From
Er. B.Bertrand Russell, B.E., (Hons.)
Chief Engineer/Projects-I,
Tamil Nadu Generation and Distribution Corporation Ltd.,
5th Floor, Western Wing,
NPKRR Maaligai,144, Anna Salai,
Chennai – 600 002.
Cell No: 9445857543
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To
The Director (IA-I Division),
Ministry of Environment, Forests & Climate Change,
Indira Paryavaran Bhavan,
2nd Floor, Vayu Wing,
Jor Bagh Road, Aliganj,
New Delhi – 110 003.
Phone No: 011-24695314(O), 26113096 (R)
E-mail id: yogendra78@nic.in

Kind attention : Shri. Y.P.Singh, Director.

Lr.No.CE/Proj-I/ SE/PD&C/EE/C-3/AEE2/C/F. KPSHEP-EC/D.No.05 /21,dt. 11 .01.21.

Dear Sir,

Sub:- TANGEDCO, a subsidiary of TNEB Ltd – Kundah Pumped Storage Hydro Electric Project (4x125MW) in Nanjanad Village, Udhagamandalam Taluk, Nilgiris District, Tamilnadu – 4th EAC meeting for River Valley Projects held on 02.12.2020 – Additional details - Furnished.

Ref: 1.Lr.No.CE/Proj-I/SE/PD&C/EE/C-3/AEE2/C/F.Kundah PSHEP-EC/D.No. 125/20, dt.18.11.20.
2. Minutes of the 4th Meeting of the Expert Appraisal Committee for River Valley Project held on 02.12.2020.

* * * * *

The Environmental Clearance proposal of TANGEDCO for the on-going Kundah Pumped Storage HEP (4x125 MW) in Nilgiris District was considered in the 4th Expert Appraisal Committee meeting for River Valley Projects held on 02.12.2020.

The additional information sought for by EAC therein are submitted herewith.

S. No	Observations	TANGEDCO's Response
1.	As the project is located in the Buffer Zone of Nilgiri Biosphere Reserve Area, impact study shall be carried out with detailed mitigation measures.	As the project is located in the Buffer Zone of Nilgiri Biosphere Reserve Area, maximum precautions and preventive measures will be adopted in minimizing impacts during the construction & operational phase of the project. Regarding the same, a detailed impact study has been carried out along with mitigation measures - **Annexure-I.**

S. No	Observations	TANGEDCO's Response
2.	Conservation plan for Schedule- I species to be prepared and submitted to the Chief Wildlife Warden for approval.	A detailed Wildlife Conservation Plan has been prepared for Scheduled - I species and submitted to the Principal Conservator of Forests and Chief Wildlife Warden, Chennai for approval vide TANGEDCO letter dated 07.01.21 - **Annexure-II.** Suggestions of Forest Department if any, will also be complied by TANGEDCO.
3.	Details of CER to be made as part of EMP as per Ministry's OM dated 30.09.2020. Based on the concern/issues raised in the earlier Public Hearing, activities may be included in local area development of EMP.	CER budget is merged with EMP budget which is proposed in Chapter-10 of EIA Report as per O.M. dated 30.09.2020 - **Annexure-III.**
4.	Environmental matrix during construction and operational phase needs to be submitted.	The various project activities and associated potential environmental impacts have been identified and summarized in a matrix - **Annexure-IV**.
5.	Fisheries management plan alongwith budgetary provision to be submitted.	Detailed Plan for Fishery Management alongwith budget provision is prepared - **Annexure-V**.

Further, The revised Environmental Management Plan incorporating the Wildlife Conservation Plan, Local Area Development Plan and Fisheries Management plan is furnished as **Annexure – VI**.

It is requested that the proposal may kindly be considered for issue of Environmental Clearance enabling completion of the Kundah Pumped Storage Hydro Electric Project.

Thanking You,

Yours Sincerely,

14/1/21

Chief Engineer/Projects -I

Enclosures: As above.

Annexure I

Study on the impact of Kundah Pumped Storage Hydro Electric Project on Buffer Zone of Nilgiris Biosphere Reserve Area

The Kundah Pumped Storage Hydro Electric Project (4x125 MW) is a Pumped Storage Scheme in Nilgiris hills of Tamil Nadu for providing peaking benefits utilizing the existing reservoir at Porthimund (live storage 20.10 Mm^3) as the upper reservoir and Avalanche-Emerald reservoir (live capacity 130.84 Mm^3) as lower reservoir. Construction of new reservoir is not proposed. Both the existing reservoirs will be connected with tunnels which will serve as Head race & Tail race water conducting system. The underground powerhouse is proposed to house 4 units of 125 MW each to produce 500 MW electricity.

1.0 Land requirement:

Forest Land: Forest land requirement is 30 ha. Forest clearance has been obtained vide letter dated 21.08.2013. Lease Agreement has been signed with State Forest Department.

Private Land: Private land of 47.89 ha has been purchased. Out of this, 36 ha have been transferred to forest department towards compensatory afforestation. Balance 11.89 ha of land will be utilized for project purpose.

2.0 Description of Biological Environment of the project area:

The Kundah Hydro Power Project is located in the Buffer Zone of Nilgiri Biosphere Reserve area of Western Ghat. The underground project location falls in Kaducuppa Reserved Forest and Hiriyashigee Reserved forest of Nilgiris District.

The project area is surrounded by natural forests. The vegetation falls in the tropical and subtropical moist broadleaf forests, tropical moist forests of the western slopes of the Ghats to the tropical and subtropical dry broadleaf tropical, dry forests on the east slopes. Rainfall ranges from 2100mm to 2300mm per annum in the region. Various kinds of tree plantation of exotic species are also evident in the area. Tea gardens as the main agricultural patches create the mosaic like landscape in the study area. Presence of the silver oak tree is very common in the tea gardens. Eucalyptus trees are planted throughout the area. Pines and Cyprus trees are also very common at the higher altitudes. A mix representation of various kinds of trees, shrubs and herbs is represented by the Shola forest with patches of grasslands. The mixed variety montane shola forests are separated by rolling grasslands at higher elevations.

The area of the Kundah Valley is very diverse with respect to its biological composition. In past, plantation of exotic plants, economic crops like tea and growth of invasive species such

as lantana is hindering the regeneration process of the natural vegetation. Excessive cattle grazing and tourism is also threatening the ecology of the area.

The study area includes Nilgiris hills, upper small lake (Porthimund Lake) the lower large lake (Avalanche-Emerald Lake). Based on primary survey conducted in study area and consultation with the secondary resources, a total of 145 floral species belonging to 58 plant families have been listed in the project area. Based on the number of species, the most important plant families reported in this region are Acanthaceae, Amaranthaceae, Euphorbiaceae, Fabaceae, Poaceae and Malvaceae etc.

As per inventory of the fauna recorded in the primary survey (by direct and indirect method) and reported in the secondary resources, a total of 21 mammalian, 46 avian, 11 amphibian, 8 reptilian and 17 butterflies are found. Fishing activities are banned in the lakes of the Nilgiri hills.

2.1 Endangered species of the Study Area

During the primary survey, although no Schedule-I species of fauna was observed in the study area. However, discussion with forest officials and villagers indicated presence of eight Schedule-I species in the vicinity of the project site i.e. *Panthera pardus* (Indian Leopard), *Bos gaurus* (Gaur), *Macaca silenus* (Lion-Tailed Macaque), *Melursus ursinus* (Sloth Bear*), Elephas maximus* (Indian Elephant), *Nilgiri tragushylocrius* (Nilgiri Tahr), *Trachypithecus johnii* (Nilgiri Langur) and one bird i.e. *Pavo cristatus* (Peafowl).

2.2 Impact of the project on Ecology and Biodiversity

As the project is located in the Buffer Zone of Nilgiri Biosphere Reserve area, a detailed impact study has been carried out along with mitigation measures. The HEP project with large-scale activities is likely to have notable impacts on various components of the local ecosystem. In a hydroelectric project, the impacts occur largely during construction phase.

2.2.1 Impact during Construction Phase

The impacts of the project during construction phase are described below:

- Construction of HEP involves HRT, TRT, surge shaft, pressure shaft, penstock, underground power house, switch yard, approach road; etc. Construction of these components involves several activities such as excavation, drilling and blasting, movement of men, machineries and materials. These activities lead to loss of vegetation during site preparation, soil loosening and its erosion.

- Land degradation due to debris and removal of plants; Habitat fragmentation due to construction of linear infrastructure.

- The construction of the project may lead to loss of feeding and breeding habitats of certain species inhabiting the project area.

- The movement of vehicles for men and materials, operation of heavy earth moving machineries, drilling and blasting increase the ambient noise level which is likely to disturb the animals and avian fauna. They are normally very sensitive to certain frequency range of sound.

- Man-animal conflicts including death of animals due to road accidents and hits.

- The blasting and excavations activities for tunnels, especially close to their mouths and in areas where the tunnels pass by close to the surface may affect some wild species in the immediate vicinity.

- Construction of sheds or shanties and cutting of trees for fuel purpose by laborers may threat neighboring forests and impede movement of wild animals.

The proposed project is not likely to cast major negative impact on the biodiversity of the area as the major linear components are underground. Most of the over ground structures of the project will be located in wattle plantations. The wattle rich areas are widely spread in project area and loss of patches due to diversion for project activities is likely to divest habitats for any species in a limited way. Since the water of the lakes will be recycled/ interchanged for the production of the electricity, there will be no impact on the water regime of these two lakes.

2.2.2 Mitigation Measures for minimizing the impacts on the Ecology and Environment

Since the project area and its environs fall within the buffer zone of The Nilgiri Biosphere Reserve, maximum precautions and preventive measures should be adopted in minimizing impacts during the construction phase of the project. Proper scheduling of the project execution, stringent control on vehicle movement and access to roads, controlled and regulated blasting to the bare minimum and effective training and educating the workers can help considerably in reducing the impacts on the local ecology and environment.
A detailed EMP which includes Greenbelt Development Plan, Wildlife Conservation Plan, and Forest Protection Plan etc. for the project has been described in Chapter 10 of the EIA report.

Some of the major mitigation and prevention measures are presented below:

- Sholas found in close vicinity of project areas should be protected as a part of larger commitment to protect environment. In addition, plantation in neighboring forest areas should be undertaken in consultation with local Forest Dept.

- Land for compensatory afforestation has already been handed over to Forest Department & cost of compensatory afforestation has already been remitted to Forest Department. The compensatory afforestation plan is under implementation by the Tamil Nadu Forest Department.

- Development of Green Belt along the boundary of the project as well as along the road sides of the project area should be undertaken. This will minimize the impact of noise and dust if any being produced. Plantation is perfect solution to minimize the erosion and to improve the macroclimate as well as suitable habitat for wild fauna.

- Restoration and Landscaping of working areas is essential as soon as the construction activities are over. Restoration and Landscaping activities would improve degraded land due to activities during construction phase and would enhance aesthetic of the project area. It would also prevent soil erosion and assist in maintaining the ecological equilibrium of the area. The reclaimed and restored sites need to be properly landscaped with local natural species to amalgamate with surrounding natural milieu.

- Habitat improvement works should also include sustained efforts to control spread of invasive weeds.

- Bare areas should be covered with suitable grass species to avoid soil erosion. A layer of surface soil should be laid and grass grown to enhance soil binding and stabilization.

- Proper disposal of the excavated muck and its filling on the low-lying area with proper measures for the stabilization and greenery will minimize the impacts of the generated construction muck. The muck should not be allowed to go to water bodies.

- The contour bunds and fringes of the waste dumps should be regularly maintained and properly monitored.

- A tall Watch tower at a strategic point should be constructed for observation and monitoring of forest fire, monitoring of wildlife movement and illegal poaching of wild animals. This would also help in periodic surveillance to strength the quality of crisis preparedness and management.

- The natural existing Water holes should not be used for project activities. Project proponent should create and maintain new water holes along corridors of wild animals and avian fauna.

- The traffic on roads carrying men and materials should be carefully regulated and managed through check post and barriers to minimize the impact.

- All the vehicles including earth moving equipment's should be regularly serviced and well maintained to keep noise generation low.

- The blasting pattern and technique should be adopted depending upon actual geology of the site and rock structure. Regulated and controlled blasting to bare minimum required should be done. Further, the blasting need to be practiced only during day time, avoiding dawn and dusk period.

- Necessary facilities such as fuel wood/ gas cylinder/kerosene oil/ electricity etc. should be provided to construction workers to eliminate dependency on nearby forest.

- The firefighting equipment's should be well placed to reduce loss of flora and fauna in case of manmade and natural fire. Proper training also needs to be imparted to workers and staff for operation of firefighting equipment's.

- The detailed Greenbelt Development Plan, Fishery Management Plan, Forest Protection Plan, Wildlife Conservation Plan duly approved by Chief Wildlife Warden and other EMP activities should be implemented effectively by the project proponent which will go a long way in protection and restoration of ecology and environment of the project site area in the Nilgiri.
- Involvement of village communities and panchayat in conservation activities is essential for its successful implementation. This should also include resolution of man- animal conflict through proper planning with the help of local forest officials and local community.

- Active participation and interventions of Nilgiri Forest Department to ensure protection of wildlife against poaching, illicit felling, grazing and lopping; controlling spread of invasive weeds and loss of habitat through soil erosion, fires, biodiversity conservation activities, etc should be ensured by the project management.

- A detailed ecological monitoring and survey covering forestry, fisheries, wildlife and its habitat is recommended during the entire construction phase once in two years.

The project proponent is already implementing various mitigation measures and is further strengthening to protect and conserve the buffer zone of biosphere reserve.

Annexure II

From
Er. B.Bertrand Russell, B.E., (Hons.)
Chief Engineer/Projects-I,
Tamil Nadu Generation and Distribution
Corporation Ltd.,5th Floor, Western Wing,
NPKRR Maaligai,144, Anna Salai,
Chennai – 600 002.
Cell No: 9445857543
FAX: 044-28520878
Email:cepr@tnebnet.org.

To
The Principal Conservator of Forests
and Chief Wildlife Warden,
Panagal Maaligai,
Saidapet,
Chennai-600 015.
Email id: cwlw_wildlife3@yahoo.in,
Phone No. 044 – 24321738.

Lr.No.CE/Proj-I/ SE/PD&C/EE/C-3/AEE2/C/F. KPSHEP-EC/D.No.04/21, dt.07.01.21.

Dear Sir,

Sub:- TANGEDCO, a subsidiary of TNEB Ltd – Kundah Pumped Storage Hydro Electric Project (4x125MW) in Nanjanad Village, Udhagamandalam Taluk, Nilgiris District, Tamilnadu – Wildlife Conservation Plan – Approval requested.

* * * * *

TamilNadu Generation and Distribution Corporation Ltd (TANGEDCO) is executing Kundah Pumped Storage Hydro Electric Project with an installed capacity of 500MW in Nilgiris District of Tamilnadu to meet the peak Power demand of the State grid. In this proposal, the existing Porthimund and Avalanche – Emerald reservoirs are proposed to be utilized as upper and lower reservoirs respectively. Both the reservoirs will be connected with tunnels which will serve as Head race & Tail race water conducting system. An underground power house will be constructed between the two reservoirs and connected with the tunnels. The surplus energy available during off-peak time to be utilized for pumping water from lower reservoir to upper reservoir and same water will be utilized for Generation during peak time.

Execution of major Civil and Hydro Mechanical works have been awarded on Engineering Procurement and Construction Contract basis and the works have commenced on 15.02.2018. About 40% of civil works have been completed so far. The

Electro –Mechanical works have been awarded during November 2019. The scheduled date of commissioning of this project is May 2023.

Government of Tamil Nadu have accorded approval for taking up this project in three phases as follows:

i. G.O Ms No 133/ Energy (A-2) Department dt.03.12.2008.
ii. G.O Ms No 50/ Energy (A-2) Department dt.29.04.2013.
iii. G.O Ms No 44/ Energy (A-2) Department dt.20.06.2014.

Forest clearance to this project was accorded by MoE&F/GoI vide letter dt. 21.08.2013. GOTN have accorded approval for diversion of 30ha of forest land vide G.O.(Ms) No.149, Environment and Forest (FR.10) Department Dated. 28.09.2013.

Further 47.89 Ha of Private land was purchased in SF.No 266 & 268/3 of Nanjanadu village. Out of 47.89 Ha, 36 Ha was handed over to Forest Department towards compensatory afforestation and the rest of the land is utilized for project purpose.

Environmental clearance to this project was accorded by MoE,F&CC / GOI vide letter dt.08.05.2007 and the validity of Environmental clearance was extended in stages upto 07.05.2020. As the project could not be commissioned within the Environmental Clearance (E.C) validity period due to various reasons, application for fresh ToR was filed by TANGEDCO on 21.10.2019, based on the direction made by MoE,F&CC/GOI vide letter dated 17.10.2019.

The MoE,F&CC/GoI vide letter dated 05.06.2020 issued fresh Terms of Reference (ToR) and additional ToR for preparation of EIA/EMP report for the activities at the proposed site as per the provisions of the Environmental Impact Assessment Notification, 2006 and as amended from time to time with one season fresh base line data collection for preparation of EIA/EMP report. A copy of the same is enclosed as Annexure –I.

As per condition No. (x) of additional terms of reference, Conservation plan for the Scheduled I species, if any, in the project study area has to be prepared and submitted to the Competent Authority for approval.

The Environmental Impact Assesment Study was conducted in the project area through QCI/NABET accredited EIA Consultant viz., M/s Mantec Consultants Pvt. Ltd . During the baseline study of flora & fauna (December 2019 to February 2020) conducted by Dr. Bhagwaan Jee Prasad, approved category "A" Expert by National Accreditation Board for Education and Training (NABET), it was found that out of 21 mammalian species, 7 scheduled-I species are found such as *Panthera pardus* (Indian Leopard), *Bos gaurus* (Gaur), *Macaca silenus* (Lion-Tailed Macaque), *Melursus ursinus* (Sloth Bear), *Elephas maximus* (Indian Elephant), *Nilgiri tragushylocrius* (Nilgiri Tahr) and *Trachypithecus johnii* (Nilgiri Langur) and out of 46 avian species reported in the study area, only one species is listed in Sch-I of WPA 1972, i.e *Pavo cristatus* (Peafowl).

Hence, the detailed Wildlife Conservation Plan for scheduled- I species prepared by the Consultant M/s. MANTEC Consultants, Pvt Ltd., is furnished herewith as Annexure - II. It is requested that necessary approval for the above report may kindly be accorded at the earliest please.

Yours sincerely,

O/C

7/1/21

Chief Engineer / Projects-I

7/1/21

ER/C-3

Enclosure:1) Copy of ToR letter-Annexure-I.

2) Copy of Conservation Plan-Annexure-II.

Copy to the Additional Principal Chief Conservator of Forest & Field Mudumalai Tiger Reserve, M.S Hill, Udagamandalam,The Nilgiris District, Pincode:643001. (with enclosures)

Principal Chief Conservator of Forest & Chief Wild Life Warden Chennai - 600 015. 2021

7/1/2021

No. J-12011/62/2006-IA-I (R) Pt
Government of India
Ministry of Environment, Forest & Climate Change
(IA.I Division)

Indira Paryavaran Bhawan
3rd Floor, Vayu Wing
Jor Bagh Road
New Delhi-110 003

Dated: 05th June, 2020

To

Chief Engineer
Tamil Nadu Generation And Distribution Corporation
5th Floor, Western Wing, Npkrr Maaligai,
144, Anna Salai, Chennai-600 002

Sub: Kundah Pumped Storage Hydro Electric Project (4x125 MW) in tehsil Udhagamandalam, district the Nilgiris, Tamil Nadu by M/s Tamil Nadu Generation and Distribution Corporation-Regarding Fresh Terms of Reference (ToR).

Sir,

This has reference to your online Proposal No. IA/TN/RIV/121832/2019 and letter no. CE/Proj-I/SE/PD&C/EE/C-3/AEE/C/F. Kundah PSHEP.EC/DC.No.158/19 Dated 19.10.2019 submitted to the Ministry for ToR to the project cited in the subject.

2. The above referred proposal was considered by the Expert Appraisal Committee (EAC) for River Valley & Hydroelectric projects in its 28th and 30th meeting held on 31.10.2020 and 27.01.2020, respectively. The comments and observations of EAC on the project may be seen in the Minutes of the meeting which are available on the web-site of this Ministry.

3. The Kundah Pumped Storage HEP (4x125 MW) project in Nilgiris District of Tamil Nadu is being developed by M/s Tamil Nadu Electricity Board, Government of Tamil Nadu. The Environmental Clearance for this project was earlier accorded by the Ministry on 08.05.2007 for a period of 5 years for commencement of construction work and subsequently the validity of EC was extended up to 07.05.2020. As the project couldn't be commissioned within the validity period of EC i.e. on or before 07.05.2020, Ministry informed vide letter dated 17.10.2019 to initiate the process of obtaining EC *de-novo*. Subsequently, fresh ToR has been applied by the PP as per the extant guidelines of EIA Notification, 2006 and its subsequent amendments.

4. Kundah Pumped Storage HEP (4x125 MW) in Nilgiris District is proposed to meet the peak power demands of the State grid with a view to provide quality and reliable power supply by flexible operation of State grid which will facilitate continued development of Tamil Nadu. Under Kundah

Pumped Storage HEP(4x125 MW), the existing TANGEDCO's Porthimund and Avalanche-Emerald reservoirs in Nilgiris district will be utilized as Upper and Lower reservoirs, respectively. No new reservoirs are proposed to be formed. The water conductor system shall comprise one Head Race Tunnel (HRT), 2 numbers pressure shafts, 4 numbers penstocks, one Tail Race Surge Shaft and one Tail Race Tunnel (TRT). The HRT will be 1,279 m long, 8.5 m diameter circular shape with peak discharge of 240 cumecs. Similarly, Head Race Surge Shaft (Restricted Orifice) shall be 64.94 m high, 16 diameter (lower) and 24 m diameter (upper). Adit to Head Race Surge Shaft shall be410 m long and 6.5x7.5 m D-shape. Two Nos. Pressure Shafts shall be each 458 m long, 5.5 m diameter with peak discharge of 120cumecs each. Four penstocks of each having 59.9 m long, 3.9 m diameter with peak discharge of 60 cumecs. Tail Race Tunnel (TRT) shall be 915 m long 8.5 m diameter circular shape with peak discharge of 240 cumecs. Tail Race Surge Shaft shall be 76.50 m high, 16 m diameter (lower) and 22.5 m diameter (upper). Adit to Tail Race Surge Shaft shall be471 m long and 6.5x6.5 m diameter of D-Shape. Access Tunnel shall be 1,249 m long and 8x8 m diameter of D-Shape. Cable Cum Ventilation Tunnel shall be 827 m long and 6.5x6.5 m diameter of D-Shape.

5. Above proposal was considered by the EAC in the 28th meeting held on 31.10.2019. EAC deliberated on the information submitted by the PP. After detailed deliberation based on the above facts as presented by the PP, Committee proposed to take up a site visit for prescribing the additional Terms of Reference for preparing EIA studies including the prevailing Environmental settings. The Sub-committee shall examine the requirement of collection of baseline data based on one/three seasons for preparation of EIA/EMP report including necessity of any specific measures to be taken up during construction work as the area falls within Western Ghat Eco-Sensitive Areas. The EAC discussed and opined that the PP may not be called for in the subsequent EAC meeting for clarification on the project. EAC shall deliberate the recommendations of the Sub-committee and if any, additional ToR is to be prescribed. Accordingly, **proposal was recommended for grant of ToR** but shall be processed only after the review by the EAC on the site visit report of the Sub-committee.

6. The Sub-committee visited the proposed site on 06.12.2019 and held discussion on 07.12.2019 with the project officials. During site visit, various site viz., HRT, TRT, Switch Yard, Muck Disposal Site, etc. were visited by the Sub-committee. Discussion was held with the PP and the Sub-committee was briefed about the project including configuration with component wise status of construction work. It was informed to the Sub Committee that over all physical Progress is 19% and total financial progress of 16% has been achieved till 31st December, 2019 with total payment made to the tune of Rs. 282.47 crores The total cost of the project is Rs. 1,832 crores including IDC at 2014-15 PL, of which Rs. 282.47 crores have been spent till December, 2019. The tentative commissioning schedule of the project is 2023-24 (May, 2023). Main reason of delay in execution of works are due to paucity of funds during 2007-08 and 2012-13, non-availability of surplus power for pumping from 08.05.2007 to 07.05.2012, announcement of GST forced for re-evaluation of the bids and pending court cases.

7. No additional land will be acquired for this on-going project. The total land requirement is 77.89 ha, of which 47.89 ha is private land required for the execution of the project which has already been acquired and 30 ha forestland was to be diverted for non-forest use for which Stage-I Forest

Clearance has been obtained vide letter dated 27.11.2008 and Stage-II Forest Clearance has been obtained vide letter dated 21.08.2013.

8. The site visit report inter alia recommendations of the Sub-committee was presented before the EAC in the meeting 30th meeting held on 27.01.2020. EAC noted that Sub-committee visited the proposed site on 06.12.2019 and held discussion on 07.12.2019 with the project officials at the project site. During site visit, various site viz., HRT, TRT, Switch Yard, Muck Disposal Site, etc. were visited. **EAC deliberated on the site visit report and agreed to the recommendation of the Sub-committee.**

9. Recommendations of the EAC on the project were examined in the Ministry along with a request regarding exemption of Public Hearing and permission to continue project work without any stoppage while issuing ToR to the project. Ministry of Environment Forest & Climate Change after detailed deliberation hereby accords a fresh Terms of Reference (TOR) as per the following **Standard ToR** (Hydro projects) and **additional ToR** for preparation of EIA/EMP report for the activities at the proposed site as per the provisions of the Environmental Impact Assessment Notification, 2006 and as amended time to time **with one season fresh base line data collection for preparation of EIA/EMP report, permission to carry out construction work at the project site for a period of six months from the date of issue of this letter or grant of new Environmental Clearance, whichever is earlier and exemption of Public Hearing:**

Standard ToR

The EIA/EMP report should contain the information in accordance with provisions & stipulations as given in the **Standard ToR for hydro projects** (*Please visit the following link to download the Standard ToR:*

http://environmentclearance.nic.in/writereaddata/standardtorreference.pdf.

Additional ToR

i. Land to be acquired, if any, for the project shall be suitably compensated in accordance with the law of the land with the prevailing guidelines. Private land shall be acquired as per provisions of Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013.

ii. Funds allocation for Corporate Environment Responsibility (CER) shall be made as per O.M. No. 22-65/2017-IA.III dated 01.05.2018 for various activities therein.

iii. The details of funds allocation and activities for CER shall be incorporated in EIA/EMP report.

iv. The EIA report should clearly mention activity wise EMP and CER cost details and should earmarked clear break-up of the capital and recurring cost along with the timeline for incurring the capital cost.

v. One season fresh baseline data shall be collected for preparation of the EIA/EMP report. Secondary data may also be collected on flora, fauna, aquatic life, etc. from the local sources of the area and may also form part of the modified EIA/EMP report.

vi. Necessary conservation measures shall be taken up in the area that is falling within Western Ghat Eco-sensitive (WGE) area and to be incorporated in the EIA/EMP report for all the environmental parameters.

vii. Compliance of Environmental Conditions stipulated vide EC letter dated 08.05.2007 from the concerned Regional Office of this Ministry.

viii. Declaration should be submitted regarding No additional requirement of land including forest land.

ix. Consolidated EIA/EMP report is to be submitted as per the generic structure (Appendix III & IIIA) given in the EIA Notification, 2006.

x. Conservation plan for the Scheduled I species, if any, in the project study area shall be prepared and submitted to the Competent Authority for approval.

xi. Pre-DPR Chapters viz., Hydrology and Layout Map and Power Potential Studies duly approved by CWC/CEA shall be submitted.

xii. Environmental matrix during construction and operational phase needs to be submitted.

xiii. Both capital and recurring expenditure under EMP shall be submitted.

xiv. Impact of developmental activity/project on the wildlife habitat, if any, within 10 km of the project boundary shall be studied.

xv. The consultant engaged for preparation of EIA/EMP report has to be registered with Quality Council of India (QCI/ NABET) under the scheme of Accreditation & Registration of MoEF& CC. This is a pre-requisite.

xvi. Consultant shall include a "Certificate" in EIA/EMP report regarding portion of EIA/EMP prepared by them and data provided by other organization(s)/ laboratories including status of approval of such laboratories. Declaration by the Consultant that information submitted in the EIA/EMP is factually correct and shall be submitted along with EIA/EMP reports.

xvii. An undertaking as part of the EIA report from Project proponent, owning the contents (information and data) of the EIA report with the declaration about the contents of the EIA report pertaining to a project have not been copied from other EIA reports.

xviii. All the tasks shall be done as per the provisions of EIA Notification, 2006 and as amended from time to time. Issues raised during previous Public Hearing and compliance of the same shall be incorporated in the EIA/EMP report in the relevant chapter. Final EIA/EMP report should be submitted to the Ministry for Environmental Clearance only after incorporating these issues, before the expiry of validity of ToR.

xix. As per Ministry's Notification 17.02.2020, the ToR will remain valid for a period of 5 years from the date of issue of this letter for submission of EIA/EMP report. The ToR will stand lapsed after completion of 5 years in case final EIA/EMP is not submitted.

xx. Baseline data shall not be older than 3 years, at the time of submission of the proposal, for grant of Environmental Clearance.

xxi. In case of any change in the scope of the project such as capacity enhancement, change in submergence, etc., fresh scoping clearance has to be obtained.

xxii. The PP should submit a copy of TEC of the DPR along with EIA/EMP report.

xxiii. Details of the name and number of posts to be engaged by the project proponent for implementation and monitoring of environmental parameters be specified in the EIA report.

xxiv. The EIA/ EMP report must contain an Index showing details of compliance of all ToR conditions. The Index will comprise of page No. etc., vide which compliance of a specific ToR is available. It may be noted that without this index, EIA/ EMP report will not be accepted.

xxv. The PP should complete all the tasks as per the provisions of EIA Notification, 2006 and as amended time to time) and submit the application for final clearance within the stipulated time.

xxvi. Appropriate Biodiversity Conservation and Management plan for the Native, Rare & Endangered floral and faunal species getting affected due to the project shall be prepared.

This has approval of the Competent Authority.

Yours faithfully,

(Dr. S. Kerketta)
Director
Telefax: 011-24695314

Copy to:

1. The Secretary, Ministry of Power, Shram Shakti, Bhawan, Rafi Marg, New Delhi 110001.
2. The Principal Secretary, Department of Power, Government of Tamil Nadu, Secretariat, Chennai - 600 001
3. The Secretary, Department of Environment & Forests, Government of Tamil Nadu, Secretariat, Chennai - 600 001
4. The Chief Engineer, Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi-110066.

5. The DDG, Forest (Central), Regional Office (SR), Ministry of Environment, Forest & Climate Change, Regional Office (SEZ), 1st and 2nd Floor, Handloom Export Promotion Council, 34, Cathedral Garden Road, Nungambakkam, Chennai -600034.
6. The Member Secretary, Tamil Nadu State Pollution Control Board, 76-Mount salai, Gundy, Chennai - 600 032.
7. NIC Cell - uploading in MoEFCC's website.
8. PPS to JS (GM)
9. Guard file.

(Director)

DETAILED WILDLIFE CONSERVATION PLAN
(FOR SCH-I SPECIES)

KUNDAH PUMPED STORAGE HYDRO ELECTRIC PROJECT (4X125 MW)
IN
NILGIRIS DISTRICT, TAMIL NADU

Submitted to

PRINCIPAL CHIEF CONSERVATOR OF FORESTS AND CHIEF WILDLIFE WARDEN
PANAGAL MAALIGAI
SAIDAPET
CHENNAI – 600 015.
TAMIL NADU

Submitted by
PROJECT PROPONENT

TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO), CHENNAI, TAMIL NADU

Prepared by

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JANUARY 2021

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CHAPTER-1 : DETAILED CONSERVATION PLAN FOR SCH-I SPECIES

INTODUCTION

Biodiversity Conservation and protection of the rare and endangered species is most important for maintaining the ecological balance of the Nilgiri ecosystem of Western Ghat. It is also statutorily mandatory to prepare and implement conservation plan for such faunal species found in the study area of any developmental project. This conservation plan has been developed to understand Schedule-I RET faunal species found in the ecosensitive study area and to provide appropriate measures for their protection.

This Wildlife Conservation Plan has been developed with particular reference to Schedule-I faunal species to understand their habit, habitat, feeding, breeding and the potential threat for planning and undertaking necessary action plan for their protection and conservation.

The plan would provide appropriate guidance to the project proponent to undertake required measures for conservation and protection of the rare and endangered species of the area. Implementation of the Wildlife Conservation Plan should be carried out in consultation with State Forest Dept.

STATUS OF WILDLIFE IN THE STUDY AREA

A primary survey of the project site (10 km radius of the project site) was carried out during the month of Dec 2019 to Feb 2020 to understand the structure of wildlife in the study area.

During the primary survey, although no Sch-I species of fauna was observed in the study area; however, during discussion with forest officials and villagers indicated presence of eight Sch-I species in the vicinity of the project site i.e. *Panthera pardus*(Indian Leopard), *Bos gaurus* (Gaur), *Macaca silenus* (Lion-Tailed Macaque), *Melursus ursinus* (Sloth Bear), *Elephas maximus* (Indian Elephant), *Nilgiri tragushylocrius* (Nilgiri Tahr), *Trachypithecus johnii* (Nilgiri Langur) and one bird i.e. *Pavo cristatus* (Peafowl).

The conservation plan comprises of a brief description of the project, description of the general environment and assessment of baseline condition of the study area in 10km radius of project site, habit and habitat of eight Schedule-I species and recommendations for their conservation.

Project Proponent

The Tamil Nadu Electricity Board (TNEB) is a statutory body formed under the Electricity Supply Act as a successor to the erstwhile Electricity Department of the Government of Madras. The Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) is a Corporation registered under the Companies Act 1956, one of the successor entities to the erstwhile TNEB wholly owned by the Government of Tamil Nadu and a Subsidiary of TNEB Ltd. As on 31.03.2018 there are 1,592 substations, 2.09 lakh circuit km of Extra High Tension /High Tension (EHT/HT) lines, 6.28 lakh km of Low Tension (LT) lines, 2.93 lakh distribution transformers and 288.09 lakh service connections in the state.

The role of TANGEDCO in improving the economy of the state by extensive electrification of the villages, large scale utilization of agricultural electrical pump sets and extension of electricity services to poor/ backward and down trodden sections of the society, in addition to extension of supply to large number of industries has been well recognised.

Need of the Project

Hydro Power is considered as an ideal peaking power when compared with other energy sources. But in the context of Tamil Nadu, as the entire hydro potential has been harnessed and as there will be capacity additions from Nuclear/Thermal base load stations in future, it is considered appropriate to go in for Pumped Storage hydro-electric projects.

The Hydro-electric system well developed in the Western Ghats during 1960 come in handy to meet out the project proposals. The surplus energy in the grid available during night times and holidays will be utilised for pumping and the same water will be utilised to generate power during the morning and evening peak hours, particularly for lighting loads.

Location and Approach for Final Layout of the Project

The Proposed project is located between latitude 11°20' & 11°22' N and Longitude 76°33' & 76°37' E. This underground project location falls in Kaducuppa Reserved Forest and Hiriyashigee Reserved forest of Nilgiris District, between TNEB's Porthimund Reservoir (formed during 1966) and Avalanche Emerald reservoir (formed during 1961). The Project office and the residential Quarters will be at Nanjanad Village, Uthagamandalam Taluk, Nilgiris District. The portal of Access tunnel of the proposed Power House will be at 45 km from Uthagamandalam (Ooty), the famous Hill station of Tamil Nadu.

The proposed Power House can be accessed from Uthagamandalam (Ooty) on the Uthagamandalam-Porthimund road.

Uthagamandalam (Ooty) being the district capital of Nilgiris, good communication facilities by way of frequent Bus services from Coimbatore city are available.

Coimbatore city is the second biggest city in Tamil Nadu (i.e) next to Chennai city and it is having domestic Airport along with limited international Air services.

Coimbatore Rail station is well connected to all parts of the country. The route to the proposed power station from Coimbatore will be as follows:

Coimbatore - Mettupalayam	Plain Section	42 km
Mettupalayam-Uthagamandalam (Ooty)	Ghat Section	60 km
Uthagamandalam - Proposed Power House	Ghat Section	45 km
Distance from Coimbatore city		**147**

Salient Features

Kundah Pumped Storage Hydro Electric Project envisages construction of anunderground power house between the two reservoirs having installed capacity of 500 MW which includes:

- Phase I includes all the common civil and hydro-mechanical works for all the units, exclusive civil works for unit 1, facilitating civil works for the remaining 3 units and supply and erection of one unit of 125 MW turbo generator and connected accessories alongwith EOT Crane.
- Phase II includes exclusive civil works for unit 2 & 3 and supply, erection, testing and commissioning of 2nd and 3rd units along with all the project enabling works.
- Phase III includes civil works such as penstock lining & machine foundation pertaining to the 4th unit and supply, erection, testing and commissioning of 4th unit along with all the project enabling works.

The two reservoirs are Porthimund Reservoir (Upper Reservoir) having capacity of 49.03 Mm^3 and Avalanche-Emerald Reservoir (Lower reservoir) having capacity of 149.57 Mm^3.

The project would provide peaking benefits of 500 MW (daily peaking energy would be 3 MU with all 4 units of 125 MW each operating for 6 hours daily for the whole year except during the month of January). Annual average energy benefits for (11 months) would be 1005 MU.

Table 1.1: Salient Features

S.No	Details	SalientFeatures
1.	Name of the Project	Kundah Pumped Storage Hydro Electric Project
2.	Type of Project	Pumped Storage
3.	Location	Nilgiris district
	Latitude	$11^{o}20'$ & $11^{o}22'$ N
	Longitude	$76^{o}33'$ & $76^{o}37'$ E
4.	River Basin	Kundah
5.	Catchment area of Kundah basin	285 km^2
6.	Upper Reservoir (existing)	Porthimund Reservoir
	Location	Nilgiris District
	River	Porthimund stream
	Purpose	Diversion dam for Cascading Kundah Hydro-electric Stations 1-4
	Gross Capacity	$49.01x10^6$ m^3
	Full Reservoir Level	2220.46 m
7.	Lower Reservoir (existing)	Avalanche-Emerald Reservoir
	Location	Nilgiris District
	River	Porthimund /Avalanche stream
	Purpose	Diversion dam for Cascading Kundah Hydro-electric Stations 1-4
	Gross Capacity	$149.57x10^6$ m^3 (5.5 TMC)
	Full Reservoir Level	1985.80 m
8.	Executing Agency	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
9.	Head Race Tunnel (HRT)	
	Length	1246.6 m
	Peak Discharge	240 cumecs
	Size	8.5m X 8.5m D Shape
	Slope of HRT	1 in 53.76
10.	Head Race Surge Shaft	
	Diameter(OD)	28/16m/10m
	Height	68m
11.	Adit to HRT & PS Top	
	Section of Adit	7m/7m
	Length of the Adit to HRT	433.5 m
	Length of Adit to Pr. Shaft Top	120.2 m
12.	Pressure Shaft	
	Number of lines	Two
	Diameter	5.5 m
	Peak discharge (each)	120 cumecs
	Sloping Length (each)	298.5m
13.	Penstocks	
	Number of lines	Four

	Diameter	3.9 m
	Length	50 m
	Peak discharge (each)	60 cumecs
14.	Adit to PH Bottom	
	Length	398.2 m
	Size	6.5 m (W) x 6.5 m (H) D-Shape
15.	Underground Power House	
	Size of Power House	156x 22 x 48 m
	Installed Capacity	4 x 125 MW
	Generating Net head	236 m
	Type of turbine	Francis Reversible Pump Turbine
	Size of transformer cavern	137m x 19m x 18.5m
16.	Construction adit to PH top	Size 94.8 m, 6.5 m x 6.5 m D-Shape
17.	Tail Race Tunnel (TRT)	
	Length	939 m
	Diameter	8.5 m
	Peak Discharge	240 cumecs
18.	Adit to Tail Race Tunnel	
	Size	6.5 x 6.5 m D- Shape
	Length	267 m
19.	Tail Race Surge Shaft	
	Size of Collection Chamber	13 m x 52 m
	Height	72.5m
20.	Adit to Tail Race Surge Shaft	
	Length	469 m
	Size	6.5 m x 6.5 m D-Shape
21.	Main Access Tunnel	
	Length	1284 m
	Size	8 m x 8 m D- Shape
22.	Cable cum Ventilation Tunnel	
	Length	869 m
	Size	6.5 m x 6.5 m D-Shape
23.	Project Cost (in Crores)	
	Phase I	879.85 (989.80 including IDC)
	Phase II	553.06 (599.32 including IDC)
	Phase III	224.22 (242.17 including IDC)
	Total Project Cost	**1657.13 (1831.29 including IDC) (2013-14 Price Level)**
24.	Commissiong schedule of generating units	2023-24 (May 2023)

Land Requirement for the HEP

The details of forest lands and private lands required for the whole project of 500MW for the components and the transmission system are furnished below in Table 1.2.

Table 1.2: Land requirement for the project

S.No.	Details of components	Extent of land (in ha)
	Forest Land requirement for over ground components	
	Head Race Components	0.781
	Tail Race Components	0.220

	Formation of roads & widening of existing Roads	4.356
	Cable cum Ventilation tunnel shaft, portal, open cut portion	0.500
	Access Tunnel Portal	0.675
	Total	6.532
	Or Say	**6.6**
	Forest Land required for underground components	
	Head Race Tunnel	2.3070
	Pressure Shaft	1.4624
	Cable cum ventilation tunnel	1.5527
	Access Tunnel	1.7000
	Tail Race Tunnel	1.5910
	Adits	1.2420
	Power House & Transformer caverns	0.9721
	Tail race surge shaft and penstock	0.5900
	Total	11.3722
	Or Say	**11.37**
	Forest Land required for Transmission system	
	In Kaducuppa Reserve Forest	5.880
	In Hiriyashighe Reserve Forest	6.125
	Total	12.005
	Or Say	**12.00**

The Forest Land required for the project is 30 ha. Ministry of Environment & Forest (MoEF) has accorded Stage-I Forest Clearance for the diversion of 30 ha. Of forest lands in Kaducuppa R.F and Hiriyashighe R.F for the establishment of this project vide lr.dt.27.11.2008 (copy enclosed as Annexure VIII). MoEF has accorded Stage-II Forest Clearance vide letter dated. 21.08.2013 (copy enclosed as Annexure VIII).

Based on this, GOTN has accorded approval for diversion of 30 ha of forest land vide G. (Ms) No. 149, Environment and Forest (FR.10) Department dated. 28.09.2013 (copy enclosed as Annexure XIII).

TANGEDCO purchased 47.89 ha (118.30 acres) of private land from M/s ALAN FIRM, Emerald Valley Estate, Emerald vide (Per) B.P. (FB) No. 83 (Technical Branch) dated 20.06.2008 (copy enclosed as Annexure XIV) for afforestation and for locating over ground components of the project. TANGEDCO handed over 36 ha (88.92 acres), out of the above 47.89 ha, to State Forest Department for compensatory afforestation and the balance land 11.89 ha of private land is utilized for switchyard and for dumping yard. No other additional land is required for the project.

1.6 BRIEF DESCRIPTION OF THE PROJECT

The Kundah Pumped Storage Hydro Electric Project (4X 125 MW) is a Pumped Storage Scheme in Nilgiris hills of Tamil Nadu for providing peaking benefits utilizing the existing reservoir at Porthimund (live storage 20.10 Mm^3 between FRL 2220.46m and MDDL of 2207.55 m) as the upper reservoir and Avalanche-Emerald reservoir (live capacity 130.84 Mm^3 between FRL 1985.80m and MDDL 1957.98m) as lower reservoir. In this project proposal, no new reservoir is proposed. Both the reservoirs will be connected with tunnels which will serve as Head race & Tail race water conducting system. An underground power house will be constructed between the two reservoirs and connected with the tunnels. The Proposed project is located between latitude $11^{o}20'$ & $11^{0}22'$ N and Longitude $76^{o}33'$ & $76^{o}37'$ E. This underground project location falls in Kaducuppa Reserved Forest and Hiriyashigee Reserved forest of Nilgiris District, between TNEB's Porthimund Reservoir (formed during 1966) and

Avalanche Emerald reservoir (formed during 1961). The Project office and the residential Quarters will be at Nanjanad Village, Uthagamandalam Taluk, Nilgiris District.

In the DPR, installation of 500 MW units (4 Nos.125 MW capacity) with Francis Reversible Turbine have been proposed. Integrated reservoir operation studies have been carried out for the 90% dependable year. i.e. 1987-88 (June to May) on daily basis. In power potential studies, the overall efficiency of Turbo-Generator (TG set) has been considered as 92% in generation mode and the overall efficiency of Pump-Motor has been considered as 85.5 in pumping mode. The project would provide peaking benefits of 500 MW for 6 hours on daily basis. The existing reservoirs, Porthimund Reservoir with live capacity of 29.10 Mm^3 and Avalanche-Emerald Reservoir with live capacity of 130.84 Mm^3 would be utilized as upper and lower reservoirs respectively for this Project. Storage required for 6 hours operation of this project is 5.184 Mm^3. Considering the one time locked quantum into consideration, the balance water available in Avalanche-Emerald reservoir is sufficient for operation of cascading Kundah power houses for 6 hours daily.

The proposed project will be in Kaducupa Reserve Forest and forming a separate corridor for transmission lines will require acquisition of forest land and felling of trees. To keep the acquisition of forest land to minimum level and minimum felling of trees, it is proposed to use the existing corridors and form 230 KV multi circuit towers to accommodate the existing transmission lines and the new lines from this project. Since the project is a pumped storage scheme, the transmission system has been evolved to meet both power evacuation of 500MW in generation mode and power drawal of 525 MW in pumping mode. Adequate reserve has been provided in the transmission system and the system can handle the entire power evacuation/drawal even with 3 feeders.

Total project cost comes to **Rs. 1657.13 Crores** (Rs. 1831.29 Crores including IDC) which includes the estimated cost of Phase I, II & III.

1.8 Present Status of the Project

Execution of certain initial works such as Main Access Tunnel (1000m), cable cum ventilation Tunnel (500m) and Approach roads have been completed before issue of the above EPC contracts.

The contract on Engineering, Procurement & Construction basis (EPC) for Civil & Hydro Mechanical works of the project has been awarded to M/s Patel Engineering, Mumbai for Package I of Phase I at a cost of Rs. 342.94 Crores & to M/s Kundah PSP Consortium, C/o M/s. Patel Engg., Mumbai, for Package II of Phase I at a cost of Rs. 318.14 Crores on 15.02.2018. Three LOAs for Electrical & Mechanical works have been issued on 28.11.2019 to M/s. Megha Engineering & Infrastructure Ltd, Hyderabad at a cost of Rs.604.62 Crores for Phase-I/ Package –III, Rs.756.54 Crores for Phase-II & Rs.401.85 Crores for Phase-III.

Following are the present status of progress of the project:-

	Mining Progress	**Over all progress**
Package I	**77%**	**35%**
Package II	**55%**	**20%**

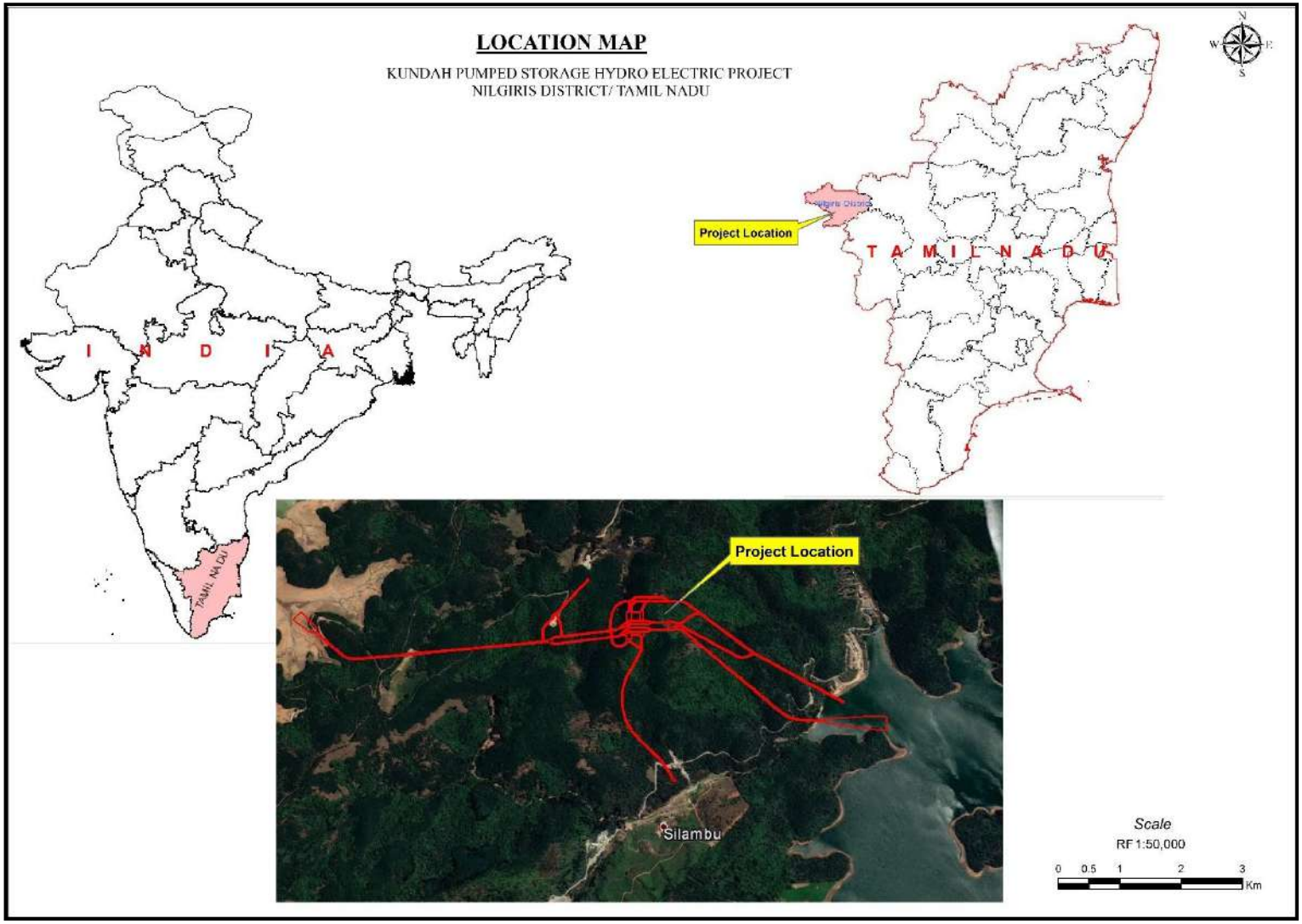

Figure 1-1: Location Map of Kundah Pumped Storage H.E.P. (Source Google map)

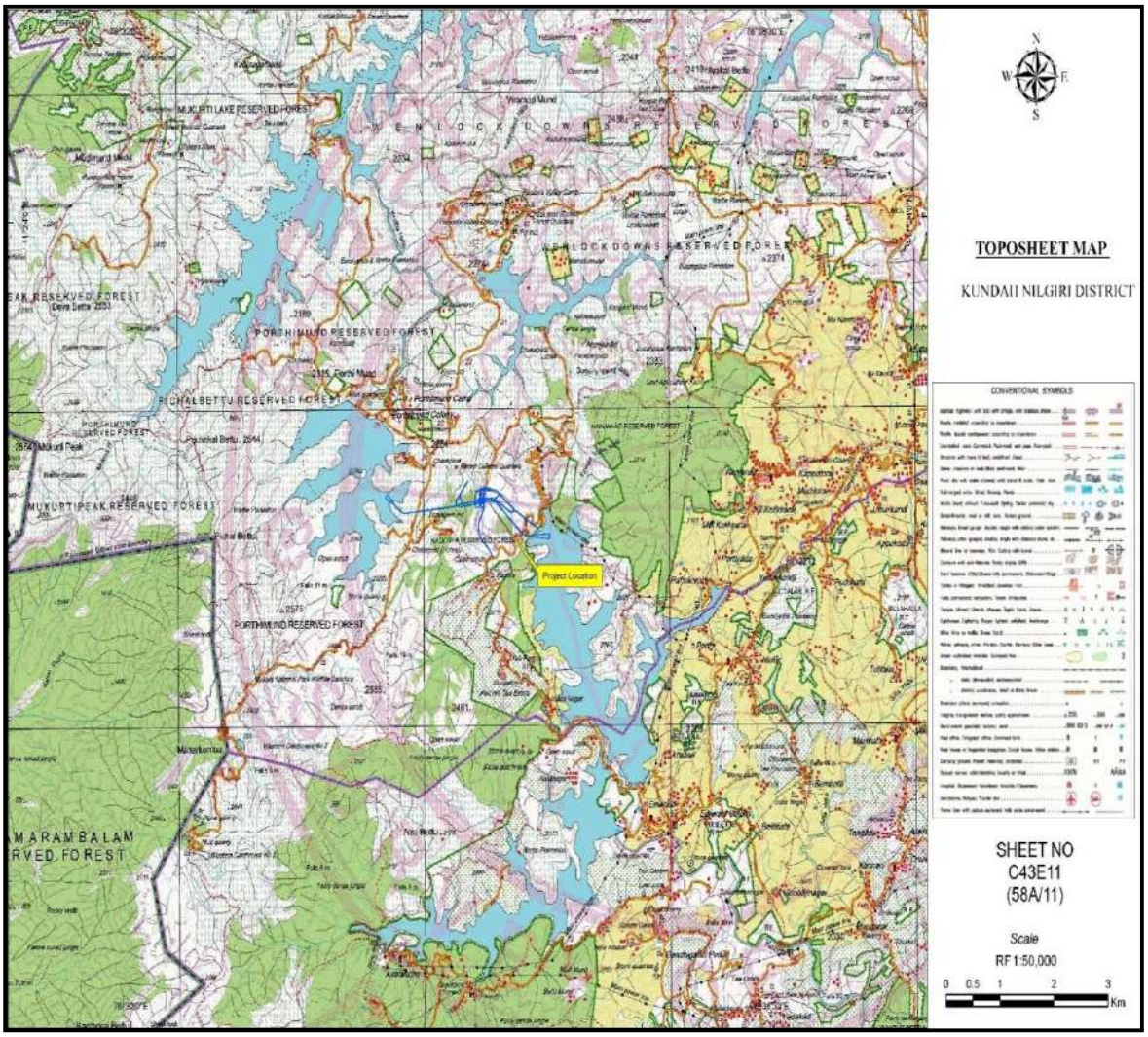

Figure 1-2: Toposheet Map of the Project

CHAPTER-2 : PHYSICAL AND BIOLOGICAL ENVIRONMENT

Study Area

The study area comprises of 10 km. radius of the project area and sites of appurtenant works of main project components (i.e. reservoir and pumping station).

Topography

The entire area of Nilgiris otherwise known as "Blue Mountains" constitutes the present district of Nilgiris is moutaineous and hilly. The topography of the area is undulating. The altitude of these hills varies between 2280 and 2290 meters, the highest peak being Doddabetta (2636 m above sea level).

Physiography

Nilgiris district lies between 11^{o} and 11^{o} 55' (North latitude) and 76^{o} 13' and 77^{o} 2' (East longitude), with Kerala on the west, the Karnataka State on the north and Coimbatore District on the east and south. The district derives its charm from its natural setting, high above the sea level, situated at the junction of the Western and Eastern Ghats. With its several hillocks, undulating terrain and deep valleys, the Nilgiris district offers a fascinating view. The steep hills and awfully narrow valleys with numerous rivers and rivulets meandering through in several directions with many fine waterfalls provide striking scenery. The temperate climate further heightens the attractiveness of the place. Total area of the district is 2366.89 km^2.

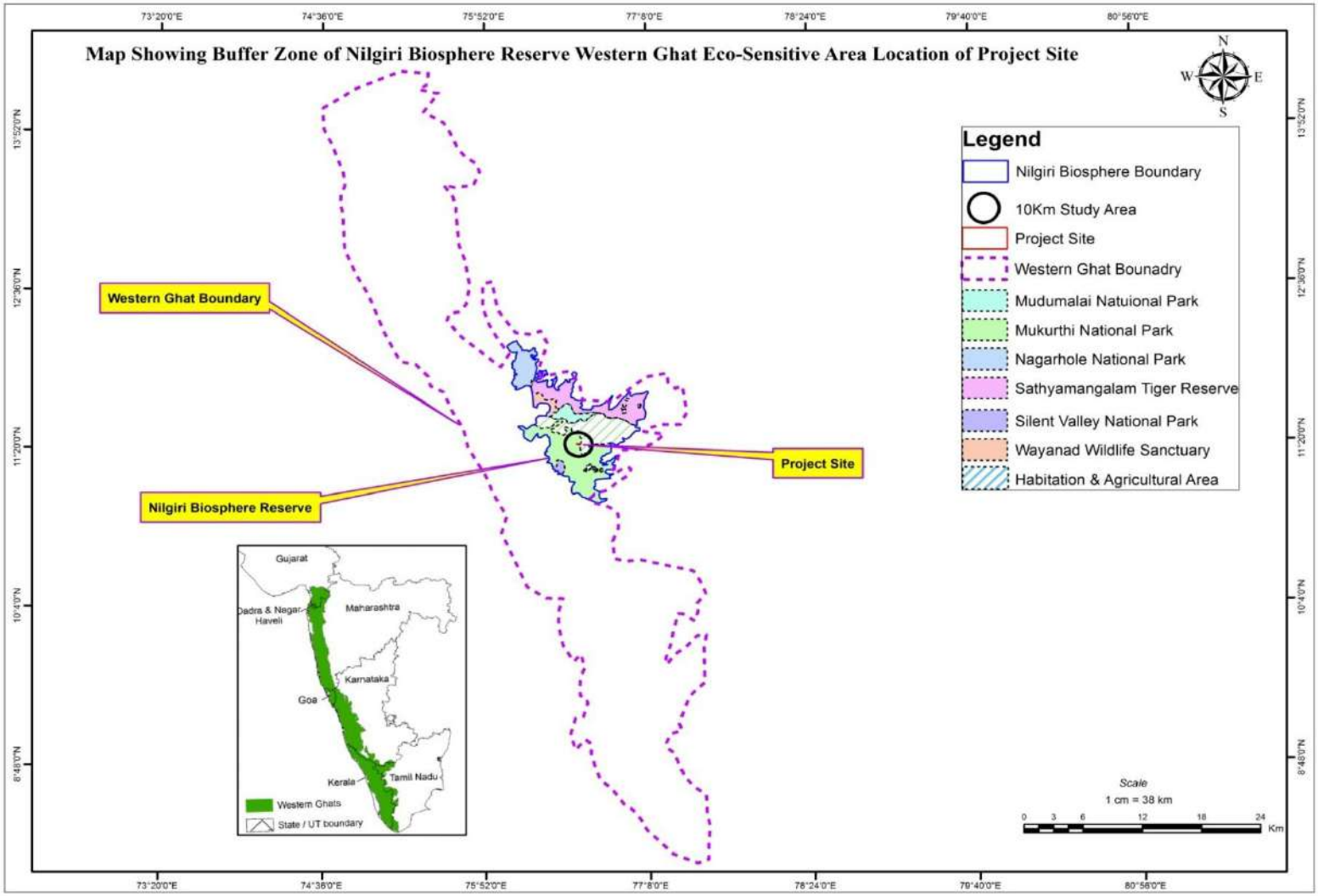

Figure 2-1: Map showing Buffer Zone of Nilgiri biosphere reserve, Western Ghat eco-sensitive area and location of the project site

Geology

Geologically, the Nilgiris belong to the Archean continental landmass of the Indian peninsula, composed of pre-Cambrian, mainly metamorphic rocks (gneisses, charnockites, and crystalline schist). Due to continental drift of the "Indian shield" which until late Jurassic times was a part of the ancient Gondwanaland – and coincident with the Himalayan orogenesis during the Cretaceous and Tertiary periods, geotectonic movements in the southern Deccan resulted in its fragmentation and in vertical dislocations along fault lines that are oriented in three main directions, viz. NNW-SSE, NE-SW and W-E, and that recur in the morphological boundaries as well as in the courses of many streams and rivers of the Nilgiris.

Thus, the triangular-shaped mountain block of the Nilgiris was formed by the phase-wise uplifting of a portion of the Deccan. This horst is almost entirely made up of more or less garnetiferous, acid hypersthenic charnockites with a general NE-SW to ENE-WSW strike of foliation (Eastern Ghats trend) and traversed by doleritic and quartzite dykes. It is slightly tilted towards the east – like the entire Deccan Plateau – and has a base size of roughly 2400 square kilometers, of which 40 % rises above 1800 meters in the central Nilgiris Plateau (which falls off steeply on all sides). It culminates in Dodabetta, or "big mountain" with 2636 m elevation above mean sea level. Geomorphology and geology of the study area is given in Table 2.1.

Table 2.1: Geomorphology and Geology of Study Area

Geomorphology			
S.No.	**Name**	**Area in km²**	**Area in %**
1	Burried Pediment (Deep)	37.85	9.91
2	Denudational Hill	33.73	8.83
3	Hill Slopes	70.95	18.58
4	Shallow Pediment	184.13	48.23
5	Structural Hill	55.15	14.44
Total		**381.80**	**100**
Geology Area			
S.No.	**Name**	**Area in km²**	**Area in %**
1	Charnocklte Rocks	381.80	100

Hydrogeology

Nilgiri district is underlain entirely by Archaean Crystalline formations with recent alluvial and colluvial deposits. The occurrence and movement of ground water are controlled by various factors such as physiography, climate, geology and structural features. Weathered, fissured and fractured crystalline rocks and the Recent alluvial and colluvial formations constitute the important aquifer systems in the district.

The porous formations in the district are represented by alluvium, colluvium. The alluvial deposits comprising sand with admixtures of silt and clay are confined to the major river and stream courses only. It has been reported that the wells tapping river alluvium remain dry during drought years and in the year of less rainfall. The colluvial materials comprising the sands and gravels are seen in the valley portions. Ground water is developed by dug wells and occurs under phreatic conditions. The depth range of these shallow aquifers ranging from 5.00 to 20.00 m.

The crystalline rocks of gneisses and charnockites represent weathering, fissures and fractures. Ground water occurs under phreatic conditions in the weathered mantle and under semi-confined conditions in the fractured zones. The thickness of the weathered mantle is varying from less than a meter to as much as 20.00 m. The depth of the wells ranged from 5.00 to 15.00 m bgl. The weathered mantle followed by the jointed and fractured rocks constitutes the shallow water table aquifer and it occurs in the major part of the district with in the depth of 20 – 25 m in general.

The Specific capacity of large diameter wells tested in crystalline rocks varying from 100 to 200 lpm / m. of draw down. The saturated thickness of the aquifer varies from 2 to 5 m only. The yield characteristics of wells vary considerably depending on the topographic set-up, lithology and the degree of weathering. The yield of bore wells drilled down to a depth of 45 to 100 m, by various state agencies mainly for domestic purposes ranged from 60 to 100 lpm.

The depth to water level in the district varied between 1.20 and 17.06 m bgl during pre-monsoon (May 2006) and it varied between 1.28 and 16.60 m bgl during post monsoon (Jan 2007). The seasonal fluctuation shows a rise in water level in the range of 0. 35 to 3.05 m bgl and fall in the range 0.08 to0.73 m bgl. The piezometric head is 2.48 m bgl during pre monsoon (May 2006) and 2.94 bgl during post (Jan 2007).

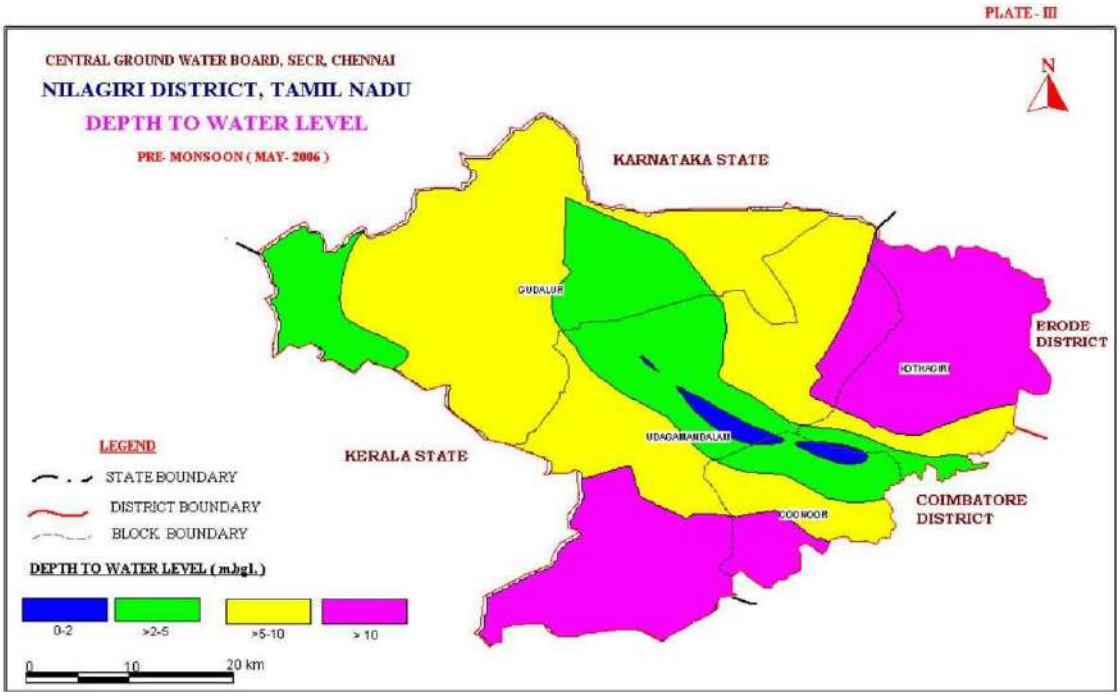

Figure 2-2: Depth to water level of Nilgiri District Pre-monsoon as per CGWB, 2008

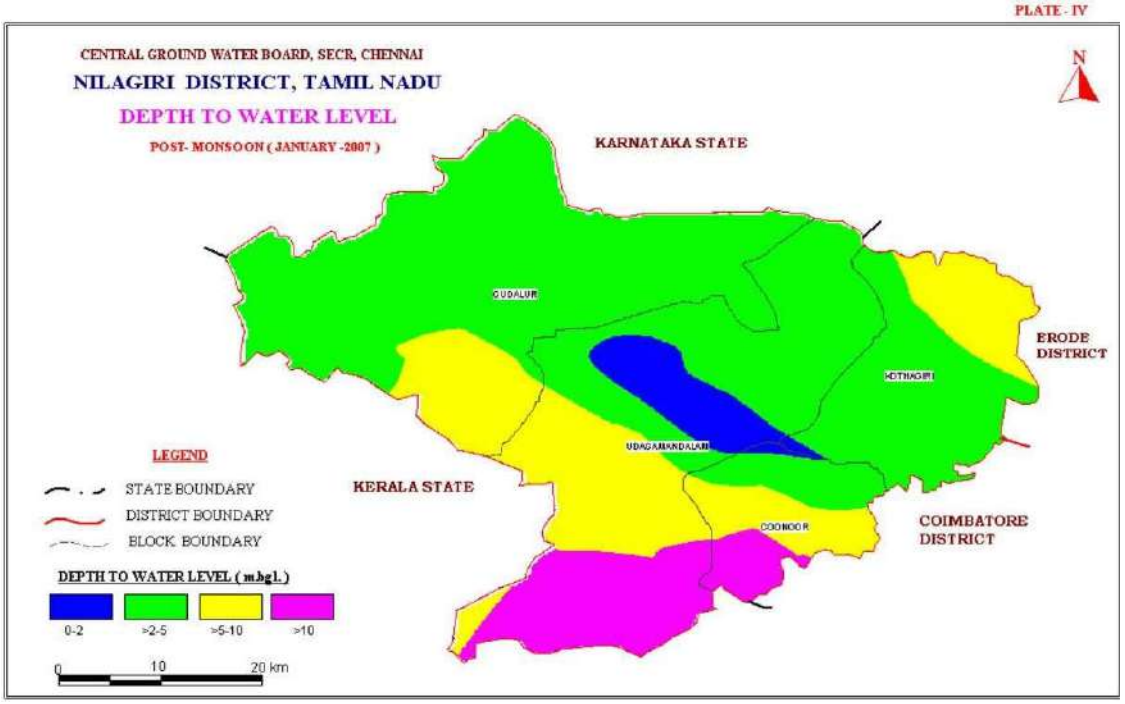

Figure 2-3: Depth to water level of Nilgiri District Post-monsoon as per CGWB, 2008

Environmental Sensitive Features

There are presence of Natural Vegetation, Water body and Grassland within 10 km radius of the project site. The sensitive features are listed in Table 2.2 and shown in Figure 2.4.

Table 2.2: Environmental Sensitive Features

	S.No.	Map ID Code	Environmental Sensitivity Types	Latitude	Longitude
Within 10 km	1	ID 1	Natural vegetation and Water body	11°21'46.21"N	76°36'33.90"E
	2	ID 2	Natural vegetation	11°17'42.91"N	76°41'7.07"E
	3	ID 3	Water body and Grass Land	11°16'2.00"N	76°33'14.89"E
	4	ID 4	Natural vegetation	11°18'55.79"N	76°31'40.75"E
	5	ID 5	Natural vegetation and Water body	11°26'12.52"N	76°39'28.09"E
	6	ID 6	Natural vegetation and Water body	11°24'46.37"N	76°33'26.01"E
	7	ID 7	Natural vegetation and Water body	11°24'50.24"N	76°29'42.74"E
	8	ID 8	Natural vegetation and Water body	11°17'3.33"N	76°39'6.01"E

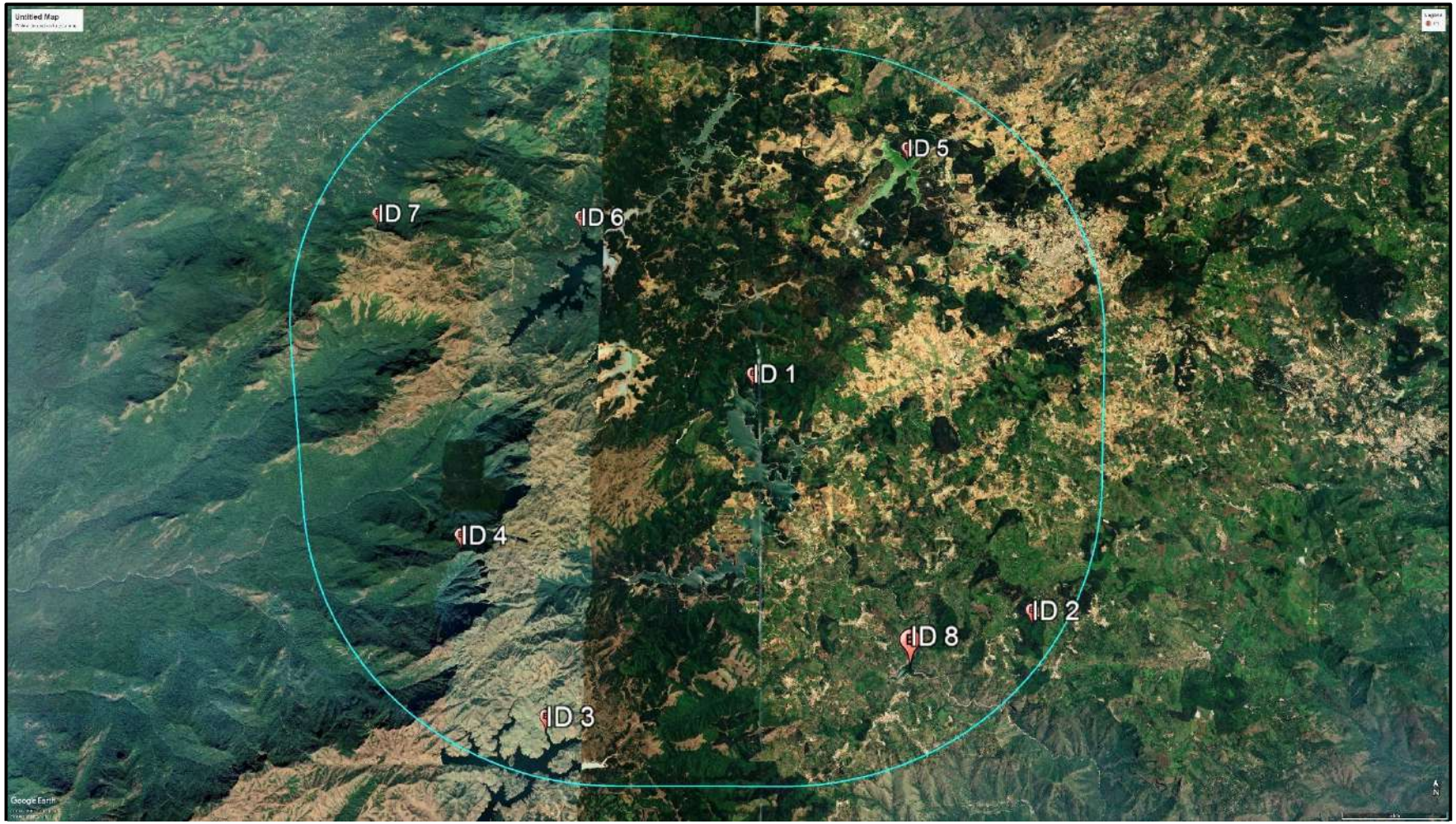

Figure 2-4: Environmental Sensitive Features Map of the KPSHEP Study Area

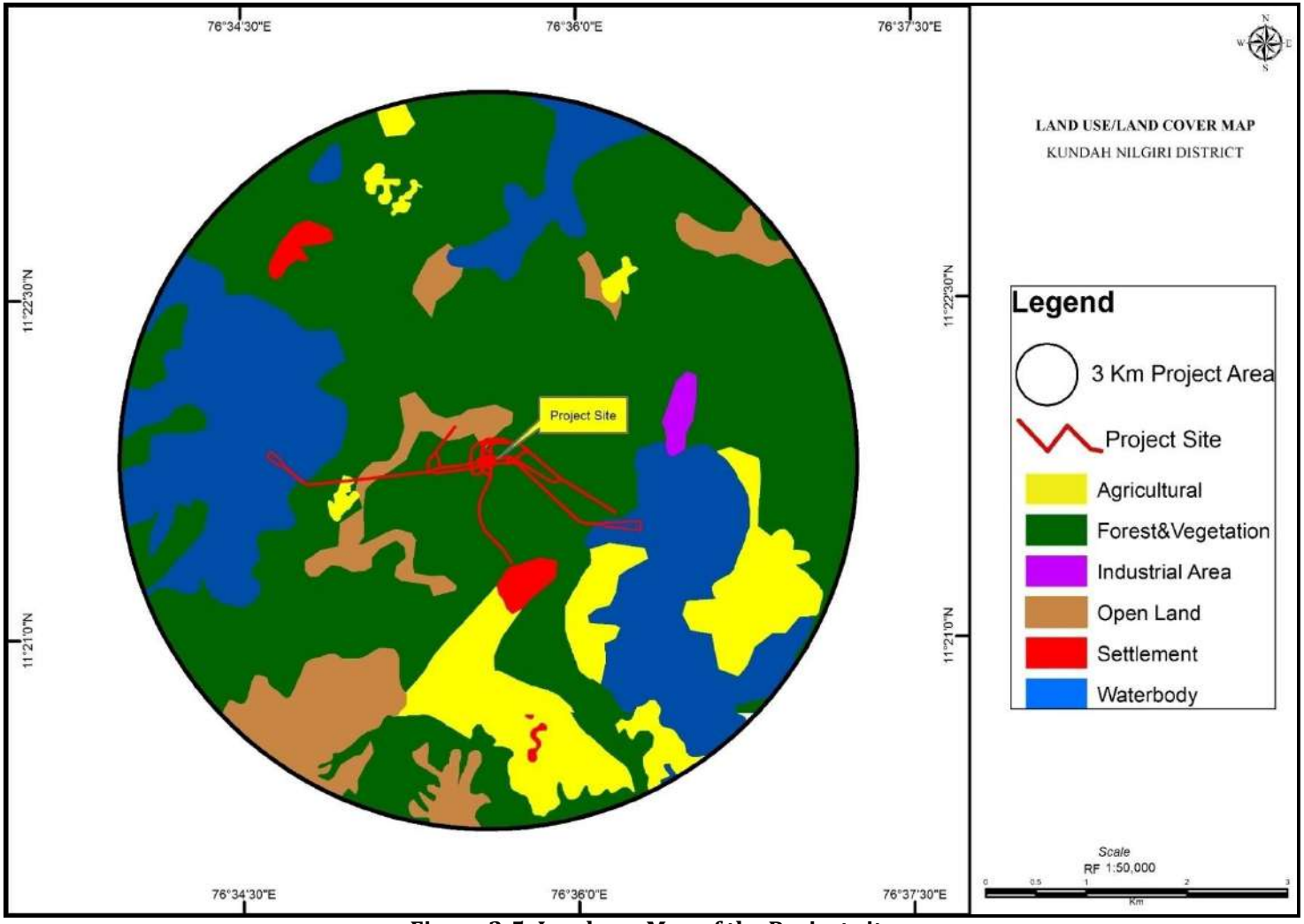

Figure 2-5: Land-use Map of the Project site

Baseline Data Generation

Baseline studies on environmental components are generated on the basis of winter (December 2019 to February 2020) season data. Baseline data for socioeconomic environment has been generated irrespective of seasons. The report contains baseline data for all environmental components i.e. physical, biological and socio-economic components.

Methods along with instruments used for collecting data of soil, air, noise, water, flora, and fauna and socio-economic are mentioned in the subsequent paragraph. The land-use/land-cover pattern of the area will be determined through topographic sheets coupled with ground truth. In analysis of terrestrial as well as aquatic biota, the references used as guidelines should be cited. Standard methods are used for characterizing the diversity and other significant features of the biota and details of field survey given. Baseline data collection for the project is done for the Winter Season (December 2019 to February 2020).

The methodology has been representing under the following Environmental component.

Noise Quality Assessment

Noise is a very important parameter for the environment. With progress in industrial growth, the level of noise has been increasing continuously. Noise has been further accelerated by introduction of the diesel engine, jet engine, high-tech machineries and increasing road traffic. Noise is considered to be one of the dimensions of pollution, which leads to degradation of the environment and also poses health and communication hazards to living beings.

Interpretation

The values of noise observed in some of the residential areas are primarily owing to vehicular traffic and other anthropogenic activities. In residential areas wind blowing and chirping of birds would contribute to noise levels especially during the nights. In Industrial area, noise from the factory equipments would be the primary source. Assessment of day time noise levels around the pumping station are ranging between 46.4 to 68.5 dB(A) during study period. Whereas the night equivalents were in the range of 37.5 to 56.5 dB(A). From the results it can be seen that the Day equivalents and the Night equivalents were within the Ambient Noise standards of residential areas standards.

Water Quality Assessment

The quality of water is vital concern for mankind since it is directly linked with the human welfare. Water quality characteristics of aquatic environment arise from multitude of physical, chemical and biological interactions. The water bodies are continuously subjected to dynamic state of changes with respect to their geo-chemical characteristics. The dynamic balance in aquatic ecosystem is upset by human activities, resulting in pollution which is obvious by bad taste of drinking water, offensive odor, unchecked growth of aquatic weeds, and decrease in number of fish, oil and grease floating on water bodies. These disturb the normal uses of water for public water supply, industry, agriculture etc. Samples of surface water and ground water were collected within the study area along the project site. To assess the water quality of the area samples were tested for physico-chemical parameters. Total nine sites which include four surface water and five ground water samples were selected for sampling. The selection of sites was done considering the location of different project components, junctions of streams, river course, spots of high water velocity and some of the slow flowing water pools.

Results for water quality analysis (surface water)

The characteristics of surface water samples from the 5 locations within the study area, and have been compared with the tolerance limits specified by Central Pollution Control Board for surface water sources under Class B.

Interpretation

Analysis results of surface water reveal the following:

- pH varies from to 7.40 to 8.44.
- Total Hardness varies from 160 to 318 mg/L.
- Total Dissolved Solids varies from 122 to 340 mg/L.

Analysis results of ground water reveal the following:

- pH varies from to 7.36 to 7.68.
- Total Hardness varies from 154 to 188 mg/L.
- Total Dissolved Solids varies from 264 to 304 mg/L

Biological Environment

Introduction

Biodiversity is the most important component of the nature on the earth to sustain and maintain life system on this planet. The biological study is an important part of the environmental impact assessment study to understand the present status of ecosystem prevailing in the study area in order to predict changes in the biological environment as a result of the proposed development activity and to suggest measures for maintaining its health through proper mitigation measures.

Study area

The Kundah Hydro Power Project is located in the Buffer Zone of Nilgiri Biosphere Reserve area. This is under construction phase by TANGEDCO. The project is based on a pumped storage system to produce 500 MW by installing four turbines of 125 MW each. The project is envisaged on the two lake's pump storage system. The upper small lake (Avalanche lake) and the lower large lake (Emerald lake) situated in Kundah Valley of Nilgiri Hills near the Ooty hill station.

Objectives of the Study

The ecological study of the surrounding area up to 10 km radius of propose project has been conducted in order to understand the ecological status of the existing flora and fauna to baseline information and evaluate the probable impacts on the biological environment.

The objectives of the terrestrial ecological survey were to:

- Preparation of comprehensive checklist of flora and fauna.
- Estimation of ecological diversity of different plant communities.
- Identification and listing of Rare Endangered species –RET.
- Identification and listing of plants of biologically, economical and medicinal importance.

Methodology

The present study on the floral assessment for the existing project activity is based on field survey of the study area. The plant species were identified with the help of plant taxonomy manual, Published Literatures, Reports and Websites (BSI, ZSI and State/District Forest Departments). In addition, information was also collected with vernacular names of plant species collected from local inhabitants.

Ecology & biodiversity study was carried out during Dec 2019 to Feb 2020 to assess the existing ecological status of the project site. The primary baseline survey was conducted to assess the nature of the existing habitat, species composition within the core area (within 500m radius of the project site) and the buffer area (up to 10 km radius of the project site).

As the study area mainly comprises of water reservoir, natural forest land, some agriculture land and plantation work.

A profile of the faunal species (terrestrial, aerial and aquatic) of the project area have also been developed through direct sighting and through secondary means like nests, roosts, pug marks, droppings, etc.

Moreover, authentic secondary information i.e. Published Research documents and published research papers and web search have also been referred which are given below in the Table below.

- BSI (2016),State wise Distribution of Endemic and Threatened plant texa of India.http://www.bsienvis.nic.in/Database/E_3942.aspx
- http://tnenvis.nic.in/writereaddata/Endemic%20Plants%20of%20Tamil%20Nadu.pdf.
- Champion, H.G. and Seth (1968). A revised survey of the forest types of India. Govt. of India Press, Nasik, India.
- ENVIS Centre on Wildlife & Protected Areas Schedule Species Database http://wiienvis.nic.in/Database/ScheduleSpeciesDatabase_7969.aspx
- Forest survey of India, State of Forest Report -2017
- IUCNRedListofThreatenedSpecies,version3.1 https://www.iucn.org/resources/conservation-tools/iucn-red-list-threatened-species.
- http://cpcbenvis.nic.in/scanned%20reports/PROBES-75%20Guidelines%20For%20Developing%20Greenbelts.pdf
- Mishra R. Ecology Work Book Oxford and IBH Publishing Co. Calcutta, India. 1968.
- http://bsienvis.nic.in/Database/RedlistedPlants_3940.aspx
- https://www.cabi.org/isc/FullTextPDF/2015/20153142002.pdf
- ZSIhttp://faunaofindia.nic.in/PDFVolumes/cas/011/index.pdf
- https://www.forests.tn.gov.in/pages/view/Introduction-wild

Interview of the local people were performed to verify the presence of the flora and fauna species with their common names. Ecological sensitivity along with critical habitats (National Park, Sanctuary, Ecological Sensitive Area, Migratory Corridor, habitat of endangered, vulnerable and range restricted species etc) in the project area has also been worked out.

Identification and classification of species recognized as critically endangered, endangered, threatened etc. as per IUCN Red list and Scheduled Species as per WPA (1972).

The water bodies and stream in the area also assessed for the status of the aquatic life and fishes.

Eco-sensitive zone in the Study Area

A detailed Ecological Sensitivity study has been carried out within 10km from project site. The details are given in following Table 2.3 and Figure 2.6.

Table 2.3: Environmental Sensitivity within 10 km Study Area

S.No.	Name	Distance (in km)	Address	Direction	Latitude (^{O}N)	Longitude (^{O}E)
1	Karimpuzha	7	Malappuram, Kerala	SSE	11.29276	76.53328
2	Nilgiri tahr	6.5	Nilgiris, Tamil Nadu	SSE	11.28766	76.55149
3	Upper Bhavani Reservior	8.7km	Upper Bhavani Reservior, Tamil Nadu 643209	SSE	11.26452	76.55983
4	Porthimund Lake	0	Porthimund Lake, Tamil Nadu	Project Area	11.36791	76.57393
5	Emerald Lake	0	Emerald Lake, Tamil Nadu	S	11.33831	76.61165
6	Avalanche Lake	2.5km	Avalanche Lake Lake, Tamil Nadu	S	11.30807	76.59376
7	Sandynulla	4.6km	Sandynulla, Tamil Nadu	NW	11.43449	76.6554
8	Reserve Forest	7.9km	Reserve Forest, Tamil Nadu	NE	11.4201	76.49621

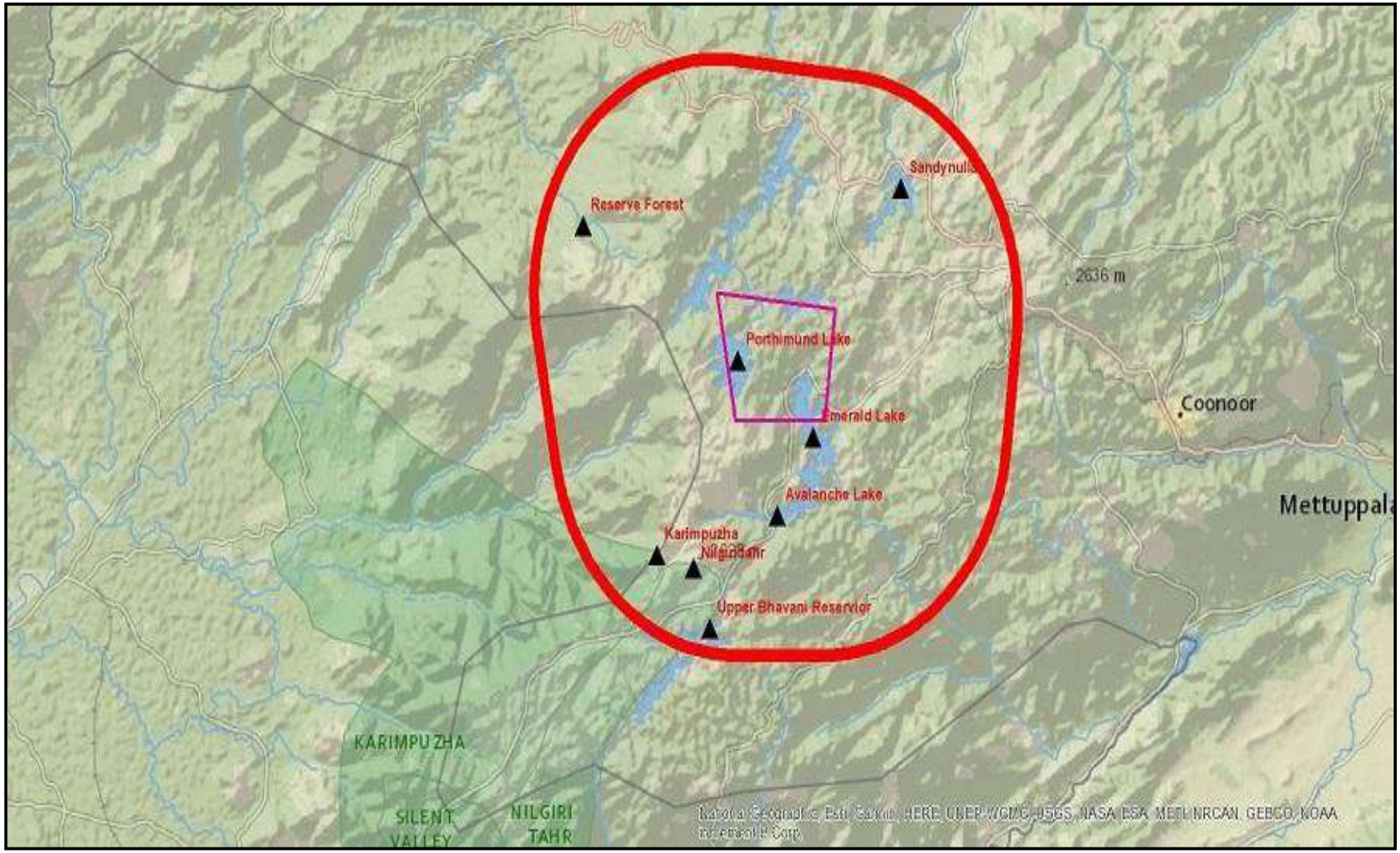

Figure 2-6: Environmental Sensitivty within 10 km Study Area

Vegetation and Forest Types in the Project Area

The project area is surrounded by natural forests. The vegetation falls in the tropical and subtropical moist broadleaf forests, tropical moist forests of the western slopes of the Ghats to the tropical and subtropical dry broadleaf tropical, dry forests on the east slopes. Rainfall ranges from 2100mm to 2300mm per annum in the region.

Various kinds of tree plantation of exotic species are also evident in the area. Tea gardens as the main agricultural patches create the mosaic like landscape in the study area. Presence of the silver oak tree is very common in the tea gardens. Eucalyptus trees are planted throughout the area and are visible everywhere. Pines and Cyprus trees are also very common at the higher altitudes. A mix representation of various kinds of trees, shrubs and herbs is represented by the Shola forest with patches of grasslands.

Endangered species of the Study Area

Out of the total species of vertebrates observed in the general study area, only 8 are listed in the Schedule-I of the WPA -1972 (Table 2.6 to Table 2.10).

Floral Species Observations during Primary Survey

The mixed variety montane forests are called as Shola forests in Nilgiri Hills. These are sometimes separated by rolling grasslands at higher elevations. The deciduous trees shed their green leaves during the summer and adopt a floral garb while the arrival of the monsoons hails fruits and tender greens.

Predominant species in the Shola forests include *Measaindica*, *Microtropis ramiflora* and *Rhododendron arboreum*. The grasslands will have a number of grass species like *Chrysopogon zeylanicus* and *Eulalia phaeothrix.*

Tree species in this habitat include *Casseriaovoides*, *Litseamysorensis*, *Cinnamomumma labatrum*, *Olea dioca* and *Rhododendron nilagiricum*, *Borassus flabellifer, Calophyllumino phyllum, Carissa spinarum, Drypetessepiaria, Mimusopselengi, Pandanus fascicularis, Phoenix pusilla and Prosopis cineraria. Atalantia monophylla, Calophyllumino phyllum, Canthium parviflorum, Carissa spinarum, Erythroxylum monogynum, Lannea cooromandelica, Manilkara hexandra, Mimusopselengi, Callitropis macrocarpa. Mangifera indica*, *Pongamia glabra*, *Terminalia arjuna*, *Syzygium cumini*, *Dalbergia latifolia* (Indian rosewood) and bamboos.

Moist bamboo clumps are found amidst dry deciduous, moist deciduous and semi-evergreen forests and along the fringes of riparian forests and swamps. There are two species of bamboo found mainly the giant clumping bamboos (*Bambusa arundinacea* and *Dendrocalamus strictus*).

Shrubs like *Caesalpinia bonduc, Calotropis gigantea, Carissa spinarum, Cassia auriculata, Clerodendroninerme, Indigofera oblongifolia, Jatropha glandulifera, Tephrosia purpurea, Waltheria indica*, etc. are commonly found.
Climbers including *Dregeavolubilis*, (sneeze wort) *Gnetumula* and *Entada scandens* with common woody climber's species include *Canavalia gladiata C. virosa, Mucunaatropurpurea and M. pruriens. Parasites like Cassythafiliformis, Dendrophthoe falcata* and *Viscum orientale*are frequently found. *Vanda tessellatta* is very common orchid species.

Observations on the Biodiversity of the Study Area

The Nilgiri hills are very rich in plant diversity of which 133 are endemic to the reserve. The genus Poeciloneuron is exclusively endemic to the Nilgiris. Some of the plants entirely restricted to the Nilgiri hills include species of *Adenoon, Calycanthus, Baeolepis, Frerea, Jarodina, Wagatea, Poeciloneuron* etc.

The unique habitat of the Nilgiri hills are known to home for several species of wild relatives of cultivated plants including wild rice, wild ginger, turmeric, cinnamon, solanum, guava, mango and pepper.

Unfortunately, the Sholas have begun to gradually shrink due to the introduction of alien plant species and annual fire occurrences. Alien species like Sticky Snakeroot, Gorse and Scotch Broom introduced during British rule, have encroached upon the grasslands. During 1840, tree species such as Acacia and Eucalyptus were introduced from Australia. Afterwards, between 1886 and 1891, Pine and Cypress were introduced, again from Australia. As the alien species grew, the forests and grasslands gradually became degraded and shrank. The comparison of the results of the 1849 and 1992 studies shows that cultivation of tea, wattle and eucalyptus has reduced the Shola forest-grassland ecosystem to a great extent.

The manmade single stand plantation of trees are commonly visible in the Kundha Valley including Pines (*Pinus roxburghii*), Silver oak (*Grevillea robusta*), Eucalyptus (*Eucalyptus globulus*), Wattles (*Acacia mearnsii*), Cedar (*Cederusdeodara*), Cyprus (*Cupressus sp*.) and bamboo, etc. At some places, *Anacardium occidentale, Casuarina equisetifolia* and *Cocos nucifera* are cultivated.

Significant populations of invasive shrubs and herbs (*Eupatoriurn glandulosuni, Ulexeuro paeus* and *Cytisus scoparius*) in the shola-grassland ecosystem mosaic were reported by early researchers and new exotic species like *Calceolaria Mexicana* and *Erigeron mucronatus* have recently been reported from the ecosystem. *Lantana camara, Aculeata, Lepisanthestetra phylla* and *Sapindus emarginta* etc are also reported.

In addition, unscientific practices like growing tea on the slopes, cattle grazing and fuel wood collection have become serious causes for degradation. Unregulated tourism has created concrete jungles, traffic congestion have caused generation of garbage in the region.

After realizing the seriousness of the situation, the government banned the planting of wattle and eucalyptus completely in 1987. Ecological restoration and biodiversity conservation were given importance. Under the Hill Area Development Programme since the mid-1980s, seedlings have been planted in degraded patches and protected with chain-link fences to restore the forests.

Special Shola forest protection committees were formed involving teachers, nature lovers, ecologists, environmentalists, students and villagers in the Nilgiris. They were motivated to remove plastic garbage from the nearby forests, protect Shola trees, remove alien species and learn about the importance of the Sholas. Presently, the Tamil Nadu forest department is focusing on eradicating wattle, providing fencing and planting Shola seedlings in degraded Shola forests.

Floral species in the core zone and Buffer zone

According to primary survey conducted in study area and consultation with the secondary resources, a total of 145 floral species belonging to 58 plant families have been listed in the

project area (Table 2.4). Some photographs of landscape and flora of the study area is given in Figures 2.7. The list of the floral species found in the study area showing Trees, Shrubs, Herbs, Grasses and Climbers with their corresponding families along with the common names has been presented in Table 2.5.

Based on the number of species, the most important plant families reported in this region are; Acanthaceae, Amaranthaceae, Euphorbiaceae, Fabaceae, Poaceae and Malvaceae etc.

Table 2.4: Number of Floral Species in Different Categories of the Study Area

S. No.	Plant Life Form	Number of Species
1	Trees	58
2	Shrubs	29
3	Herbs	40
4	Climbers	10
5	Grasses	7
Total No. of Species		**145**
Total Number of Families		**58**

Table 2.5: List of Floral Species found in the Study Area

Family		Species		Common name	Habit
1	Acanthaceae	1	*Adhatoda vasica*	Adatodai	S
		2	*Barleria prionitis*	Kukong Manok	H
		3	*Lepidagathis cristata*	Karappanpoondu	H
		4	*Rostellularia prostrata*	Kotakacalai	H
2	Agavaceae	5	*Agave americana*	Anaikathalai	S
3	Amaranthaceae	6	*Achyranthes aspera*	Antisha	H
		7	*Aerva javanica*	Perumpoolai	H
		8	*Amaranthus virids*	Kuppai	H
4	Anacardiaceae	9	*Mangifera indica*	Ma	T
		10	*Buchanania lanzan*	Charam	T
		11	*Lannea coromandelica*	Oti	T
5	Apocynaceae	12	*Caralluma bhupinderiana*	Mooliyan	T
		13	*Calotropis gigantea*	Erukku	S
		14	*Carissa spinarum*	Chirukila	S
		15	*Dregea volubilis*	Cinkittam	H
		16	*Carissa carandas*	Kalakkai	S
		17	*Hemidesmus indicus*	Nannari	H
		18	*Nerium indicum*	Arali	S
6	Arecaceae	19	*Borassus flabellifer*	Talam	T
		20	*Phoenix pusilla*	Small wild date palm	S

7	Asclepiadaceae	21	*Calotropis procera*	Vellaierukkan	S
		22	*Tylophora indica*	Atikam	H
8	Asperagaceae	23	*Asparagus racemosus*	Shimai- Shadvari	H
9	Asteraceae	24	*Acanthospermum hispidum*	Palleur	H
		25	*Ageratum conyzoides*	Pumppillu	H
		26	*Parthenium hysterophorus*	Congress pacha	H
		27	*Vernonia cinerea*	Naichottepoonde	H
10	Balsaminaceae	28	*Impatiens balsamina*	Aivartyenki	H
11	Bixaceae	29	*Bixa orellana*	Sappiravirai	T
12	Celastraceae	30	*Microtropis ramiflora*	-	T
13	Clusiaceae	31	*Calophyllum inophyllum*	Nameru	T
14	Caesalpiniaceae	32	*Cassia occidentalis*	Nattutakarai	S
		33	*Cassia siamea*	Manjalkonrai	T
		34	*Caesalpinia bonduc*	kaccuram	Cli
15	Capparaceae	35	*Capparis zeylanica*	Adondai	H
16	Convolvulaceae	36	*Argyreia nervosa*	Samudrappacho	H
17	Cucurbitaceae	37	*Cucumis sativus*	Vellarikkay	Cli
18	Combretaceae	38	*Terminalia arjuna*	Marutu	T
19	Euphorbiaceae	39	*Acalypha fruticosa*	Chinni	S
		40	*Croton sparsiflorus*	Rail poondu	H
		41	*Euphorbia antiquorum*	Chaturakalli	S
		42	*Euphorbia resinifera*	Caturakakalli	H
		43	*Jatropha glandulifera*	Vellaikattukottai	S
		44	*Phyllanthus reticulatus*	Karunelli	H
20	Ericaceae	45	*Rhododendron arboreum*	Billi	T
21	Erythroxylaceae	46	*Erythroxylum monogynum*	Sembulichan	T
22	Fabaceae	47	*Acacia horrida*	Sarai	T
		48	*Pongamia glabra*	Pungai	T
		49	*Acacia leucophloea*	Sarai	T
		50	*Canavalia gladiata*	Segapputampattai	Cli
		51	*Mucuna atropurpurea*	Talargodi	Cli
		52	*M. pruriens*	Punaippidukkan	Cli
		53	*Cassia auriculata*	Aavaram	S
		54	*Cassia fistula*	Konrai	T
		55	*Indigofera oblongifolia*	Avuri	S
		56	*Acacia nilotica*	Karuvelam	T
		57	*Acacia planifrons*	buddathumma	T
		58	*Albizia amara*	Wunja	T
		59	*Albizia lebbeck*	Siridam	T
		60	*Arachis hypogea*	Manila-k- kottai	H
		61	*Cassia auriculata*	Avaram	S
		62	*Crotalaria globosa*	kilukiluppai	T
		63	*Crotalaria retusa*	Pottigilligichacha	H
		64	*Dalbergia horrida*	Ana – mullu	T
		65	*Tephrosia purpurea*	kavali	H
		66	*Dalbergia latifolia*	Totakatti	T
		67	*Dalbergia coromandeliana*	Vettatholi	T
		68	*Delonix regia*	Mayilkondari	T
		69	*Dichrostachys cinerea*	Veduttalam	T
		70	*Mimosa pudica*	Sleepy Plant	H
		71	*Pterolobium hexapetalum*	Walekadooda	S

		72	*Tamarindus indica*	Puli	T
		73	*Vachellia horrida*	Velvelam	T
		74	*Butea monosperma*	Kincukam	T
23	Gnetaceae	75	Gnetum edule	Anapendu	Cli
24	Lamiaceae	76	*Ocimum sanctum*	Thulasi	H
		77	*Ocimum tenuiflorum*	Nallathulasi	H
		78	*Tectona grandis*	Tekku	T
		79	*Vitex negundo*	Nocchi	Cli
		80	*Clerodendrum inerme*	Catpitakkani	S
25	Liliaceae	81	*Aloe vera*	Chiruli	H
26	Lauraceae	82	*Litsea mysorensis*	-	T
		83	Cinnamomum malabatrum	Kattukaruvappattai	T
		84	*Cassytha filiformis*	Erumai-k-korran	Cli
27	Loranthaceae	85	*Dendrophthoe falcata*	Pulluri	S
28	Malvaceae	86	*Hibiscus esculentus*	Ventai	S
		87	*Pavonia odorata*	Peramutti	S
		88	*Sida rhombifolia*	Kurundotti	H
29	Meliaceae	89	*Azadirachta indica*	Sengumaru	T
30	Menispermaceae	90	*Tinospora cordifolia*	Kunali	Cli
31	Mimosaceae	91	*Prosopis cineraria*	Parambai	T
		92	*Leucaena leucocephala*	Savundalmaram	T
		93	*Prosopis juliflora*	Velikathan	T
		94	*Prosopis glandulosa*	Vanni	T
		95	*Entada scandens*	Kakavalli	Cli
32	Moringaceae	96	*Moringa oleifera*	Murungai	T
33	Myrtaceae	97	*Syzygium cumini*	Nagai	T
		98	*Eucalyptus globulus*	Gum trees	T
		99	*Rhodomyrtus tomentosa*	Malai-k-koyya	S
34	Nyctaginaceae	100	*Boerhavia diffusa*	Sukuaetti	H
35	Oxalidaceae	101	*Oxalis corniculata*	Paliakiri	H
36	Oleaceae	102	*Olea dioica*	Italai	T
37	Orchidaceae	103	*Vanda tessellata*	Kantanakuli	-
38	Papaveraceae	104	*Argemone mexicana*	Kudiyotti	S
39	Primulaceae	105	*Maesa indica*	Periya-unni	S
40	Putranjivaceae	106	*Drypetes sepiaria*	Kalvirai	T
41	Pandanaceae	107	*Pandanus fascicularis*	Ketakai	T
42	Phyllanthaceae	108	*Phyllanthus emblica*	Nelli	T
43	Poaceae	109	*Aristida setacea*	-	H
		110	*Bambusaarundinacea*	Peru-munkil	G
		111	*Dendrocalamus strictus*	Ciru-munkil	H
		112	*Chloris barbata*	Kodaipullu	H
		113	*Cynodon dactylon*	Arugampillu	G
		114	*Digitaria bicornis*	Sesbania	G
		115	*Eleusine coracana*	Aariyam	H
		116	*Pennisetum typhoideum*	Pearl millet	G
		117	*Saccharum officinarum*	Karumbu	G
		118	*Saccharum spontaneum*	Pekkarimpu	G
		119	*Themeda triandra*	Kangaroo grass	H
		120	*Chrysopogon zeylanicus*	-	H
		121	*Eulalia ophiothrix*	-	H
44	Pinaceae	122	*Pinus roxburghii*	Chir	T
45	Proteaceae	123	*Grevillea robusta*	Savukku-maram	T

46	Rhamnaceae	124	*Ziziphus oenoplia*	Suraimullu	T
		125	*Zizyphus sp.*	Elandhai	T
47	Rubiaceae	126	*Adina cordifolia*	Mannakatampu	T
		127	*Canthium parviflorum*	Nallakkarai	S
		128	*Catunaregam spinosa*	Maalankaari	S
		129	*Morinda tinctoria*	Mannanunai	T
48	Rubiaceae	130	*Canthium parviflorum*	Kudiram	S
		131	*Psychotria congesta*	Pavadakkambu	T
		132	*Saprosma foetens*	Peenari	T
49	Rutaceae	133	*Murraya koenigii*	Curry Leaf	T
		134	*Aegle marmelos*	Vilvam	T
		135	*Atalantia monophylla*	KattuElumeachi	T
50	Sapotaceae	136	*Mimusops elengi*	Magizhamboo	T
		137	*Manilkara hexandra*	Ulakkai-p-palai	T
51	Sapindaceae	138	*Dodonaea viscosa*	Virali	S
52	Santalaceae	139	*Viscum orientale*	Jointed Mistletoe	S
53	Simaroubaceae	140	*Ailanthus excelsa*	Agal	T
54	Solanaceae	141	*Solanum indicum*	Chiru vazhuthalai	H
55	Sterculiaceae	142	*Waltheria indica*	Shengalipoondu	S
56	Typhaceae	143	*Typha angusta*	Jambu	G
57	Vitaceae	144	*Cissus quadrangularis*	Perandai	H
58	Zingiberaceae	145	*Curcuma longa*	Manjal	H
Abbreviations: T= Tree, S= Shrub, H= Herb, G= Grass, Cli= Climber					

Medicinal Plant

Medicinal plants of various kinds are found in abundance in the natural forests of Nilgiri hills. Important ones are; Vilvam (*Aegle marmelos*), Veppai (*Azadirachta indica*), Sappiravirai (*Bixaorellana*), Kincukam (*Butea monosperma*), Tannir-vittan (*Asparagus racemosus*), Kurukku (*Argemone mexicana*), Charam (*Buchananialanzan*), Kathalai (*Aloe vera*), Nelli (*Phyllanthus emblica*), Manjal (*Curcuma longa*), Kannikkodi (*Clitoriaternatea*), Konrai (*Cassia fistula*), Wunja (*Albizia amara*), Siridam (*Albiziab lebbeck*) and Avaram (*Cassia auriculata*) *etc.*

Terrestrial Fauna

The faunal composition comprises of mammal, bird, reptile, amphibian, butterfly and insect species. Mammal diversity is higher in the dry deciduous and dry thorn forests than in the other habitats. They include, Indian leopard, jungle cat and Black Panther. These populations exist due to the high density of prey species thriving in these deciduous forests.

Faunal Survey in the Core zone and Buffer zone

An inventory of the fauna recorded in the primary survey (by direct and indirect method) and reported in the secondary resources has been enlisted in the Table 2.6to 2.10. A total of 21 mammalian, 46 avian, 11 amphibian, 8 reptilian and 17 butterflies are mentioned in the list along with their common names and conservation status.

Table 2.6: Mammals Species reported from the Study Area

S.No	Scientific Name	Common Name	IUCN and WPA status
1	*Panthera pardus*	Indian Leopard	VU/I
2	*Panthera onca*	Black Panther	NT
3	*Bos gaurus*	Gaur	VU/I

4	*Elephas maximus indicus*	Indian Elephant	EN/I
5	*Herpeste sedwardsii*	Indian Mongoose	LC/II
6	*Ratufa indica*	Malabar Giant Squirrel	LC/II
7	*Macaca silenus*	Lion-tTailed Macaque	EN/I
8	*Trachypithecus johnii*	Nilgiri Langur	VU/I
9	*Semnopithecus priam*	Gray Langur	EN/II
10	*Nilgiritragus hylocrius*	Nilgiri Tahr	EN/I
11	*Hyaena hyaena*	Striped Hyena	NT/III
12	*Canis aureus*	Golden Jackal	LC/II
13	*Melursus ursinus*	Sloth Bear	VU/I
14	*Macaca radiate*	Bonnet Macaque	LC/II
15	*Cervus unicolor*	Sambar Deer	VU/III
16	*Axis axis*	Chital Deer	LC/III
17	*Muntiacus muntjac*	Indian Muntjac	LC/III
18	*Moschiola indica*	Indian Spotted Chevrotain	LC
19	*Sus scrofa*	Wild Boar	LC/III
20	*Ratufaindica maxima*	Indian Giant Squirrel	LC/II
21	*Petaurista petaurista*	Red Giant Flying Squirrel	LC
Abbreviations: LC= Least Concerned, CR= Critically Endangered, VU= Vulnerable, DD= Data Deficient, NT= Near Threatened, EN= Endangered, End=Endemic.			

Table 2.7: Reptiles Species reported from the Study Area

S.No	Scientific Name	Common Name	IUCN and WPA Status
1	*P. molurus*	Indian Python	-
2	*Draco dussumieri*	Indian Flying Lizard	LC
3	*Najanaja*	Indian Cobra	II
4	*Bungarus caeruleus*	Common Krait	-
5	*Trimeresurus malabaricus*	Asian Pit Viper	LC
6	*Calotes nemoricola*	Nilgiri Forest Lizard	LC
7	*Sphenomorphus indicus*	Indian Skink	-
8	*Hemidactylus triedrus*	Indian Gecko	-
Abbreviations: LC= Least Concerned, CR= Critically Endangered, VU= Vulnerable, DD= Data Deficient, NT= Near Threatened, EN= Endangered, End=Endemic.			

Table 2.8: Avians Species reported from the Study Area

S.No	Scientific Name	Common Name	IUCN and WPA Status
1	*Ficedula nigrorufa*	Black-and-Orange Flycatcher	LC
2	*Harpactes fasciatus*	Malabar Trogon	LC
3	*Ocyceros griseus*	Malabar Grey Hornbill	LC
4	*Lophotriorchis kienerii*	Rufous-Bellied Eagle	NT
5	*Spilornis cheela*	Crested Serpent Eagle	LC
6	*Nisaetus cirrhatus*	Changeable Hawk Eagle	LC
7	*Ictinaetus malaiensis*	Black Eagle	LC
8	*Pernis ptilorhynchus*	Oriental Honey-Buzzard	LC
9	*Aquila fasciata*	Bonelli's Eagle	LC
10	*Accipiter trivirgatus*	Crested Goshawk	LC
11	*Accipiter virgatus*	Besra	LC
12	*Strix ocellata*	Mottled Wood Owl	LC
13	*Ninox scutulata*	Brown Hawk Owl	LC
14	*Buceros rhinoceros*	Hornbill	NT

15	*Oriolus oriolus*	Golden Oriole	LC
16	*Chloropseidae sp.*	Chloropsis	LC
17	*Terpsiphone paradise*	Paradise Flycatcher	LC
18	*Dinopium benghalense*	Golden-Backed Woodpecker	LC
19	*Psittacula columboides*	Blue-Winged Parakeet	LC
20	*Irena puella*	Fairy Bluebird	LC
21	*Gallus gallus*	Jungle Fowl	LC
22	*Dicrurus paradiseus*	Racket-Tailed Drongo	LC
23	*Pavo cristatus*	Peafowl	LC/I
24	*Galloperdix spadicea*	Red Spurfowl	LC
25	*Francolinus pondicerianus*	Grey Francolin	LC
26	*Galloperdix lunulata*	Painted Spurfowl	LC
27	*Perdicula erythrorhyncha*	Painted Bush Quail	LC
28	*Dryocopus javensis*	White-Bellied Woodpecker	LC
29	*Picus chlorolophus*	Lesser Yellownape	LC
30	*Melanerpes aurifrons*	Golden Woodpecker	LC
31	*Picus xanthophyceae*	Streak-Throated Woodpecker	-
32	*Merops leschenaultia*	Chestnut-Headed Bee-Eater	LC
33	*Chalcophaps indica*	Emerald Dove	LC
34	*Ducula aenea*	Green Imperial Pigeon	LC
35	*Treron affinis*	Grey-Fronted Green Pigeon	LC
36	*Cacomantis passerinus*	Grey-Bellied Cuckoo	LC
37	*Cuculus micropterus*	Indian Cuckoo	LC
38	*Tachymarptis melba*	Alpine Swift	LC
39	*Oriolus xanthornus*	Black-Hooded Oriole	LC
40	*Dicrurus paradiseus*	Greater Racket-Tailed Drongo	LC
41	*Coracina melanoptera*	Black-Headed Cuckoo Shrike	LC
42	*Pycnonotus priocephalus*	Grey-Headed Bulbul	NT
43	*Dendronanthus indicus*	Forest Wagtail	LC
44	*Leptocoma minima*	Crimson-Backed Sunbird	LC
45	*Cinnyris lotenius*	Loten's Sunbird	LC
46	*Macronus gularis*	Striped Tit-Babbler	-
Abbreviations: LC= Least Concerned, CR= Critically Endangered, VU= Vulnerable, DD= Data Deficient, NT= Near Threatened, EN= Endangered, End=Endemic.			

Table 2.9: Amphibians Species reported from the Study Area

S.No	Scientific Name	Common Name	WPA & IUCN Status
1	*Duttaphrynus melanostictus*	Common Indian Toad	IV
2	*Euphlyctis cyanophlyctis*	Indian Skipper Frog	LC
3	*Euphlyctis hexadactylus*	Indian Pond Frog	LC
4	*Rana tiger*	Common Frog	IV
5	*Duttaphrynus brevirostris*	Short-Nose Toad	DD
6	*Euphlyctis ghosi*	Manipur Frog	DD
7	*Hoplobatrachus tigerinus*	Indian Bull Frog	IV/LC
8	*Polypedates maculatus*	Common Tree Frog	LC
9	*Kaloula taprobanica*	Painted Frog	LC
10	*Microhyla rubra*	Red Small-Mouthed Frog	LC
11	*Ramanella variegata*	Marbled Small-Mouthed Frog	LC
Abbreviations: LC= Least Concerned, CR= Critically Endangered, VU= Vulnerable, DD= Data Deficient, NT= Near Threatened, EN= Endangered, End=Endemic.			

Table 2.10: Butterflies Species reported from the Study Area

S.No	Scientific Name	Common Name	WPA & IUCN Status
1	*Tirumala limniacae*	Blue Tiger	-
2	*Ictinogomphus rapax*	Common Club Tail	LC
3	*Catopsilia pomona*	Common Emigrant	-
4	*Taractrocera maevius*	Common Grass Dart	-
5	*Eurema hecabe*	Common Grass Yellow	-
6	*Papilio polytes*	Common Mormon	-
7	*Neptis hylas*	Common Sailor	-
8	*Danaus chiysippus*	Common Tiger	-
9	*Zizeeria knysna*	Dark Crass Blue	-
10	*Parantica aglea*	Glassy Tiger	IV
11	*Orthetrum sabina*	Green Marsh Hawk	-
12	*Diplacodes trivialis*	Ground Skimmer	LC
13	*Peacock pansey*	Junonia Almanac	-
14	*Junonia lemonias*	Lemon Pansy	-
15	*Papilio demoleus*	Lime Butterfly	-
16	*Danaus chiysippus*	Plain Tiger	IV
17	*Junonia hierta*	Yellow Pansy	-
Abbreviations: LC= Least Concerned, CR= Critically Endangered, VU= Vulnerable, DD= Data Deficient, NT= Near Threatened, EN= Endangered, End=Endemic.			

Aquatic Ecology in the Study Area

The study area includes Nilgiris hills, upper small lake (PorthimundLake) the lower large lake (Avalanche-Emerald Lake). The survey was carried out for assessment of aquatic flora and fauna and fisheries. The aquatic biological organisms are the best indicators of the quality of water bodies. The presence or absence of certain organisms indicates the health of an aquatic environment and various physico-chemical characteristics of water such as pH, conductivity, nutrients, BOD etc.

Aquatic Flora

The aquatic plants were found in reservoir and nearby river banks. The commonly found macrophytes were *Eichhornia crassipes* (Common water hyacinth), *Potamogeton* spp.(Pondweed), *Salvinia molesta* (Giant salvinia) and *Typha latifolia* (Common bulrush). Other recorded plants were *Hydrilla verticillate* (Waterthymes), *Nelumbo lutea* (Yellow lotus), *Ipomoea aquatica* (Water spinach) and *Neptunia oleracea* (Water Mimosa) etc.

Aquatic Insects

Aquatic insects are significant in many ways such as processing organic matter and transporting energy along food chain. Aquatic insects are present in some quantity in almost every type of habitat and many are habitat specialists so they are good indicators. Because of their differential responses to stimuli in their aquatic habitat and determining the quality of that environment, aquatic insects are used for monitoring the health of aquatic environments. At the larval stage, they constitute the principal nutritive fauna of fish.

The study recorded the presence of insects from 6 orders (Odonata, Hemiptera, Coleoptera, Ephemeroptera, Diptera and Trichoptera). The insects reported in reservoir are below:

Table 2.11: Insects Species found in the Study Area/ Reservoir

S.No	Order	Species
1	**Odonata**	*Ischnura*

		Urothemis
		Epitheca
2	**Ephemeroptera**	*Caenis*
		Ephemerella
		Baetis
3	**Hemiptera**	*Paraplea*
		Microvelia
		anotrephes
4	**Trichoptera**	*Polycentropus*
		Leptocerus
5	**Coleoptera**	*Amphiop*
		Hydroporus
6	**Diptera**	*Chironomus*
		Sepedon

Many aquatic insects are very sensitive to changes in levels of pollutants in the water and are therefore used as indicators of the ecological well-being of the aquatic ecosystem. Therefore, they should be preserved as they play a significant role in maintaining the health of the ecosystems by being part of the food chain, cleaning up the system as scavengers and contributing immensely to decomposition of dead organic matter. Their decrease will therefore result in the disruption of critical ecosystem services.

Phytoplankton

Phytoplanktons are the primary producers of an aquatic ecosystem and help in maintaining DO of a water body. If there is any increase or decrease in number of phytoplankton, it ultimately affects the whole aquatic ecosystem. The phytoplanktons observed in study area were *Microcystis, Oscillatoria, Nitzschia, Navicula* and *Pediastrum.*

Zooplankton

Zooplankton provides feed to the larger animals present in the water body. These consist mainly of *Nauplii*, *Daphnia* and *Cyclops*. The other zooplanktons observed in study area were *Colurellaobtusa, Chlamydomonas minor & Amoeba* etc. The zooplanktons found in water bodies of the study area listed below:

Table 2.12: Zooplanktons found in the Study Area/ Reservoir

S. No.	Rotifers	Protozoa	Cladocera	Copepoda
1	*Ascomorphasaltans*	*Amoeba proteus*	*Bosminalongirostris*	*Cyclops sp.*
2	*Brachionusbidentata*	*Chlamydomonas minor*	*Chydorussphaericus*	*Eucyclopsagilis*
3	*Colurellaobtusa*	*Volvox aureus*	*Daphnia laevis*	*Nauplii*
4	*Epiphanes senta*	*Euglena acus*	*Leydigiaacanthocercoides*	-
5	*Horellabrahmi*	*Paramecium*	*Moinabrachiata*	-

Fishes

Fishing activities are banned in the lakes of the Nilgiri hills. No commercial fishing is allowed in these lakes. There are only small and ornamental and colorful species. Some exotic trout species were introduced by the British authorities in the lakes and rivers of the area. Common fishes reported in the area have been listed in the Table 2.13.

The first attempt to introduce trout was carried out in 1863 without success. Brown trout and Loch Leven trout (*Salmo levensis*) failed to establish themselves in spite of repeated transfers from the UK over four decades. In 1909 Mr. H.C. Wilson gave preference to rainbow over brown and established a trout farm at Avalanche in the Nilgiris. The eyed eggs were imported from New Zealand. In addition, fingerlings from Sri Lanka were brought and stocked in one of the streams of the Nilgiris. Another batch of eyed eggs was brought from Kashmir during the 1920s. In 1943 rainbow trout was released in streams of the Palni Hills. In 1968 eyed eggs ofgolden rainbow, ordinary rainbow, tiger trout, brown trout and Kokanee salmon (*Oncorhynchus nerka*) were brought from Japan. Of these new releases, only golden strain of rainbow survived and established itself as a dominant strain of rainbow in anglers' catches.

Table 2.13: Fish Species reported in the Project Area and its environs

S.No	Scientific Name	Common Name	WPA & IUCN Status
1	*Oncorhynchus mykiss*	Trout	LC
2	*Tor putitora*	Mahseer	EN
3	*Cyprinus carpio*	Common Carp	VU
4	*Danio aequipinnatus*	Giant Danio	LC
5	*Rasbora daniconius*	Black-line Rasbora	LC
6	Barilius gatensis	-	LC
7	Danio neilgherriensis	NilgiriDanio	EN
8	*Tor khudree*	Black Mahseer	EN
9	*Barbodes carnaticus*	Carnatic Carp	LC
10	*Puntius bimaculatus*	RedsideBarb	LC
11	*Puntius chola*	Chola Barb	LC
12	*Puntius mudumalaiensis*	Ray-finned Fish	VU
13	*Cirrhinus reba*	Reba Carp	LC
14	*Labeo bata*	Labeo	LC
15	*Mystus cavasius*	Gangetic Mystus	LC
16	*Gambusia affinis*	-	LC
Abbreviations: LC= Least Concerned, CR= Critically Endangered, VU= Vulnerable, DD= Data Deficient, NT= Near Threatened, EN= Endangered, End=Endemic.			

Image of Landscape

Image of Landscape

	
Image of Landscape	Image of Landscape
	
	

Actinodaphne bourdillonii

Rhododendron nilagiricum

Argemone mexicana

Lantana camara

Figure 2-7: Photographs of floral species and landscape in the study area

Probable Impacts of the Proposed Pumped Storage Scheme on the Biological Environment

The area of the Kundah Valley is very diverse with respect to its biological composition. In past, plantation of exotic plants, economic crops like tea and growth of invasive species such as lantana is hindering the regeneration process of the natural vegetation. Excessive cattle grazing and tourism is also threatening the ecology of the area if not managed in a strict manner.

The project does not propose development of any storage structures and intents to pump water from the lower Avalanche-Emerald reservoir to Porthimund reservoir situated at an upper level. This pumped water will be utilized for power production to meet peak hour demand.

Major components of the project such as Head Race Tunnel, Power House and Tail Race Tunnel will be located underground, while surges and switchyard are the major components located over ground. The project requires about 18 ha of forest land, out of which only 6.6 ha will be utilized for over ground structures. The balance 11.4 ha land will be utilized for underground project components.

As most of the installations of KPSHEP are to be placed underground and no new water storage is proposed, no submergence of land involved. All major over-ground components of the project

are located in wattle plantations and hence, the project is expected to cause minimum damage to the local environment.

Construction Phase

In a hydroelectric project, the major impacts occur during construction phase which are given below:

- Construction of such a large scale project comprising of HRT, TRT, surge shaft, pressure shaft penstock, underground power house, switch yard, approach road involves several activities such as excavation, drilling and blasting, movement of men, machineries and materials.
- The construction of a large-scale project would lead to loss of feeding and breeding habitats to certain species inhabiting the project area. However, most of the over ground structures of the project will be located in wattle plantations. The wattle rich areas are widely spread in project area and loss of patches due to diversion for project activities is likely to divest habitats for any species in a limited way.
- The movement of vehicles for men and materials operation of heavy earth moving machineries and drilling and blasting increase the ambient noise level which is likely to disturb the animals and avian fauna. They are normally very sensitive to certain frequency range of sound.
- The blasting and excavations activities for tunnels, especially close to their mouths and in areas where the tunnels pass by close to the surface may affect some wild species in the immediate vicinity.
- Construction of sheds or shanties and cutting of trees for fuel purpose by laborers may threat neighboring forest and impede movement of wild animals.

Operation Phase

However, a pumed storage project is not considered as a cause of the pollution in its running phase and most of the negative impacts are supposed to occur in the construction phase only (as discussed above). Still, the probability of all such impacts is always there but in a lesser extent.

The establishment of a project involves the construction of new access roads. Earlier such remote areas were not easily accessible. The availability of the roads makes these areas more vulnerable to frequent illegal logging, hunting, and NTFP harvesting. These activities result in erosion, vulnerability and habitat fragmentation.

Mitigation Measures for minimizing the impacts on the Biodiversity

Since the project area and its environs fall within the buffer zone of the Nilgiri Biosphere Reserve, maximum precautions and preventive measures should be adopted in minimizing impacts during the construction phase of the project.

Projects with large-scale activities are likely to have notable impacts on various components of the local ecosystem. However, proper scheduling of the project execution, stringent control on vehicle movement and access to roads, controlled and regulated blasting to the bare minimum, and effective training and educating the workers can help considerably in reducing the impacts on the local environment. Major mitigation and prevention measures are presented below:

- The proposed project is not likely to cast major negative impact on the biodiversity of the area as the major linear components are underground and loss of habitat and vegetation will be negligible, and movement of animals will not be hindered to a large extent.
- The traffic on roads carrying men and materials should be carefully regulated and managed through check post and barriers to minimize the impact.
- All the vehicles including earth moving equipment's should be regularly serviced and well maintained to keep noise generation low.
- The blasting pattern and technique should be adopted depending upon actual geology of the site and rock structure. Further, the blasting need to be practiced only during day time avoiding dawn and dusk period.
- Necessary facilities such as fuel wood/ gas cylinder/kerosine oil/ electricity etc. should be provided to construction workers to minimize impact on nearby forest.
- The firefighting equipment's should be well placed to reduce loss of flora and fauna in case of manmade and natural fire. Proper training also needs to be imparted to workers and staff.
- Since the water of the lakes will be recycled/ interchanged for the production of the electricity, hence, there will be no impact on the water regime of these two lakes.
- The contour bunds and fringes of the waste dumps shall be regularly monitored and maintained properly.
- A layer of surface soil should be laid and grass grown to enhance soil binding and stabilization. Bare areas should be covered with suitable grass species to avoid soil erosion.
- Proper disposal of the excavated muck and its filling on the low-lying area with proper measures for the stabilization and greenery will minimize the impacts of the generated construction muck. The muck should not be allowed to go to water bodies.

CHAPTER-3 : CONSERVATION PLAN FOR SCH-I SPECIES

INTRODUCTION

The Kundah Hydro Power Project is located in the Buffer Zone of Nilgiri Biosphere Reserve area. The project area is surrounded by natural forests. The vegetation of the area are tropical and subtropical moist broadleaf forests, tropical moist forests of the western slopes of the Ghats to the tropical and subtropical dry broadleaf tropical, dry forests on the east slopes. The mixed variety montane forests are called as Shola forests in Nilgiri Hills. These are sometimes separated by rolling grasslands at higher elevations. The faunal composition comprises of mammal, bird, reptile, amphibian, butterfly and insect species. Mammal diversity is higher in the dry deciduous and dry thorn forests than in the other habitats. They include Indian leopard, jungle cat and Gaur. These populations exist due to the high density of prey species thriving in these forests.

The proposed project with large-scale activity is likely to have notable impacts on various components of the local ecosystem. However, proper scheduling of the project execution, stringent control on vehicle movement and access to roads, controlled and regulated blasting and effective training and educating the workers can help considerably in reducing the impacts on the local environment.

Therefore, the Biodiversity Conservation Plan and Wildlife Management Plan with particular reference to Schedule-I faunal species has been developed to understand and to provide appropriate guidance to the project proponent to undertake special measures to conserve/protect biodiversity and the rare and endangered species. The Biodiversity Conservation Plan Wildlife Management Plan should be further detailed and implemented in consultation with Tamil Nadu Biodiversity Board and DFO of Nilgiri District.

The Bio-diversity Conservation Plan comprises of followings aspects:

- Training and capacity building of the forest staff for protection and surveillance.
- Construction of a tall Watch tower at a strategic point for observation and monitoring of wildlife movement, forest fire and poachers. This would also help in period surveillance to strength the quality of crisis preparedness and management.
- Protection of floral and faunal resource and conservation of threatened flora and fauna and protection of corridors.
- Resolution of man- animal conflict through proper planning.
- Wireless and mobile communication for conservation and protection of biodiversity.
- Habitat improvement works including sustained efforts to control spread of invasive weeds.
- Involvement of village communities and panchayat in Biodiversity conservation activities is essential for its successful implementation.
- Development of Herbal garden of local species at a suitable location in consultation with Forest Department.
- The conservation plan should be holistic and should be reviewed periodically.

Wildlife Management Plan

Out of 21 mammals species reported in the 10km study area, a total of seven species are listed in Sch-I of WPA 1972. These mammalian species are *Panthera pardus* (Indian Leopard), *Bos*

gaurus (Gaur), *Macaca silenus* (Lion-Tailed Macaque), *Melursus ursinus* (Sloth Bear), *Elephas maximus* (Indian Elephant), *Nilgiri tragushylocrius* (Nilgiri Tahr) and *Trachypithecus johnii* (Nilgiri Langur).

Out of 46 avian species reported in the study area, only one species are listed in Sch-I of WPA 1972, i.e *Pavo cristatus* (Peafowl).

Hereafter, a brief description on all these eight species has been provided and then conservation measures are also suggested in the later part.

Description of Scheduled-I species

(A) Mammals

1. **Local Name: Indian Elephant**

Scientific Name: *Elephas maximus*

Taxonomical Classification:	
Kingdom: Animalia Phylum: Chordata Class: Mammalia Order: Proboscidea Family: Elephantidae Genus: *Elephas* Species: *maximus*	

Distribution: In India, they found in foot planes of the Himalayas in Uttaranchal, Northern West Bengal, foothills of Nagaland, Garo Hills, Khasi Hills, Arunachal Pradesh, Lower Brahmaputra, Barak Valley, Western Assam, Mishmi Hills, Karbi Plateau, Jharkhand, Chhattisgarh, Tripura, Barak Valley, Western Ghats, Bhadra-Malnad, Eastern Ghats, South India, Nilambur-Silent Valley and Nilgiri hills.

Habit and Habitat: They inhabit a wide range of grasslands and forest types, including scrub forest, rainforest and semi-cultivated forests, preferring areas that combine grass with low woody plants and trees. They are usually found in thick forests and moist deciduous lush green and semi-green forests.

Breeding: Mating occurs year round.

Threats: The greatest threats to *E. maximus* include loss and fragmentation of habitat, human-elephant conflicts, and poaching. Asian elephants are being affected by the loss of their natural habitat due to the expanding human population. Poaching male elephants for their tusks is another major issue affecting *E. maximus*. Since only males have tusks, poaching leads to imbalanced sex ratios, creating a problem with inbreeding since there aren't enough breeding males. The elephants are also hunted for skins and tusks. Poor elephant management in captivity is also a major issue as elephants are chained and kept separately whereas elephants are very social and its affects them very badly.

Conservation Status: *Elephas maximus* is listed as Endangered on the IUCN Red List. The subspecies *Elephas maximus sumatranus* is Critically Endangered. Asian Elephants are included as Endangered on The US Federal list. *Elephas maximus* is listed under Appendix -I in CITES, with the most endangered species. To provide direct protection legally this species is listed in Sch-I of WPA, 1972.

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2. **Local Name: Lion-Tailed Macaque**

Scientific Name: *Macaca silenus*

Taxonomical Classification:	
Kingdom: Animalia	
Phylum: Chordata	
Class: Mammalia	
Order: Primates	
Suborder: Haplorhini	
Infraorder: Simiiformes	
Family: Cercopithecidae	
Genus: *Macaca*	
Species: *silenus*	

Distribution: The natural range of this species is restricted to the Western Ghats Mountains, located in southwestern part of India.

Habit and Habitat: *Macaca silenus* lives in evergreen and semi-evergreen rainforests and monsoon forests. They typically are associated with broadleaf trees, and can be found at elevations as great as 1,500 m. Lion-tailed macaques are omnivorous but their diet consists mainly of fruit. They also eat a wide variety of vegetation such as leaves, stems, flowers, buds, and fungi. They occasionally eat meat from insects, lizards, tree frogs and small mammals.

Breeding: *Macaca silenus* has no specific breeding season.

Threats: Lion-tailed macaques are affected by habitat loss due to the harvesting of firewood, timber, and other forest products for human use. They are also subject to inbreeding, resulting from having low numbers in the wild and different troops being separated in small forest fragments.

Main threats are habitat loss and degradation due to road building, dams, power lines, deforestation, fragmentation, crop plantations, agriculture and mining. The species is also hunted for food. Pathogens and parasites, delayed sexual maturity and long inter-birth interval, and inbreeding may also threaten the population. Landslide is a future threat. In private forests and plantations, change in land use is a problem for the species. There is local trade for whole animal for pets. The species is hunted for subsistence food near Amarambalam. There are also reports of Lion-tail Macaques being used in medicine.

Conservation Status: The lion-tailed macaque, endemic to the evergreen forests of the Western Ghats in southern India, is endangered.

Legally protected by Sch-I, part I of the Indian Wildlife (Protection) Act, 1972. Included in CITES Appendix I. Protected area coverage in India are: Brahmagiri WLS, Kudremukh NP, Mookambika WLS, Pushpagiri WLS, Sharavathi Valley WLS, Someshwara WLS, Talakaveri WLS (Karnataka); Aralam WLS, Chimmony WLS, Neyyar WLS, Peppara WLS, Parambikulam WLS, Periyar NP, Periyar WLS, Shendurney WLS, Silent Valley NP (Kerala); Indira Gandhi WLS, Kalakkad WLS, Mundanthurai WLS, Grizzled Giant Squirrel WLS (Tamil Nadu).

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3. Local Name: Nilgiri Tahr

Scientific Name: *Nilgiritragus hylocrius*

Taxonomical Classification:	
Kingdom: Animalia Phylum: Chordata Class: Mammalia Order: Artiodactyla Family: Bovidae Subfamily: Caprinae Genus: *Nilgiritragus* Species: *hylocrius*	

Distribution: Nilgiri Thar is found in Western Ghats, Kerala and Tamil Nadu in southern India. The largest population of Nilgiri Thar is found within the Eravikulam National Park at Western Ghats in the Idukki district of Kerala.

Habit and Habitat: Nilgiri Thar is a herbivores animal. They feed on various types of grasses, herbs, shrubs, and leaves. Nilgiri Thar is a social animal. They found in small groups or some

time large groups. They also found at high elevations oncliffs, grass-covered hills, and open terrain areas. They are active from dawn to late evening, grazing most frequently in the early morning and late afternoon.

Breeding: Mating occurs throughout the year but may peak in winter.

Threats: The Nilgiri Tahr symbolizes the conflicts inherent in conservation of threatened fauna and their habitat. Their number totals around 2200-2500 individuals in the wild. Nilgiri Tahrs exist only in small, isolated populations due to extreme habitat fragmentation and illegal hunting. They are, as a result, vulnerable to local extinction. The reasons for the decline of Tahr populations have not been fully understood. Despite several studies over the years, there are only rough estimations of Nilgiri Tahr populations. The species has always been under severe stress on account of the construction of numerous hydroelectric projects, timber felling and monoculture plantation of eucalyptus and wattles. All these development activities, especially the plantation activities affect the heart of the Tahr habitat, which are the grasslands (shoals).

Conservation Status: The IUCN Caprinae Specialist Group classifies the Nilgiri Tahr as endangered (Alempath and Rice, 2008), but it does not appear on any CITES appendix. It is also a Sch-I species in WPA, 1972 for more protection.

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4. **Local Name: Nilgiri Langur**

Scientific Name: *Trachypithecus johnii*

Taxonomical Classification:	
Kingdom:	Animalia
Phylum:	Chordata
Class:	Mammalia
Order:	Primates
Suborder:	Haplorhini
Infraorder:	Simiiformes
Family:	Cercopithecidae
Genus:	*Semnopithecus*
Species:	*johnii*

Distribution: The Nilgiri langur (*Semnopithecus johnii*) is a langur (a type of Old World monkey) found in the Nilgiri Hills of the Western Ghats in South India. Its range also includes Kodagu in Karnataka, Kodayar Hills in Tamil Nadu, and many other hilly areas in Kerala and Tamil Nadu.

Habit and Habitat: *Trachypithecus johnii* typically inhabits a wide range of forest habitats in the Western Ghats. They are found primarily in secondary moist deciduous forests and wet

evergreen to semi evergreen forests. They prefer locations which are close to water, and far from humans.

Nilgiri langurs are an arboreal species, sleeping in the middle or lower canopy in trees of medium height. They reside in the sholas of the Western Ghats. Sholas are narrow stretches of forest surrounded by grasslands, nestled in valleys at high elevations.

Threats: The two main threats to Nilgiri langurs include the destruction of their natural habitat and poaching for various purposes.

This species is hunted for its skin, which is used for making drums, as well as for other parts of the body, which are used for meat as well as in traditional medicine. Hunting has decreased in recent years due to better protection and NGO activities through community participation.

Main threats include habitat loss due to crop plantations, mining, dams, fragmentation, human settlement, hunting, road kills, deliberate fires, storms/flooding, landslides, and local trade for pets. Although fragmentation and habitat loss are threats, this species is not affected as much as lion-tailed macaques. They are better dispersers and have better colonization ability.

Conservation Status: The species is listed on CITES Appendix-II, and Sch-I, Part I of the Indian Wildlife (Protection) Act, 1972 amended up to 2002.

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5. Local Name: Leopard
Scientific Name: *Panthera pardus*

Taxonomical Classification:	
Kingdom: Animalia Phylum: Chordata Class: Mammalia Order: Carnivora Suborder: Feliformia Family: Felidae Subfamily: Pantherinae Genus: *Panthera* Species: *pardus*	

General Description of Species:

The Indian leopard (*Panthera pardus*) is a leopard subspecies widely distributed on the Indian subcontinent. The species *Panthera pardus* is listed as Vulnerable on the IUCN Red List because

populations have declined following habitat loss and fragmentation, poaching for the illegal trade of skins and body parts, and persecution due to conflict situations.

The Indian leopard is one of the big cats occurring on the Indian subcontinent, apart from the Asiatic lion, Bengal tiger, snow leopard and clouded leopard.

Its coat is spotted and rosette on a pale yellow to yellowish-brown or golden background, except for the melanistic forms; the spots fade toward the white underbelly and the insides and lower parts of the legs. Rosettes are most prominent on the back, flanks and hindquarters. The pattern of the rosettes is unique to each individual.

Male Indian leopards grow to between 4 ft to 5 ft in body size with a 2ft to 3ft long tail and weigh between 50 kg and 77kg. Females are smaller, growing to between 3ft to 4ft in body size with a 2.5ft to 3ft long tail, and weigh. Sexually dimorphic, males are larger and heavier than females.

Distribution: The Indian leopard is distributed in India, Nepal, Bhutan and parts of Pakistan. Bangladesh has no viable leopard population but there are occasional sightings in the forests of Sylhet, Chittagong Hill Tracts and Cox's Bazar. It has also been recorded in Qomolangma National Nature Preserve in southern Tibet.

Habit and Habitat: The leopard is elusive, solitary, and largely nocturnal. It is known for its ability in climbing, and has been observed resting on tree branches during the day, dragging its kills up trees and hanging them there, and descending from trees headfirst. It is a powerful swimmer, although is not as disposed to swimming as the tiger. It is very agile, and can run at over 58 kilometers per hour (36 mph), leap over 6 m (20 ft) horizontally, and jump up to 3 m (9.8 ft) vertically. It produces a number of vocalizations, including grunts, roars, growls, meows, and purrs.

The leopard is a versatile, opportunistic hunter, and has a very broad diet. It is able to take large prey due to its massive skull and powerful jaw muscles. In Sariska Tiger Reserve, the dietary spectrum of the Indian leopard includes axis deer, sambar deer, nilgai, wild boar, common langur, Indian hare and peafowl. In Periyar Tiger Reserve, primates make up a large proportion of its diet.

Threats: Hunting of Indian leopards for the illegal wildlife trade is the biggest threat to their survival. They are also threatened by loss of habitat and fragmentation of formerly connected populations, and various levels of human–leopard conflict in human–dominated landscapes.

Several newspapers reported of leopards falling into open wells and being rescued with the help of Forest Department officials.

Poaching and human conflict

A significant immediate threat to wild leopard populations is the illegal trade in poached skins and body parts between India, Nepal and China. The governments of these countries have failed to implement adequate enforcement response, and wildlife crime remained a low priority in terms of political commitment and investment for years.

The frequency of Leopard attacks on humans varies by geographical region and historical period. Attacks are regularly reported only in India and Nepal. Among the five "big cats", leopards are less likely to become man-eaters—only jaguars and snow leopards have a less fearsome reputation. While leopards generally avoid humans, they tolerate proximity to

humans better than lions and tigers and often come into conflict with humans when raiding livestock.

Leopard attacks may have peaked in India during the late 19th and early 20th centuries, coinciding with rapid urbanization. Attacks in India are still relatively common, and in some regions of the country leopards kill more humans than all other large carnivores combined.

In Nepal, the rate of leopard predation on humans is estimated to be 16 times higher than anywhere else, resulting in approximately 1.9 human deaths annually per million inhabitants. Most attacks occur in the midland regions, i.e. in the Terai, midhills, and lesser Himalaya.

Conservation Status and Measures:

In 2015, 7,910 leopards were estimated to live in and around tiger habitat in India; about 12,000 to 14,000 leopards were speculated to live in the entire country. The following table gives the major leopard populations in the Indian states.

It is possible for humans to win a fight with a leopard, as in the case of a 56-year-old woman who killed an attacking leopard with a sickle and spade, and survived with heavy injuries. Globally, attacks on humans—especially nonfatal attacks that result in only minor injury—likely remain under-reported due to the lack of monitoring programs and standardized reporting protocol. Notable man-eaters include Leopard of Panar, Leopard of the Central Provinces, Leopard of Rudraprayag, Leopard of Gummalapur, Leopard of the Yellagiri Hills and Leopard of the Golis Range.

Panthera pardus is listed in CITES Appendix I. Despite India and Nepal being contracting parties to CITES, national legislation of both countries does not incorporate and address the spirit and concerns of CITES. Trained human resources, basic facilities and effective networks for control of poaching and trade in wildlife are lacking.

There a few leopard rescue centers in India, such as the Manikdoh Leopard Rescue Centre in Junnar, but more rescue and rehabilitation centers are being planned. Some wildlife experts think that such centers are not an ideal solution, but that conflict resolution by way of changing human behavior, land use or grazing patterns and implementing responsible forest management to lessen human-animal conflict would be far more effective to conserve leopards.

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6. **Local Name: Sloth Bear**
Scientific Name: *Melursus ursinus*

Taxonomical Classification:	
Kingdom: Animalia	
Phylum: Chordata	
Class: Mammalia	
Order: Carnivora	
Family: Ursidae	
Subfamily: Ursinae	
Genus: *Melursus*	
Species: *ursinus*	

General Description of Species: The sloth bear (*Melursus ursinus*) is a myrmecophagous bear species native to the Indian subcontinent. It feeds on fruits, ants and termites. It is listed as Vulnerable on the IUCN Red List, mainly because of habitat loss and degradation.
It uses its long lower lip and palate used for sucking insects. It has a long, shaggy fur, a mane around the face, and long, sickle-shaped claws. It is lankier than brown and Asian black bears. It shares features of insectivorous mammals and evolved during the Pleistocene from the ancestral brown bear through convergent evolution.

Distribution: The sloth bear's global range includes India, the southern lowlands of Nepal, and Sri Lanka. It is regionally extinct in Bangladesh. It occurs in a wide range of habitats including wet and dry tropical forests, savannahs, scrublands, and grasslands below 1,500 m (4,900 ft) on the Indian subcontinent, and below 300 m (980 ft) in Sri Lanka's dry forests.

Habit and Habitat: Sloth bears breed during spring and early summer and give birth near the beginning of winter. When their territories is encroached upon by humans, they sometimes attack them.

Adult sloth bears may travel in pairs. Males are often observed to be gentle with cubs. They may fight for food. They walk in a slow, shambling motion, with their feet being set down in a noisy, flapping motion. They are capable of galloping faster than running humans.

The cubs can be threatened by predators such as tigers, leopards, and other bears. They are adequate climbers on more accessible trees but cannot climb as quickly or on as varied surfaces as can black bears due to the sloth species' more elongated claw structure.

They are good swimmers, and primarily enter water to play. To mark their territories, sloth bears scrape trees with their forepaws, and rub against them with their flanks

They make their day beds out of broken branches in trees, and rest in caves during the wet season. Sloth bears are the most nocturnal of bears, though sows become more active in daytime when with cubs.

The breeding season for sloth bears varies according to location: in India, they mate in April, May, and June, and give birth in December and early January, while in Sri Lanka, it occurs all year. Sows gestate for 210 days, and typically give birth in caves or in shelters under boulders. Litters usually consist of one or two cubs, or rarely three. Cubs are born blind, and open their eyes after four weeks. Sloth bear cubs develop quickly compared to most other bear species: they start walking a month after birth, become independent at 24–36 months, and become sexually mature at the age of three years. Young cubs ride on their mother's back when she walks, runs, or climbs trees until they reach a third of her size. Individual riding positions are maintained by cubs through fighting. Intervals between litters can last two to three years. Sloth bears are expert hunters of termites, which they locate by smell.

Threats: Historically, humans have drastically reduced their habitat and diminished their population by hunting them for food and products such as their bacula and claws. Sloth bears have been tamed and used as performing pets.

Conservation Status and Measures:

IUCN estimates that fewer than 20,000 sloth bears survive in the wilds of the Indian subcontinent and Sri Lanka. The sloth bear is listed in Schedule I of the Indian Wildlife Protection Act, 1972, which provides for their legal protection. International trade of the sloth bear is prohibited as it is listed in Appendix I of the Convention on International Trade in Endangered Species.

To address the human-bear conflict, people may be educated about the conservation ethics, particularly among locals. To resolve this conflict, the basic issue of deteriorating habitat, which is the reason for the conflict between people and bears, improvements through government or community-based reforestation programs, may be promoted.

The population of sloth bears grows when they live in high-profile reserves that protect species, such as tigers and elephants. Directly managed reserves could conserve the sloth bear, hence such reserves must be supported.

The government of India has banned use of sloth bears for entertainment, and a 'Sloth Bear Welfare Project' in the country has the objective of putting an end to their use for entertainment. However, their number in such activity is still large.

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7. **Local Name: Gaur**

Scientific Name: *Bos gaurus*

Taxonomical Classification:	
Phylum : Chordata	
Class : Mammalia	
Order : Cetartiodactyla	
Family : Bovidae	
Sub-family : Bovinae	
Genus : *Bos*	
Species *:* *Bos gaurus*	

Distribution: The gaur is found in Western Ghats including its southern ranges, Nilgiris, Anamalais and the Cardamom Hills and adjacent plateau. On the eastern side of thepeninsula, it is found in the Palani and Dindugal hills, the Shandamangalam ranges, the Shervaroys and some of the hill ranges near Vellore and the border of Karnataka.The species range extends from South Western Maharastra through Goa, Karnataka, Tamil Nadu and Kerala.

Breeding: November and March

Threats: Most gaur range countries are developing countries with limited financialresources to commit to conservation, so funds remain major constraints in gaurconservation.One of the major limitations is lack of information regarding the populationdynamics and habitat requirements of gaur in most protected areas.

Habitat loss has been largely responsible for the large scale decline of gaur rangeand it remains a major threat to gaur conservation in Asia (Choudhury, 2002;Duckworth et al., 2008). The habitat degradation and fragmentation affect gaurpopulation.They are;

- The physical disturbance caused by people such as wood cutting and forest fire.
- Loss of food availability due to extensive cattle grazing.

Poaching of gaur for meat and horns is one of the serious threats for conservation of gaur even in protected areas and every year shooting of guar is regularly takes place in the boundary of protected areas. There are incidences of poaching in Kerala-Tamil Nadu and Kerala-Karnataka boundary (Arrendran 2000).

Conservation Status: The red list of threatened species categorizes gaur as a vulnerable species andtoday it is found in 11 countries. India is having the best chance for long-term conservation of this species. The populations inother countries are declining alarmingly. Gaur is listed in CITES Appendix-I, whichbans all international trade of gaur products. It is protected under Schedule I of Wildlife (Protection) Act 1972 of India.

Forest departments established anti-poaching camps in protected areas for effective patrolling to control poaching. This considerably reduced poaching in theprotected areas at least. But these strategic management measures are lacking inreserve forest areas and it should be implemented in adjoining reserve forest areasalso.Epidemic outbreaks are being controlled by regulating transport of domesticcattle, vaccination programs and control of cattle grazing in sanctuary areas. TamilNadu Forest Department along with Animal Husbandry Department and NilgiriWildlife Environment Association (NWEA) has been vaccinating cattle every year toprevent outbreak of epidemics. This measure should be implemented in other protectedareas to control epidemics.

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(B) Avian

1. **Local Name: Indian Peafowl**

Scientific Name: *Pavo cristatus*

Taxonomical Classification:	
Kingdom:	Animalia
Phylum:	Chordata
Class:	Aves
Order:	Galliformes
Family:	Phasianidae
Genus:	*Pavo*
Species:	*cristatus*

Distribution: The Indian Peafowl is a resident bird across the Indian subcontinent and is also found in the drier lowland areas of Sri Lanka.

Habit and Habitat: It is found in moist and dry-deciduous forests, but can adapt to live in cultivated regions and around human habitations also. Peafowl is omnivorous, feeds on grain, green crops, insects, small reptiles and small mammals also.

Breeding: April to September

Threats: The Indian Peafowl population is facing threat of several kinds. Some direct threats are demand for feathers and wild meat, conflict with farmers during cropping season, increased use of chemical fertilizers and pesticides, habitat degradation mainly due habitat fragmentation due to agriculture and industrial growth.

Conservation Status: Peafowl is the National Bird of India. In India it is notified under the Sch-I of WPA, 1972 which protects these birds from killing and illegal trade. Now this bird is considered flourishing well.

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Wildlife Conservation and Management Plan

A total of 8 Sch-I species is reported from the study area. As per the description and status of these species there are common threats to these species kind of which are habitat loss, illegal hunting, and particularly the removal of the old-growth trees and less awareness towards the conservation and importance of the endangered species. Few recommendations of the preventive nature are given below:

- Identification of green pockets with the presence of *Panthera pardus*(Indian Leopard),*Bos gaurus* (Gaur), *Macaca Silenus* (Lion-Tailed Macaque), *Melursus ursinus*(Sloth Bear), *Elephas*

maximus (Indian Elephant), *Nilgiritragush ylocrius* (Nilgiri Tahr) and *Trachypithecus johnii* (Nilgiri Langur). Such patches must be demarked and protected from any kind of disturbance. Moreover, the greenery in these patches must be enhanced by plantation of the native wild trees and shrubs. This will provide the enhance shelter and prey availability to the concerned species.

Following recommendations are suggested as the part of conservation and management plan:

- Green belt development plan along the boundary of the project as well as along the road will minimize the impact of noise and dust if any being produced. Plantation is perfect solution for providing the suitable habitat for wild fauna.
- The project area shall be strictly used for only the activities permitted. The workers must be instructed to not to enter in the adjoining forest. Project Proponent must instruct all the workers not to harm or kill any animal, and also they must not cut trees for their various needs.
- The natural existing Water holes/pits should not be used for project activities. Project proponent should create and maintain water holes along corridors for wild animals and avian fauna in consultation with local Forest Department.
- Awareness program among the local people to make them understand the importance of wildlife and not to perform any poaching or killing of animals. People must be educated to protect plants and animals. Villagers must be aware of the endangered species.
- Celebration of 'Wildlife Week', 'Van Mahotsav' and 'Environment Day' etc. must be popularized and organized with various public participation activities.
- People must be educated and aware that speed of the vehicles must be in limit to avoid accidents/killing while passing such roads where wild animals usually cross sides.
- The people living in the surrounding area and employee of the company would be motivated towards the protection of the animals. The concerned authorities must be informed immediately if any illegal poaching, illegal trade or human- wild life conflict in the area is noticed. Local trackers and wildlife guards should be appointed for this purpose.
- Project activity must not be carried out in night time as animals are sensitive to noise and they also disturbed by lights. Measures for the dust and noise suppression should also be practiced to avoid any disturbance to the wild life.
    - The fire fighting equipments should be well placed to reduce loss of flora and fauna in case of manmade and natural fire. Proper training also needs to be imparted to workers and staff regarding operation of fire fighting equipments.
    - Construction of a tall Watch tower at a strategic point for observation and monitoring of forest fire.
    - The project proponent should implement Forest Protection Plan, Compensatory Afforestation Plan, Plantation and Greenbelt Development Plan and local Ecology Improvement activities should be earnestly implemented and monitored at interval to assess their effectiveness.
    - Local Forest Department should be actively involved in Wildlife Conservation and Protection activities.

BUDGET ESTIMATES:

Table 3.1: Budget for Conservation Plan

S. No.	Activities	Cost (lakh),Rs
1	a) Green belt development along the boundary of the project as well as along the road to minimize impact of noise and dust. b) Creation of water pits, renovation of water bodies/ponds in the core area	25.00 15.00
2	Consruction of Watch Tower for monitoring of forest fire and poaching of wildlife.	10.00
3	Awareness program in village to protect & conserve the wildlife.	05.00
	Total	**Rs 55.00**

Annexure III

Local Area Development Plan

`Details of CER to be made as part of EMP as per Ministry's O.M dated 30.09.2020. Based on the concerns /issues raised in the earlier Public Hearing activities to be included in Local Area Development of EMP'.

As per the Office Memorandum F.No. 22-65/2017-IA.III dated 30.09.2020 of the Ministry of Environment, Forest and Climate Change regarding "Corporate Environment Responsibility" (CER), the project proponents are required to allocate funds towards environment development activities as proposed by the project proponent or prescribed by EAC or SEAC, as the case may be, shall be a part of EMP and the commitments made by project proponent to address the concerns raised during Public consultation.

As such, a provision of **Rs.90 lakhs** has been made under Local Area Development Plan in lieu of CER towards provision of Power supply in nearby areas (esp. Governor Sholas) (50 lakhs) based on the commitment made under Public hearing meeting held on 20.04.2007 and Rs. 40 lakhs towards Public Health Delivery System.

Matrix for various project activities and associated potential environment impact on environmental parameters

S. No	Project intervention	Soil & land	Geology	Hydrology	Water Quality	Air Quality	Noise Quality	Flora /Fauna	Employment	Socio-economic
Construction Phase										
1	Earthwork and excavation including blasting and drilling	√	√		√	√	√	√	√	
2	Construction diversion cum intake structure, such as approach channel, balancing reservoir, spilling arrangement, water conductor	√	√						√	
3	Disposal of muck and construction wastes	√	√		√			√		
4	Transportation of construction materials					√	√	√	√	
5	Operation and maintenance of construction equipment				√	√	√		√	
6	Disposal of sewage and solid waste from labor camps	√			√					
7	Acquisition of labor population	√			√	√	√	√	√	√
Operation Phase										
1	Equipment maintenance				√	√	√		√	
2	Disposal of sewage and solid waste from project colony	√			√					
3	Mushrooming of allied activities	√			√	√	√		√	√

Annexure V

Fishery Management and Conservation Plan for Kundah Pumped Storage Hydro Electric Project

INTRODUCTION

Kundah Pumped Storage Hydro Electric Project (HEP) envisages construction of an underground power house between the two reservoirs having installed capacity of 500 MW. The Proposed project is located in Western Ghat of Nilgiris District. The HEP involves TNEB's two reservoirs namely Porthimund Reservoir (formed during 1966) and Avalanche Emerald reservoir (formed during 1961). The Porthimund Reservoir (Upper Reservoir) has capacity of 49.03 Mm3 and Avalanche-Emerald Reservoir (Lower reservoir) has capacity of 149.57 Mm3.

Status of Fishery in the area

Fishing activities are banned in the lakes of the Nilgiri hills. No commercial fishing is allowed in these lakes. Small and ornamental colorful fish species are found in these lakes. Some exotic trout species were introduced by the British authorities in the lakes and rivers of the area.

Common fishes reported in the area are listed in the Table given below:

Table:1 Fish species reported in the project area and its environs

S.No	Scientific Name	Common Name
1	*Oncorhynchus mykiss*	Trout
2	*Tor putitora*	Mahseer
3	*Cyprinus carpio*	Common Carp
4	*Danio aequipinnatus*	Giant Danio
5	*Rasbora daniconius*	Black-line Rasbora
7	Danio neilgherriensis	NilgiriDanio
8	*Tor khudree*	Black Mahseer
9	*Barbodescarnaticus*	Carnatic Carp
10	*Puntius bimaculatus*	RedsideBarb
11	*Puntius chola*	Chola Barb
12	*Puntius mudumalaiensis*	Ray-finned Fish
13	*Cirrhinusreba*	Reba Carp

Fishery Management and Conservation

The proposed HEP could impact these two reservoirs and their fish fauna to some extent during construction phase. However, such impacts could be avoided and mitigated by adopting proper protection and mitigation measures.

Although fishing activities are banned in the lakes of the Nilgiri hills and no commercial fishing is allowed in these lakes, it is important that fish fauna of the two lakes, lower Avalanche-Emerald reservoir and upper Porthimund reservoir which are involved in the proposed project, be protected and environmentally managed and conserved. In view of this, a fishery management plan has been prepared for these two reservoirs which should be implemented during construction and operation of the project.

Fishery Management and Conservation Plan

- Treatment of the catchment area of two lakes, lower Avalanche-Emerald reservoir and upper Porthimund reservoir through plantation of local vegetation to retard siltation and flow of soil to lakes is under progress under CAT Plan. Avoidance of flow of soil to the reservoirs would protect the gills of small fishes. This would also minimize siltation of the two lakes.
- Screen bars of suitable size and design at intake/outlet at upper and lower reservoirs should be provided to avoid entrapment of fish fauna.
- The velocity of water drawl should be optimum to avoid entrainment of fishes.
- Monitoring of water quality and fish fauna should be done on quarterly basis through State Fishery Dept./Fishery Dept. of local University/ research institute of repute.
- Restriction of entry of unauthorised persons in accessible locations viz. roads, etc.near reservoir areas should be made.
- The Fishery conservation plan would require provision of fish seedlings. The technical details of the seeding plan should be framed in collaboration with district Fishery Dept.
- The implementation of the plan should be monitored six monthly.

BUDGET ESTIMATES:

1) In general trash rack arrangements are provided at intake point using heavy structural arrangement to prevent the entry of wooden logs etc. To avoid entrapment of fish fauna, a screen bars of suitable size have to be provided over the Trash rack arrangement at both the intake points.

For one location : 20 T x Rs. 85,000/T = Rs. 17,00,000

For two location: 2 x Rs. 17,00,000 = **Rs. 34,00,000**

2) In general fishing activities are prohibited in Nilgiris lake. Moreover all dams in Nilgiris district are owned by TANGEDCO and hence no fishing activities. So providing Guard for prohibition of fishing activities are not necessary and also not provided so far. However, we are providing the such budget provision.

[2 Guards @ Rs 15,000/ month for two reservoir for 3 years= **Rs.10,80,000**]

3) a) Provision of Fish Seedlings for 3 years = **2.50 lakhs**

b) Monitoring of water quality and fish fauna on twice in a year basis for 3 years= **2.00 lakhs**

Table 2: Budget estimate for Fishery Management and Conservation Plan

S. No.	**Activities**	**Cost(Rs in lakh)**
1	Screen bars of suitable size and design at intake/outlet at upper and lower reservoirs.	34.00
2	Guard for restriction of entry of unauthorized persons to reservoir areas for prohibition of fishing [2 Guards @ Rs 15,000/ month for two reservoir for three years]	10.80
3.	a) Provision of Fish Seedlings for 3 years b) Monitoring of water quality and fish fauna on twice in a year basis for 3 years.	2.50 2.00
	Total	**Rs 49.30**

Annexure-VI

EMP BUDGET

Description	Capital Cost INR Lakh	Working Costs INR Lakh	Total Costs INR Lakh
Catchment Area Treatment Plan	56.24	-	56.24
Fishery Management Plan	49.30	--	49.30
Greenbelt Development Plan	35.94	-	35.94
Biodiversity Conservation and Wildlife Management Plan	55.00	-	55.00
Muck Disposal Plan	12.695	11.77	24.465
Energy Conservation Measures	-	105.00	105.00
Restoration and landscaping of working Areas	35.00	-	35.00
Sanitation and Solid Waste Management Plan	50.00	-	50.00
Water and Air Quality & Noise Management Plan	40.00	-	40.00
Forest Protection Plan	25.00	-	25.00
Reservoir Rim Treatment Plan	50.00	-	50.00
Compensatory afforestation Plan	72.594	5.00	77.594
Disaster Management Plan	80.00	-	80.00
Local Area Development including provision of Power Supply to nearby areas & Public Health Delivery system.	90.00	--	90.00
Total EMP Budget	**651.769**	121.77	**773.539**