory clearances from the Government | Statutory approvals from Government | Compliance with regulations – once for each subproject | | | |
| Encroachment into farmland | Loss of agricultural productivity | Use existing tower footings/towers wherever possible | Tower location and line alignment selection | Consultation with local authorities and design engineers - once | POWERGRID | Part of detailed alignment survey and design | Transmission Line Tower Packages |
| | | Avoid siting new towers on farmland wherever feasible | Tower location and line alignment selection | Consultation with local authorities and design engineers - once | | Part of detailed siting and alignment survey /design | |

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| | | Farmers compensated for any permanent loss of productive land | Design of Implementation of Crop Compensation (based on affected area) | Consultation with affected parties – once in a quarter | | Prior to construction phase | |
| | | Farmers/landowners compensated for significant trees that need to be trimmed/ removed along RoW. | Design of Implementation of Tree compensation (estimated area to be trimmed/removed) | Consultation with affected parties – once in a quarter | | Prior to construction phase | |
| | | Statutory approvals for tree trimming /removal | Compliance with regulations – once for each subproject | Part of detailed siting and alignment survey /design | | | |
| Noise related | Nuisance to neighbouring properties | Substations sited and designed to ensure noise will not be a nuisance. | Noise levels | Noise levels to be specified in tender documents - once | POWERGRID | Part of detailed equipment design | Substation Packages |
| Interference with drainage patterns/Irrigation channels | Flooding hazards/loss of agricultural production | Appropriate siting of towers to avoid channel interference | Tower location and line alignment selection (distance to nearest flood zone) | Consultation with local authorities and design engineers - once | POWERGRID | Part of detailed alignment survey and design | Transmission Line Tower Packages |

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| Escape of polluting materials | Environmental pollution | Transformers designed with oil spill containment systems, and purpose-built oil, lubricant and fuel storage system, complete with spill cleanup equipment. | Equipment specifications with respect to potential pollutants | Tender document to mention specifications - once | POWERGRID | Part of detailed equipment design /drawings | Transformer specifications |
| | | Substations to include drainage and sewage disposal systems to avoid offsite land and water pollution. | Substation sewage design | Tender document to mention detailed specifications - once | POWERGRID | Part of detailed substation layout and design /drawings | Substation packages (civil) |
| Equipment submerged under flood | Contamination of receptors (land, water) | Substations constructed above the high flood level (HFL) by raising the foundation pad. | Substation design to account for HFL (elevation with respect to HFL elevation) | Base height as per flood design - once | POWERGRID | Part of detailed substation layout and design /drawings | Substation packages (civil) |
| Explosions/Fire | Hazards to life | Design of substations to include modern fire control systems/firewalls. | Substation design compliance with fire prevention and control codes | Tender document to mention detailed specifications - once | POWERGRID | Part of detailed substation layout and design /drawings | Substation packages |
| | | Provision of fire fighting equipment to be located close to transformers. | | | | | |
| Construction | | | | | | | |
| Equipment layout and installation | Noise and vibrations | Construction techniques and machinery selection seeking to minimize ground disturbance. | Construction techniques and machinery | Construction techniques and machinery creating minimal ground disturbance - | POWERGRID (Contractor through contract provisions) | Construction period | All packages |

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| | | | | once at the start of each construction phase | | | |
| Physical construction | Disturbed farming activity | Construction activities on cropping land timed to avoid disturbance of field crops (within one month of harvest wherever possible). | Timing of start of construction | Crop disturbance – Post harvest as soon as possible but before next crop - once per site | POWERGRID (Contractor through contract provisions) | Construction period | All packages |
| Mechanized construction | Noise, vibration and operator safety, efficient operation | Construction equipment to be well maintained. | Construction equipment – estimated noise emissions | Complaints received by local authorities - every 2 weeks | POWERGRID (Contractor through contract provisions) | Construction period | All packages |
| | Noise, vibration, equipment wear and tear | Turning off plant not in use. | Construction equipment – estimated noise emissions and operating schedules | Complaints received by local authorities - every 2 weeks | POWERGRID (Contractor through contract provisions) | Construction period | |
| Construction of roads for accessibility | Increase in airborne dust particles | Existing roads and tracks used for construction and maintenance access to the line wherever possible. | Access roads, routes (length and width of new access roads to be constructed) | Use of established roads wherever possible - every 2 weeks | POWERGRID (Contractor through contract provisions) | Construction period | Transmission Line Tower Packages |

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| | Increased land requirement for temporary accessibility | New access ways restricted to a single carriageway width within the RoW. | Access width (meters) | Access restricted to single carriageway width within RoW - every 2 weeks | POWERGRID (Contractor through contract provisions) | Construction period | |
| Temporary blockage of utilities | Overflows, reduced discharge | Temporary placement of fill in drains/canals not permitted. | Temporary fill placement (m ³) | Absence of fill in sensitive drainage areas - every 4 weeks | POWERGRID (Contractor through contract provisions) | Construction period | All Packages |
| Site clearance | Vegetation | Marking of vegetation to be removed prior to clearance, and strict control on clearing activities to ensure minimal clearance. | Vegetation marking and clearance control (area in m ²) | Clearance strictly limited to target vegetation - every 2 weeks | POWERGRID (Contractor through contract provisions) | Construction period | All Packages |
| Trimming/cutting of trees within RoW | Fire hazards | Trees allowed growing up to a height within the RoW by maintaining adequate clearance between the top of tree and the conductor as per the regulations. | Species-specific tree retention as approved by statutory authorities (average and maximum tree height at maturity, in meters) | Presence of target species in RoW following vegetation clearance – once per site | POWERGRID (Contractor through contract provisions) | Construction period | Transmission Line Tower Packages |

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| | Loss of vegetation and deforestation | Trees that can survive pruning to comply should be pruned instead of cleared. | Species-specific tree retention as approved by statutory authorities | Presence of target species in RoW following vegetation clearance – once per site | POWERGRID (Contractor through contract provisions) | Construction period | Transmission Line Tower Packages |
| | | Felled trees and other cleared or pruned vegetation to be disposed of as authorized by the statutory bodies. | Disposal of cleared vegetation as approved by the statutory authorities (area cleared in m ²) | Use or intended use of vegetation as approved by the statutory authorities – once per site | POWERGRID (Contractor through contract provisions) | Construction period | |
| Wood/vegetation harvesting | Loss of vegetation and deforestation | Construction workers prohibited from harvesting wood in the project area during their employment, (apart from locally employed staff continuing current legal activities). | Illegal wood /vegetation harvesting (area in m ² , number of incidents reported) | Complaints by local people or other evidence of illegal harvesting - every 2 weeks | POWERGRID (Contractor through contract provisions) | Construction period | All Packages |
| Surplus earthwork/soil | Runoff to cause water pollution, solid waste disposal | Soil excavated from tower footings disposed of by placement along roadsides, or at nearby house blocks if requested by landowners. | Soil disposal locations and volume (m ³) | Acceptable soil disposal sites - every 2 weeks | POWER GRID (Contractor through contract provisions) | Construction period | Transmission Line Tower Packages |
| Substation construction | Loss of soil | Fill for the substation foundations obtained by creating or improving | Borrow area siting (area of site in m ² and estimated | Acceptable borrow areas that provide a | POWERGRID (Contractor through | Construction period | Substation Package (Civil) |

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| | | local water supply ponds or drains, with the agreement of local communities. | volume in m ³) | benefit - every 2 weeks | contract provisions) | | |
| Substation construction | Water pollution | Construction activities involving significant ground disturbance (i.e. substation land forming) not undertaken during the monsoon season. | Seasonal start and finish of major earthworks (pH, BOD/COD, Suspended solids, other ?) | Timing of major disturbance activities - prior to start of construction activities | POWERGRID (Contractor through contract provisions) | Construction period | Substation Package (Civil) |
| Site clearance | Vegetation | Tree clearances for easement establishment to only involve cutting trees off at ground level or pruning as appropriate, with tree stumps and roots left in place and ground cover left undisturbed. | Ground disturbance during vegetation clearance (area, m ²) | Amount of ground disturbance - every 2 weeks | POWERGRID (Contractor through contract provisions) | Construction period | Substation Package (Civil) |
| | | | Statutory approvals | Statutory approvals for tree clearances – once for each site | POWERGRID (Contractor through contract provisions) | Construction period | |
| Tower construction – disposal of surplus earthwork/fill | Waste disposal | Excess fill from tower foundation excavation disposed of next to roads or around houses, in agreement with the local community or landowner. | Location and amount (m ³)of fill disposal | Appropriate fill disposal locations - every 2 weeks | POWERGRID (Contractor through contract provisions) | Construction period | Transmission Line Tower Packages |
| Storage of chemicals and materials | Contamination of receptors (land, water, air) | Fuel and other hazardous materials securely stored above high flood level. | Location of hazardous material storage; spill reports (type of | Fuel storage in appropriate locations and receptacles - | POWERGRID (Contractor through contract | Construction period | All Packages |

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| | | | material spilled, amount (kg or m ³) and action taken to control and clean up spill) | every 2 weeks | provisions) | | |
| Construction schedules | Noise nuisance to neighbouring properties | Construction activities only undertaken during the day and local communities informed of the construction schedule. | Timing of construction (noise emissions, [dB(a)]) | Daytime construction only - every 2 weeks | POWERGRID (Contractor through contract provisions) | Construction period | All Packages |
| Provision of facilities for construction workers | Contamination of receptors (land, water, air) | Construction workforce facilities to include proper sanitation, water supply and waste disposal facilities. | Amenities for Workforce facilities | Presence of proper sanitation, water supply and waste disposal facilities - once each new facility | POWERGRID (Contractor through contract provisions) | Construction period | All Packages |
| Encroachment into farmland | Loss of agricultural productivity | Use existing access roads wherever possible | Usage of existing utilities | Complaints received by local people /authorities - every 2 weeks | POWERGRID (Contractor through contract provisions) | Construction period | All Packages |
| | | Ensure existing irrigation facilities are maintained in working condition | Status of existing facilities | | | | |
| | | Protect /preserve topsoil and reinstate after construction completed | Status of facilities (earthwork in m ³) | | | | |
| | | Repair /reinstate damaged bunds etc after construction completed | Status of facilities (earthwork in m ³) | | | | |

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| | Social inequities | Compensation for temporary loss in agricultural production | Implementation of Crop compensation (amount paid, dates, etc.) | Consultation with affected parties – once in a quarter | POWERGRID | Prior to construction | |
| Uncontrolled erosion/silt runoff | Soil loss, downstream siltation; | Need for access tracks minimised, use of existing roads. | Design basis and construction procedures (suspended solids in receiving waters; area re-vegetated in m ² ; amount of bunds constructed [length in meter, area in m ² , or volume in m ³]) | Incorporating good design and construction management practices – once for each site | POWERGRID (Contractor through contract provisions) | Construction period | All Packages |
| | | Limit site clearing to work areas | | | | | |
| | | Regeneration of vegetation to stabilise works areas on completion (where applicable) | | | | | |
| | | Avoidance of excavation in wet season | | | | | |
| | | Water courses protected from siltation through use of bunds and sediment ponds | | | | | |
| Nuisance to nearby properties | Losses to neighbouring land uses/ values | Contract clauses specifying careful construction practices. | Contract clauses | Incorporating good construction management practices – once for each site | POWERGRID (Contractor through contract provisions) | Construction period | All Packages |
| | | As much as possible existing access ways will be used. | Design basis and layout | Incorporating good design engineering practices – once for each site | | | |

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| | | Productive land will be reinstated following completion of construction | Reinstatement of land status (area affected, m ²) | Consultation with affected parties – twice – immediately after completion of construction and after the first harvest | | | |
| | Social inequities | Compensation will be paid for loss of production, if any. | Implementation of Tree/Crop compensation (amount paid) | Consultation with affected parties – once in a quarter | POWERGRID | Prior to construction | |
| Flooding hazards due to construction impediments of natural drainage | Flooding and loss of soils, contamination of receptors (land, water) | Avoid natural drainage pattern /facilities being disturbed /blocked /diverted by the on-going construction activities | Contract clauses (e.g., suspended solids and BOD/COD in receiving water) | Incorporating good construction management practices – once for each site | POWERGRID (Contractor through contract provisions) | Construction period | All packages |
| Equipment submerged under flood | Contamination of receptors (land, water) | Equipment stored at secure place above the high flood level (HFL). | Store room level to be above HFL (elevation difference in meters) | Store room level as per flood design - once | POWERGRID | Construction period | # All packages |
| Inadequate siting of borrow areas (quarry areas) | Loss of land values | Existing borrow sites will be used to source aggregates, therefore, no need to develop new sources of aggregates | Contract clauses | Incorporating good construction management practices – once for each | POWERGRID (Contractor through contract provisions) | Construction period | Substation Packages |

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| | | | | site | | | |
| Health and safety | Injury and sickness of workers and members of the public | Contract provisions specifying minimum requirements for construction camps | Contract clauses (number of incidents and total lost-work days caused by injuries and sickness) | Contract clauses compliance – once every quarter | POWERGRID (Contractor through contract provisions) | Construction period | All Packages |
| | | Contractor to prepare and implement a health and safety plan. | | | | | |
| | | Contractor to arrange for health and safety training sessions | | | | | |
| Inadequate construction stage monitoring | Likely to maximise damages | Training of POWERGRID environmental monitoring personnel | Training schedules | Number of programs attended by each person – once a year | POWERGRID | Routinely throughout construction period | All Packages |
| | | Implementation of effective environmental monitoring and reporting system using checklist of all contractual environmental requirements | Respective contract checklists and remedial actions taken thereof. | Submission of duly completed checklists of all contracts for each site - once | | | |
| | | Appropriate contact clauses to ensure satisfactory implementation of contractual environmental mitigation measures. | Compliance report related to environmental aspects for the contract | Submission of duly completed compliance report for each contract - once | | | |
| Operation and Maintenance | | | | | | | |
| Location of transmission | Exposure to safety related | Setback of dwellings to overhead line route | Compliance with setback distances | Setback distances to | POWERGRID | During operations | Transmission Line Tower |

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| towers and transmission line alignment and design | risks | designed in accordance with permitted level of power frequency and the regulation of supervision at sites. | ("as-built" diagrams) | nearest houses – once in quarter | | | Packages |
| Equipment submerged under flood | Contamination of receptors (land, water) | Equipment installed above the high flood level (HFL) by raising the foundation pad. | Substation design to account for HFL ("as-built" diagrams) | Base height as per flood design - once | POWERGRID | During operations | All packages |
| Oil spillage | Contamination of land/nearby water bodies | Substation transformers located within secure and impervious bunded areas with a storage capacity of at least 100% of the capacity of oil in transformers and associated reserve tanks. | Substation bunding ("as-built" diagrams) | Bunding capacity and permeability - once | POWERGRID | During operations | Substation Packages* |
| Inadequate provision of staff/workers health and safety during operations | Injury and sickness of staff /workers | Careful design using appropriate technologies to minimise hazards | Usage of appropriate technologies (lost work days due to illness and injuries) | Preparedness level for using these technologies in crisis – once each year | POWERGRID | Design and operation | All Packages |
| | | Safety awareness raising for staff. | Training/awareness programs and mock drills | Number of programs and percent of staff /workers covered – once each year | | | |
| | | Preparation of fire emergency action plan and training given to staff on implementing emergency action plan | | | | | |

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| | | Provide adequate sanitation and water supply facilities | Provision of facilities | Complaints received from staff /workers every 2 weeks | | | |
| Electric Shock Hazards | Injury/mortality to staff and public | Careful design using appropriate technologies to minimise hazards | Usage of appropriate technologies (number of injury incidents, lost work days) | Preparedness level for using these technologies in crisis – once a month | POWERGRID | Design and Operation | All Packages |
| | | Security fences around substations | Maintenance of fences | Report on maintenance – every 2 weeks | | | |
| | | Barriers to prevent climbing on/dismantling of transmission towers | Maintenance of barriers | | | | |
| | | Appropriate warning signs on facilities | Maintenance of warning signs | | | | |
| | | Electricity safety awareness raising in project areas | Training /awareness programs and mock drills for all concerned parties | Number of programs and percent of total persons covered – once each year | | | |
| Equipment specifications and design parameters | Release of chemicals and gases in receptors (air, water, land) | Processes, equipment and systems using cholofluorocarbons (CFCs), including halon, should be phased out and to be disposed of in a manner consistent with the requirements of the Government. | Process, equipment and system design | Phase out schedule to be prepared in case still in use – once in a quarter | POWERGRID | Operations | Substation Packages* |

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| Transmission line maintenance | Exposure to electromagnetic interference | Transmission line design to comply with the limits of electromagnetic interference from overhead power lines | Required ground clearance (meters) | Ground clearance - once | POWERGRID | Operations | Transmission Line Tower Packages |
| Noise related | Nuisance to neighbouring properties | Substations sited and designed to ensure noise will not be a nuisance. | Noise levels (dB(a)) | Noise levels at boundary nearest to properties and consultation with affected parties if any - once | POWERGRID | Operations | Substation Packages* |

*Substation packages also include Transformer, Reactor, FSC / TCSC Packages