BEFORE THE HONOURABLE NATIONAL GREEN TRIBUNAL AT CHENNAI SOUTHERN ZONE.

(Original Application No.161 of 2021 (SZ))

BETWEEN

Tribunal on its motion suo-motu based
on the news item published in Deccan Chronicle newspaper
Chennai edition dated 24.06.2021, under the caption
"Penalise Company for dumping toxic waste in Kodaikanal : Activists"
And the New Indian Express newspaper Chennai Edition dated 25.06.2021
Under the caption "HUL" Begins Solid –Remediation works in
Kodaikanal"

Versus

1) The Chief Secretary to Govt. of Tamil Nadu,
Govt. Secretariat Forest George,
Chennai, Tamil Nadu – 600 009.

2) The Chairman,
Central Pollution Control Board,
Parivesh Bhawan, East Arjun Nagar,
New Delhi – 11.

3) The Secretariat to Govt. of Tamil Nadu,
Department of Environment, Climate Change & Forests,
Govt. Secretariat, Fort George
Chennai, Tamil Nadu – 600 009.

4) The Chairman,
Tamil Nadu Pollution Control Board,
No.76, Anna Salai, Guindy,
Chennai, Tamil Nadu – 600 032.

5) Hindustan Unilever Limited (HUL),
Rep. by its Chairman & Managing Director,
Unilever House, B.D.Sawant Marg,
Chakala, Andheri (E),
Mumbai – 400 099.

6) The District Collector,
Dindigul District,
District Collectorate,
First Floor,
Dindigul – 624 004.

7) The Principal Chief Conservator of Forest & Head of Forest Force & Chief Wildlife Warden,
Panagal Maaligai,
No.1, Jeenis Road,
Saidapet,
Chennai – 600 015.

8) The District Forest Officer & Wildlife Sanctuary
Kodaikanal Division,
Mudaliyarpuram, Kodaikanal – 624 101.
(Suo Moto impleaded as additional respondents 7&8
As per order dated:31.08.2021)

…….Respondent

TYPE SET OF DOCUMENTS FILED ON BEHALF OF THE 7TH AND 8TH RESPONDENT
(THE PRINCIPAL CHIEF CONSERVATOR OF FOREST & HEAD OF FOREST FORCE & CHIEF WILDLIFE WARDEN, CHENNAI AND THE DISTRICT FOREST OFFICER AND WILDLIFE WARDEN, KODAIKANAL FOREST DIVISION, KODAIKANAL)

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17	Kodaikanal Wildlife Sanctuary Notification G.O.No. 143 Environmental and Forests Department Dated 20.09.2013.	119 – 132
18	Kodaikanal Wildlife Sanctuary Eco Sensitive Zone Notification dated 23.01.2020.	133 - 158

All the above documents are certified to be true copies

Dated at Chennai on this the day of September 2021.

Counsel for the 7th and 8th Respondents

(The Principal Chief Conservator of Forests
and Chief Wildlife Warden, Chennai

District Forest Officer
& Wildlife Warden)

1. Note on Tree Cutting at the premises of Hindustan Unilever Limited, Kodaikanal

Note on Tree Cutting at the premises of Hindustan Unilever Ltd, Kodaikanal.

Hindustan Unilever Ltd (HUL) is undertaking soil remediation at the premises of its closed thermometer factory, Kodaikanal. The factory operation was closed in March 2001. Remediation of mercury contaminated soil is recommended in the Environmental Site Assessment and Risk Assessment Study conducted post closure of the factory. The contaminated soil will be excavated, treated in Soil Washing and Soil Retorting processes to bring down the mercury in soil below the remediation standard of 20mg/kg. The treated soil will be backfilled into the excavated area. The remediation protocol was prepared by National Environmental Engineering Research Institute (NEERI), Nagpur. The Tamil Nadu Pollution Control Board has granted permission to HUL for soil remediation.

The closed factory site is located at St. Mary's Road, Kodaikanal, Kodaikanal Zone, Ward B, Block 21, Survey No.5/2. Pambar Shola, a reserved forest is in the south of the site. St. Mary's Road is in the north, a few residential properties / TV tower are in the north-east and Church / a few residences are located in the north-west of the factory site. The site is sloppy into the southern side where the Pambar Shola is located.

1. **Tree cutting to facilitate soil remediation :**

The contaminated area within the factory site is around 4 acres out of the total factory area of 20.03 acres.

The contaminated area is near the northern side of the site and near the erstwhile manufacturing facility. The contaminated soil is required to be excavated for soil remediation. There were trees in the area identified for remediation. The site is underlain Archaean bedrock and the soil cover is very shallow , approx.. 1.5 m to 3 m depth. HUL submitted an application dated 25-02-2019 to the Chairman, Tamil Nadu Hill Area (Preservation of Trees) Committee for removal of trees at the contaminated area to facilitate soil remediation. The Dindigul District Hill Area (Preservation of Trees) Committee is the apex authority for tree preservation and tee cutting permission need to be approved by the committee as defined in the Tamil Nadu Hill Area (Preservation of Trees) tio5 Act 1952. In total tree cutting permission was sought for 440 trees consisting of 215 Eucalyptus, 72 Pine, 80 Berry, 63 Savukku, 5 Rubber, 5 Gloria trees.

- The trees at the contaminated area within the site are to be removed to facilitate excavation

of soil required for soil remediation. The soil around the trees is also to be excavated for remediation.

- The Tamil Nadu Pollution Control Board and the Scientific Experts Committee constituted by the Supreme Court Monitoring Committee (the oversight committee for soil remediation) recommended removal of trees from the contaminated area for undertaking soil remediation . The recommendation for trees removal is recorded in the Minutes of the Meeting held on 07-02-1019.
- The soil cover is shallow and trees roots are not deep enough, and the trees are likely to fall while soil excavation is carried out and high risk to the workers engaged in remediation work. It is required to excavate soil up to 30 cm to 60 cm depth, in some areas it may be required to go deeper depending on the contamination level.
- The soil excavation during remediation work requires mechanical handling of soil including use of excavators / trucks etc. and manual handling of contaminated soil is not recommended considering occupational safety of the workers engaged in remediation work. Use of mechanical handling / excavation of soil, access pathways to the contaminated area warrants removal of the trees in the contaminated area / remediation work area.
- All 440 trees identified for removal are not native species.

The Dindigul District Hill Area (Preservation of Trees) Committee perused the application for tree cutting in the meeting held on 16-10-2019 presided by the District Collector, who is the Chairman of the committee . The committee received the 'No objection Certificate' from the Thasildar, Executive Engineer-Agricultural Engineering department, The District Forest Officer on the application. The committee vide its letter bearing no. 66/2019/C3 dated 18.10.2019 issued an order permitting tree cutting by HUL at Dindigul District, Kodaikanal Zone, Ward B, Block 21, Survey No.5/2, of 215 Eucalyptus, 72 Pine, 80 Berry, 63 Savukku, 5 Rubber, 5 Gloria trees, in total 440 Trees subject to certain conditions.

In pursuance of the aforementioned order issued by the Committee dated 18.10.2019, the District Forest Officer vide his letter bearing No. 1182/2019/D dated 13.12.2019 granted permission to cut 440 trees subject to the remitting of caution deposit of Rs. 25,000 and certain other conditions. HUL deposited Rs 25,000 as caution deposit vide in account no. 4642472300 on 28-11-2019. The District Forest Office issued tree cutting order vide No. 1182/2019/D dated 13-12-2019 to HUL.

In line with the directions, HUL cut 425 tress (205 Eucalyptus, 69 Pine, 80 Berry, 61 Savukku, 5 Rubber, 5 Gloria trees, in total 425) out of the permitted 440 tress from 02-01-2020 to 31-01-2020. Forest Officials visited and monitored the activity prior to commencement of tree cutting, during the

above period and post completion of the activity. HUL have informed the Dindigul District Hill Area (Preservation of Tress) Committee vide letter dated 19-02-2020 regarding completion of tree cutting. The tree logs of the cut tress are stored at the factory site. The trunks and branches of the cut trees are sized and stacked at the site.

2. **Soil erosion control measures undertaken during tree cutting / soil remediation :**

The activities at the site are carried out under the guidance of Scientists from the Indian Institute of Soil and Water Conservation (IISWC), Ooty, an institute under Indian Council of Agricultural Research. The work is undertaken under the expert advice from Dr. S. Manivannan , Principal Scientist . A research associate from IISWC is posted full time at the site to monitor and provide support in implementing soil erosion control measures and restoration / rehabilitation of soil . The soil erosion control measures implemented are given below. Some of the measures as recommended by IISWC are planned to be implemented during execution of remediation work .

- Trees were not uprooted, and trees were cut 15 cm above the ground level.
- The soil beneath the trees were not disturbed and vegetation around the trees were not removed.
- The high slope areas with open soil cover are blanketed with jute textile to prevent soil erosion.
- Six soil retaining walls or terrace walls support are constructed in the contaminated area to prevent soil erosion.
- The storm water drains around the contaminated area are constructed with soil traps every 10 m length.
- The rainwater is drained through a silt settling tank. The silt setting tank is designed by the IISWC considering the maximum rain fall pattern in Kodaikanal over ten years period.
- There are four silt traps in the downstream after the silt setting tank, the stream leaving the site into Pambar Shola. The silt traps are recently upgraded under the guidance of IISWC.
- The remediation work is stopped during rainy days and excavated area is covered with tarpaulin.
- Trenches are made below the excavation area to control soil movement while excavation.

- Excavated soil will not be backfilled in high slope area and the same is to be filled within the soil retaining walls.
- The remediated area will be covered by geo-textile blanket and grass species will be planted.
- Trees of native species are planned at the remediated area.

The designed control measures are in place for silt or soil movement through runoff during soil remediation activity. In addition, monitoring of water and soil at silt traps and silt collection is periodically carried out.

3. Allegation on mercury contamination in Pambar Shola and Pambar River :

With respect to allegations on Contamination in Pambar Shola, the recent studies by NEERI and Tamil Nadu Agricultural University (TNAU) are providing assessment.

3.1. **NEERI Study :**

NEERI submitted a report "Site Assessment of Pambar Shola forest and Pambar River in the down gradient direction of the mercury contaminated site of Hindustan Unilever Ltd closed thermometer factory , Kodaikanal " recently in Aug 2021. This study was conducted as directed by the NGT . For the study NEERI took pre monsoon (sep to Oct 2020) and post monsoon (March 2021) samples in Pambar Shola and Pambar River. The summary of findings of the study, reproduced from the report are :

a) Pambar Shola Forest

- Samples of soil, bark, lichen, moss, bush, grass and leaves were collected from 44 locations from Pambar Shola forest area and analyzed for total mercury.
- The mercury concentrations in soil samples collected across the Pambar Shola forest were below the MoEF&CC guideline value of 6.6 mg/kg and the CCME SQG of 12 mg/kg for the protection of human and environmental health respectively.
- The mercury concentrations in vegetation samples such as bark, lichen, moss, bush, grass and leaves collected across the Pambar Shola forest area are generally less. There is no visible evidence of distress to vegetation, flora and fauna was noticed.

b) **Pambar River**

- Samples of water, sediment, algae, fish and river bank soil, lichen, and moss, were collected from 23 locations both pre and post monsoon periodsfrom the entire 25 km stretch of Pambar river and analyzed for total mercury.
- All water samples collected from Pambar river showed mercury below detectable levels.
- The concentrations of mercury in soil samples were low and less than 1.0 mg/kg during pre and post monsoon periods, with the exception of the location at the Levinge path. All soil mercury concentrations are below the MoEF&CC guideline value of 6.6 mg/kg.
- All sediment samples from Pambar river showed mercury below the Canadian Guidelines of 0.486 mg/kg.
- Mercury concentrations in lichen, moss, algae and fish samples were less and did not show appreciable enrichment.

c) Risk Assessment

- Screening level based Ecological Risk Assessment (Tier 1) of soil, sedimentand water indicated no/negligible risk to flora and fauna, as the observed concentrations are far less than the screening levels.
- Based on the offsite field observations, sampling and analysis, Tier IScreening Level Risk Assessment, and review of the previous Risk Assessment studies, it is observed that HUL site is not likely to pose any off-site ecological risks, particularly to the ecologically sensitive Pambar Shola forest area.
- In conclusion, considering the recommendations of international regulatory agencies, the weight of evidence on the current and past mercury monitoring data, and the screening standards, a further detailed risk assessment of the Pambar Shola is not deemed necessary.

3.2. TNAU Study :

The study conducted by Tamilnadu Agricultural University (TNAU) in Dec 2020 has also come to the conclusion that the risk associated with soil mercury contamination is low in the study area at Kodaikanal. For the study, TNAU has collected samples around the site including Pambar Shola. The abstract of the study is reproduced below:

This paper presents the evaluation of soil contamination with bioaccumulation and bioavailability of mercury in the surroundings of a former thermometer factory at Kodaikanal in connection with several other soil chemical characteristics. Mercury (Hg), a rare earth element, evolves to be the global concern because of its solubility and its persistence in nature. It is also widely known as a potential neurotoxin since it has the ability to bind with the thiol functional groups in the living system because of the accumulation in food chain and its biomagnifications. The Study was carried out at Department of Environmental Sciences, Tamil Nadu Agricultural University, Coimbatore, India during 2018-2020. Geo-coded soil and plant samples were collected in and around the former thermometer factory in different possible direction. The total mercury content in the soil ranged from

0.19 to 4.7 mg kg^{-1} and the water soluble mercury fraction ranged from 0.01 to 0.07 mg kg^{-1} in various sampling sites. The total mercury of the samples ranged from 0.24 to 3.80, 0.84 to 1.55,

0.45 to 1.67 and 0.19 to 4.97 mg kg^{-1} in east, north, south and west directions, respectively whereasthe water soluble mercury fraction ranged from 0.01 to 0.07 and 0.01 to 0.04 mg kg^{-1} in east and west direction, respectively corresponding to 0.5 to 5.36 % of the total. Despite this analysis, other chemical parameters were also studied to determine their extent of influence on mercury accumulation and availability. Among those parameters, pH was found to be having significant correlation with total mercury and water soluble mercury. The concentration of total mercury and water soluble mercury recorded were less than the permissible limit set by International standards (Canadian Soil Quality Guidelines). Among different plant species, Roots of *Sterculia sp.* was found to accumulate 1.19 mg kg^{-1} whereas mercury content was found to be below detectable limits in other plants. Based on the results obtained from Potential Ecological Risk Index, it was concluded that risk associated with soil mercury contamination is low in the study area at Kodaikanal.

4. Remedial measures with respect to tree cutting for soil remediation :

The recommended remedial measures

- Replanting equal number of trees of native species at the factory remediated area after completing the remediation work. The forest department will advise HUL the recommended

native species to be replanted.

- It has come to the forest department notice that HUL has already planted 500 native trees in the premises of Mother Teresa Women's University campus and 260 tress within the factory premises.
- It is learnt that the remediation and post remediation work will take around 3 years. In the meantime, HUL is advised to participate in the trees planting programme of Tamil Nadu Government by planting 10 times of the trees cut and ensure growth by nurturing the trees for a minimum period of one year.

1. National Green Tribunal, Principal Bench, New Delhi Order

BEFORE THE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH, NEW DELHI

Original Application No. 211/2018
(M.A. No. 1011/2018, M.A. No. 1125/2018 & M.A. No. 1341/2018)
(Earlier O.A. No. 22/2017) (SZ)

IN THE MATTER OF:

Navroz Mody
Vs.
Union of India & Ors.

CORAM : HON'BLE MR. JUSTICE ADARSH KUMAR GOEL, CHAIRPERSON
HON'BLE MR. JUSTICE S.P. WANGDI, JUDICIAL MEMBER
HON'BLE DR. NAGIN NANDA, EXPERT MEMBER

Present: Applicant: Ms. Meera Gopal Adv.
Mr. Pinaki Mishra, Sr. Adv. with Mr. Pravin Bahadur, Mr. Siddharth Banthia, Mr. Kishan Rawat and Mr. Madhan Babu, Advs.
Respondent No. 5 Ms. Pusshp Gupta and Mr. Rovins Verma, Advs. for Ministry of Environment, Forest and Climate Change
Mr. Balendu Shekhar, Adv. with Sh. Ram Babu, Scientist and Mr. Bhupender, L. Officer
Mr. R. Rakesh Sharma and Mr. V. Mowli, Advs. for TNPCB and State of Tamil Nadu

	Date and Remarks	Orders of the Tribunal
	Item No. 03 **November 01, 2018** **R**	1. Remediation of Mercury contamination which takes place on account of manufacture of Thermometers by M/s Hindustan Unilever Ltd. (HUL) at Kodaikanal is the subject matter of consideration in this application. This alarming situation was noticed in the judgment of the Hon'ble Supreme Court of India in *Research Foundation for Science Technology and Natural Resource Policy vs. Union of India and Ors.* [*(2005) 10 S.C.C 510*]. 2. Tamil Nadu Pollution Control Board (TNPCB) closed the said unit on 23.03.2001. A working group was constituted to oversee the remediation processes. The Hon'ble Supreme Court constituted a Monitoring Committee which visited the site. HUL itself was directed to carry out remediation work. The applicant, a local resident, moved this Tribunal on 25.01.2017 objecting to the remediation work undertaken by HUL. It was also prayed that remediation procedures should be as per applicable guidelines in standards.

1

	Item No. 03 **November 01, 2018** **R**	3. The Tribunal has considered the matter on several hearings. On 20.04.2017, HUL was permitted to go ahead with the preparatory work and to commence trial runs to be monitored by the SEC, TNPCB and Central Pollution Control Board (CPCB). The local body and the Local Area Environmental Committee (LAEC) were to be associated and samples were analyzed. On 28.08.2017, this Tribunal added three special invitees including the applicant in the LAEC. 4. The matter was exhaustively considered on the last date with regard to the standard to be applied. The Tribunal noted that there are conflicting opinions. According to one opinion, the remediation standard to be applied was 20-25 mg/kg and according to the other, it was 6 mg/kg. 5. In view of the statement made by learned Counsel during the hearing that experts in the field are available with IIT Delhi and IIT Madras, the Tribunal directed CPCB to obtain an expert opinion from an institute having expertise in Mercury contamination. The CPCB was also directed to examine trial results undertaken by NEERI. Accordingly, a report has been field by the CPCB on 03.10.2018. The CPCB sought opinion from eight expert as follows: (i) Dr. Vinay A Juvekar, Professor, IIT Bombay (ii) Dr. K. K. Pant, Professor, IIT Delhi (iii) Dr. A. K. Nema, Professor, IIT Delhi (iv) Dr. Indumathi M Nambi, Professor, IIT Madras (v) Dr. A. N. Vaidya, Chief Scientist, NEERI-CSIR, Nagpur (vi) Dr. N. Manickam, Sr. Principal Scientist, IITR-CSIR, Lucknow

	Item No. 03 November 01, 2018 R	(vii) Dr. Sharda Shah Peshin, Sr. Scientist, AIIMS, Delhi (viii) Dr. Atul Juneja, Scientist – E, Indian Council of Medical Research, Delhi. 6. The experts held meetings on 12.09.2018 and 24.09.2018. They considered the guidance document i.e. "Development of Methodologies for National Programme for Rehabilitation of Polluted Sites in India". Applying the guidelines to the fact situation, the experts unanimously reported that screening level of 6.6 mg/kg could not be treated as a remediation standard. The Site Specific Target Levels (SSTLs) provide for determining the risk based on hazardous constituents considering source, pathway and receptors at the sites. The CPCB considered the SSPLs values and on that basis measured the level of Mercury at the sites. It was found unnecessary to repeat the studies earlier undertaken for the following reasons: *"(i) The recommended remediation value of 20 mg/kg for subject site is far less than the Dutch intervention value 36 mg/kg thus has large margin of safety.* *(ii) Repeating entire process of detailed site assessment and risk assessment may delay the process of remediation, which his pending since the year 2006.* *(iii) Repetition of site assessment and re-evaluation of risk assessment methodology may be more of an academic interest rather than pragmatic objective of remediation. Moreover, the new set of assumptions that may be taken for re-assessment can be challenged and it may take some more time to arrive at scientific consensus on new SSTLs.* *(iv) The recommended remediation value of 25 mg/kg was reviewed by institutions like National Environmental Engineering Research Institute and Indian Institute of Technology, Delhi.* *(v) The recommended remediation value of 20 mg/kg is less than remediation target value of 22.43 mg/kg for soil suggested in a study carried out by IIT Delhi based on both human health and ecological risk assessment.*

	Item No. 03 November 01, 2018 R	*(vi) At this stage, execution of remediation work should be of primary focus rather than conducting further studies; since the subject site remains contaminated for more than 20 years posing environmental and health risks."* 7. Accordingly, the CPCB has recommended as follows: *"(i)To permit remediation of mercury contaminated soil in the premises of closed thermometer factory and its adjoining areas to the recommended remediation target level of 20 mg/kg (total mercury) with valid authorization from Tamil Nadu Pollution Control Board.* *(ii)Considering the reported environmental impacts in Pambar Shola river in down gradient of closed thermometer factory, it is proposed that a detailed site assessment be carried out to ascertain the extent of contamination and if required, an ecological risk assessment study may also be carried out."* 7. Learned counsel for the applicant states that the applicant has raised objection to the constitution of the Committee and filed an application before this Tribunal on 14.09.2018 alleging that four out of the eight members have conflict of the interest. NEERI had received Rs. 34 lakhs from HUL towards consultancy fees. Representative of IIT Delhi was author of a report to which the applicant had objected. The representative of IIT, Bombay had been a consultant to the HUL. Representative of IITR, Lucknow was a collaborator of HUL as per information on the website. The applicant has suggested experts from IIT Hyderabad, from Centre for Ornithology and Nature, Coimbatore and a retired Chemical Engineer, IIT Madras. 8. HUL in its reply filed on 01.10.2018 has opposed the objection of the applicant by submitting that engagement of NEERI was proposed by the Supreme Court Monitoring Committee (SCMC) in the year 2004 and on that account the TNPCB invited a proposal from NEERI. It does not, in any way, show any conflict of interest. IIT

	Item No. 03 November 01, 2018 R	Delhi was engaged as per direction of TNPCB and the SEC which was appointed by SCMC for risk assessment study. Representative from IIT Bombay has been described as collaborator of the HUL because of his expertise on the subject. Allegation that IITR Lucknow was collaborator of HUL is also without any basis. No financial aid has ever been given by HUL to IITR Lucknow. The institute has been described as such on account of expertise of the said institute from whom various organization take opinion on the subject. 9. We do not find any merit whatsoever in the objection of the applicant. The CPCB, under directions of this Tribunal, has selected as many as eight experts who have deliberated on the issue objectively and furnished a unanimous report. Mere fact that there was association of some of the experts as stated by the applicant will not vitiate the report and the opinion furnished by the CPCB. 10. Moreover, there is no objection for other four experts who were also party to the opinion, accepted by the CPCB. In view of above, we accept the opinion of the CPCB. Action may now be taken in terms of the above recommendation. The application is disposed of. ....., CP (Adarsh Kumar Goel) .....,JM (S.P. Wangdi) .....,EM (Dr. Nagin Nanda) 01.11.2018

2. Supreme Court of India, New Delhi Order

IN THE SUPREME COURT OF INDIA

CIVIL APPELLATE JURISDICTION

CIVIL APPEAL NO. 1666 OF 2019

NAVROZ MODY — Appellant(s)

VERSUS

UNION OF INDIA & ORS. — Respondent(s)

O R D E R

Heard learned counsel.

We do not find any merit in the appeal. The civil appeal stands dismissed.

Pending application stands disposed of.

....., J.
[ROHINTON FALI NARIMAN]

....., J.
[VINEET SARAN]

New Delhi;
March 05, 2019.

ITEM NO.9 COURT NO.6 SECTION XVII

S U P R E M E C O U R T O F I N D I A
RECORD OF PROCEEDINGS

Civil Appeal No. 1666/2019

NAVROZ MODY Appellant(s)

VERSUS

UNION OF INDIA & ORS. Respondent(s)

(FOR ADMISSION and IA No.27987/2019-STAY APPLICATION)

Date : 05-03-2019 This appeal was called on for hearing today.

CORAM :
HON'BLE MR. JUSTICE ROHINTON FALI NARIMAN
HON'BLE MR. JUSTICE VINEET SARAN

For Appellant(s)
Ms. Anitha Shenoy, Adv.
Ms. K. V. Bharathi Upadhyaya, AOR
Ms. Srishti Agnihotri, Adv.
Ms. Kanika Sood, Adv.
Ms. Sharon Mathew, Adv.

For Respondent(s)
Dr. A. M. Singhvi, Sr. Adv.
Mr. Pinaki Mishra, Sr. Adv.
Mr. Ravinder Narain, Adv.
Mr. Pravin Bahadur, Adv.
Mr. Kishan Rawat, Adv.
Mr. Siddharth Banthia, Adv.
Mr. Ishan Narain, Adv.
Mr. Rajan Narain, AOR

UPON hearing the counsel the Court made the following
O R D E R

The appeal stands dismissed in terms of the signed order.

(NIDHI AHUJA) (RENU DIWAN)
COURT MASTER (SH) ASSISTANT REGISTRAR

[Signed order is placed on the file.]

3. Tamil Nadu Pollution Control Board, Chennai Permission letter

Received on 13/06/18 5.00 pm

TAMIL NADU POLLUTION CONTROL BOARD

From
Thiru. Md.Nasimuddin, I.A.S.,
Principal Secretary/Chairman (FAC),
Tamil Nadu Pollution Control Board,
76, Mount Salai, Guindy,
Chennai – 600 032.

To
The Authorised Signatory,
M/s. Hindustan Unilever Ltd.,
St. Mary's Road,
Kodaikanal,
Dindigul District – 624 101.

Letter No.T2/TNPCB/F.36448/27568/DGL/2018, dated:04.06.2018

Sir,

Sub: TNPCB – Industries – **M/s. Hindustan Unilever Limited** (Thermometer Factory), Kodaikanal, Dindigul District – Soil Remediation associated civil works, decontamination and disposal of machinery and materials, disposal of hazardous and contaminated wastes – reg.

Ref:
1. T/O Letter No. T14/TNPCB/F.33718/2016 dated 30.12.2016
2. Minutes of the Meeting of the Meeting of the Scientific Expert Committee held on 4.07.2017
3. The unit's report on Soil Remediation Trials - November 2017
4. T/O. Letter No. T2/TNPCB/F.36448/27568/DGL/2017 dt:29.01.2018
5. The unit's letter dated 09.02.2018
6. T/O.Letter No.T2/TNPCB/F.36448/27568/DGL/2018, dt:25.04.2018
7. The unit's letter dated 02.05.2018
8. The unit's letter dated 03.05.2018
9. The unit's letter dated 04.05.2018
10. The unit's letter dated 10.05.2018
11. T/O Letter No.T2/TNPCB/F.36448/27568/DGL/2018, dt:24.05.2018

With reference to the letter 1st cited above the unit of M/s. Hindustan Unilever Limited (Thermometer Factory), Kodaikanal, Dindigul District was issued permission to carry out soil remediation trials for a three months subject to certain conditions stipulated therein and obtaining clearance from concerned authorities. In this regard a meeting was convened by the SEC on 04.07.2017 and 05.07.2017 for inspecting the site and for deciding the procedure for the trials and it was recorded in the minutes 2nd cited. Thereafter the unit has conducted trials between 16.08.2017 and 18.11.2017. The report of the trials, 3rd cited was placed in the SEC Meeting dt:21.11.2017. The minutes of the meeting was communicated to the unit vide the reference 4th cited with an instruction to submit the soil remediation up scaling plan.

Thereafter, the unit submitted the soil remediation up-scaling plan vide reference 5th cited. The deliberations on the soil remediation up-scaling plan were made in the meeting of the SEC which was held on 19.03.2018. The minutes of the SEC meeting was communicated vide reference 6th cited.

76, MOUNT SALAI, GUINDY, CHENNAI - 600 032.
Tel :22353134, 22353135, 22353136, 22353137, 22353138, 22353139, 22353140, 22353141
Fax : 044-22353068
Email : tnpcb@md3.vsnl.net.in www.tnpcb.gov.in

Subsequent to the meeting, the unit submitted requests for permission for civil works associated with soil remediation vide reference 7th cited, decontamination and disposal of machinery and materials vide reference 8th cited and for disposal of the Hazardous and Contaminated wastes vide reference 9th cited. The unit also submitted the progress on action points deliberated in the SEC meeting held on 19.03.2018 vide reference 10th cited.

The Scientific Expert Committee (SEC) reviewed the progress made by M/s. Hindustan Unilever Limited (Thermometer Factory), Kodaikanal, Dindigul District and deliberated the request made by the unit for permission for civil works associated with soil remediation, decontamination and disposal of machinery and materials and for disposal of the Hazardous and Contaminated wastes. The SEC also discussed in detail the soil remediation up-scaling plan and the aspects and features of the new remediation equipment comprising of soil washing plant and mercury vacuum retort. The minutes of the SEC meeting held on 17.05.2018 was communicated to the unit vide reference 11th cited.

Based on the recommendations of the SEC, the following instructions are issued to the unit of M/s. Hindustan Unilever Limited (Thermometer Factory), Kodaikanal, Dindigul District:

1. The unit is permitted to commence the soil remediation work by installing and commissioning the new improved version of soil washing plant and mercury vacuum retort for the soil remediation work .
2. The soil remediation work should be carried out as per the soil remediation up scaling plan, recommendations and other directions/ instructions issued by the Board from time to time.
3. The soil remediation work should be undertaken under the guidance of National Environmental Engineering Research Institute (NEERI), Nagpur and the Indian Institute of Soil & Water Conservation, Udhagamandalam. NEERI's representative should be present throughout the remediation period for monitoring the same.
4. Prior to commencing the remediation work, necessary approval and permission should be obtained from the concerned authorities.
5. The unit should successfully demonstrate the performance of the soil washing plant as well as the mercury vacuum retort towards fulfilling the objectives of remediation during a period of 3 to 6 months.

6. The performance evaluation report of the soil washing plant and the mercury vacuum retort installed is crucial for taking further decisions. Relevant performance parameters should be monitored with the involvement of National Environmental Engineering Research Institute (NEERI) and the same shall be submitted to the Board.
7. During 3 to 6 months period as above, M/s. HUL should demonstrate the performance in respect of the following:
   a. Achieve the target remediation standard of 20 mg/kg.
   b. Ensure that environmental parameters are monitored , recorded and compiled with during remediation process.
   c. Performance evaluation report of the soil washing plant and the mercury retort installed.
   d. Soil erosion and rehabilitation measures to be implemented and demonstrated
   e. Occupational Health measures to be implemented and ensure compliance.
   f. Provide detail of soil input and output including overflow and underflow in the sieves and also demonstration of the mercury distribution in the process .
8. The unit shall carry out the following civil works associated with soil remediation which are required to be carried out prior to commencing the soil remediation work.
   a. Terrace Walls construction
   b. Access Roads repair/ new road for formation
   c. Drains re-routing/ new drains construction
   d. Silt trap upgradation
   e. Silt settling tank construction

   Additional civil works comprising of
   i. Vehicle tyre wash station
   ii. Weigh bridge
   iii. Civil work for transformer
   iv. Foundation work for the equipment
   v. Demolition of old buildings and walls inside the factory premises.
9. The unit is permitted to carry out decontamination and disposal of machinery and materials by adhering to the protocol prepared by Dr. Shyam Asolekar, Indian Institute of Technology, Bombay.
10. The unit shall dispose of the hazardous and contaminated wastes including building debris as submitted to the authorised TSDF. In this regard, the unit should

76, MOUNT SALAI, GUINDY, CHENNAI - 600 032.
Tel :22353134, 22353135, 22353136, 22353137, 22353138, 22353139, 22353140, 22353141
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Email : tnpcb@md3.vsnl.net.in www.tnpcb.gov.in

obtain the protocol from the TSDF operator for stabilsation and disposal of the same. Prior to disposal, the protocol should be recommended by SEC and approved by the Board.

The receipt of the letter shall be acknowledged.

08/06/18

For Chairman

08/6/18

Copy to

1. The District Environmental Engineer,
   Tamil Nadu Pollution Control Board,
   Dindigul – for necessary further action
2. The Joint Chief Environmental Engineer (Monitoring),
   Tamil Nadu Pollution Control Board,
   Madurai
3. The Member Secretary,
   Central Pollution Control Board
   Parvesh Bhavan, CBD-cum Office Complex
   East Arjun Nagar, Delhi – 110 032
4. The Regional director,
   Central Pollution Control Board,
   1st and 2nd Floors, Nisarga Bhavan,
   A-Block, Thimmaiah Main Road,
   7th D Cross, Shivanagar,
   Bengaluru – 560 079

4. Minutes of the meeting of Scientific Experts Committee (SEC) members, TNPCB Officials & NEERI held on 7th February 2019

Recd. on 11/4/2019

TAMIL NADU POLLUTION CONTROL BOARD

From
Thiru. D. Sekar, M.Tech,
Member Secretary,
Tamil Nadu Pollution Control Board,
76, Mount Salai, Guindy,
Chennai – 600 032.

To
The Authorised Signatory,
M/s. Hindustan Unilever Ltd.,
St. Mary's Road,
Kodaikanal,
Dindigul District – 624 101.

Letter No. T2 / TNPCB/ F.36448/ 27568/DGL / 2019 , dated:01.04.2019

Sir,

Sub: TNPCB- Industries – **M/s. Hindustan Unilever Limited**, Kodaikanal, Dindigul District– reg.

Ref: Minutes of the meeting of Scientific Experts Committee (SEC) Members, TNPCB officials & NEERI held on 7.02.2019

The copy of minutes of the SEC (Scientific Expert Committee) meeting held on 7.02.2019 is enclosed herewith for taking necessary action at your end.

The receipt of this letter may be acknowledged.

Encl: as above

4/4/19
For Member Secretary
04/4/19

Copy to :

1. All the SEC members (As per list enclosed)
2. The District Environmental Engineer,
   Tamil Nadu Pollution Control Board,
   Dindigul – for necessary further action
3. The Joint Chief Environmental Engineer(M),
   Tamil Nadu Pollution Control Board,
   Madurai

76, MOUNT SALAI, GUINDY, CHENNAI - 600 032.
Tel : 22353134, 22353135, 22353136, 22353137, 22353138, 22353139, 22353140, 22353141
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Email : tnpcb@md3.vsnl.net.in Web : www.tnpcb.gov.in

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MINUTES OF THE MEETING OF SCIENTIFIC EXPERTS COMMITTEE (SEC) MEMBERS,TNPCB OFFICIALS & NEERI HELD ON 7th FEBRUARY 2019 BETWEEN 1.00 PM TO 4.00 PM, AT THE HOTEL GATEWAY, MADURAI.

(REMEDIATION MEETING No.2)

Present:

MEMBERS OF THE SCIENTIFIC EXPERT COMMITTEE:

1) Dr. S Rajamani
   Member – Scientific Expert Committee

2) Dr P Singaram
   Member – Scientific Expert Committee

3) Dr T Thirunalasundari
   Member – Scientific Expert Committee

4) Dr. K.Dharmalingam
   Member – Scientific Expert Committee

5) Dr SK Bhargava
   Member – Scientific Expert Committee

SPECIAL INVITEES:

Participant from the National Environmental Engineering Research Institute, Nagpur:

6) Dr T. Rajesh
   Scientist, NEERI, Chennai.

Participants from Tamilnadu Pollution control Board:

7) Thiru. R Mathivanan
   District Environmental Engineer, TNPCB, Dindigul

8) Thiru. Rohitkumar
   Assistant Environmental Engineer, TNPCB, Chennai

9) Thiru.Gunaseelan
   Assistant Environmental Engineer, TNPCB, Dindigul

Representatives from Hindustan Unilever Ltd (HUL) :

10)Thiru. R John George
Factory Manager, HUL, Kodaikanal

11)Thiru. S Sureshbabu
Project Manager, HUL, Kodaikanal

12)Thiru. Ravi Costa
Principle Consultant, M/s.ERM (Environmental Consultant for HUL), New Delhi.

13)Dr. K Srinvas
Associate Vice President, Ramky Enviro Engineers Ltd, Hyderabad (Remediation Service Provider for HUL)

A. Meeting held amongst SEC-Members and Officials of Tamilnadu Pollution Control Board.

An internal meeting among SEC-Members and Tamilnadu Pollution Control Board was held to discuss about the functioning of the Scientific Expert Committee in the current soil remediation phase since most of the approvals were obtained by the unit of M/s Hindustan Unilever Limited, (Thermometer Factory) Kodaikanal for remediation processes. The representatives of M/s HUL and other experts who were not the members of the SEC were not present during the internal meeting of SEC members and preliminary discussions with TNPCB.

The members reiterated that the SEC was advisory in nature and major monitoring of the further field trial of the remediation process should be carried out by Tamilnadu Pollution Control Board. During the discussions it was concluded that future meetings of the SEC should be conducted as an when there is a substantial progress at the site with respect to erection of machinery and conduct of further trials to demonstrate the performance of the equipment as per the approved procedure and protocol for the remediation process.

The SEC arrived at the following decisions during the internal meeting of the SEC.

1. Once the equipment is installed, the Tamilnadu Pollution Control Board shall closely monitor the initial scale demonstration process, effluent quality, air quality monitoring protocol adapted by the unit and get the advice of the SEC for further full-scale remediation process.
2. The Tamilnadu Pollution Control Board shall also ensure that the time frame of remediation is adhered to and seek any advice of the SEC on the process if there is involvement of scientific or technical issues.
3. The SEC can also be approached when there is an unforeseen problem.
4. In future Tamilnadu Pollution Control Board will prepare an agenda and circulate it in advance to all committee members before calling for the meeting. The date and venue of the meeting shall be fixed based on mutual convenience.
5. The minutes of the meeting shall be drafted and sent to all SEC Members for their perusal and to make necessary corrections if any. Final minutes shall be sent for signature to all the SEC Members.
6. Sitting Fee and Daily Allowance payable to SEC Members for attending the SEC Meeting shall be approved by TNPCB as mentioned in TNPCB LR No T2/TNPCB/F.36448/ 27568/DGL /2016 dated 20.03.2018 & Minutes of Meeting of SEC dated 28.05.2015. On approval , payment will be done by M/s Hindustan Unilever Limited, (Thermometer Factory) Kodaikanal. Travel and Staying arrangements shall be made by M/s Hindustan Unilever Limited.

B. Meeting held with SCIENTIFIC EXPERTS COMMITTEE (SEC) MEMBERS,TNPCB OFFICIALS, NEERI and the representatives of M/s.Hindustan Unilever Limited-Thermometer Factory Kodaikanal

Thiru. R Mathivanan, District Environmental Engineer, TNPCB, Dindigul, welcomed the SEC members and other participants. He mentioned that the meeting is convened to review progress on HUL Kodaikanal soil remediation project.

Thiru. R John George, Factory Manager, HUL in his presentation covered the present status of the project and work planned at the site once HACA permission is received:

He presented the progress made on the recommendations of the previous SEC meeting held on 13th Dec 2018.

Thereafter, he has updated the members on the status of HACA approval. NOCs already received from Agricultural Engineering, Mining and Geology, PWD Water Resources section and TNPCB. Awaiting NOC from Forest Department and thereafter the applications will be placed before HACA for approval.

He mentioned that at the site building damages post cyclone Gaja restoration jobs were being undertaken and it would take another month to complete the restoration work.

Further he explained the following activities planned that are scheduled from March 2019 to November 2019, (i.e. till the new soil washing and vacuum retort plants get commissioned).

- Decontamination and disposal of machinery scarp and accumulated scarp.
- Delineation of Biomass.
- Delineation of Contaminated Area
- Protocol finalisation for stabilisation and disposal of debris and biomass.
- Demolition of unwanted buildings and unwanted structures.
- Disposal of debris and biomass into TSDF.
- Trees removal and disposal.
- Associated civil work.
- Remediation machinery installation and commissioning.

Thiru Ravi Costa from M/s ERM thereafter explained the trials carried out for stabilization of mercury contaminated building debris and biomass. 20 batches of trials were undertaken, 10 each for building debris and biomass at TSDF site from 30 Jan to 02 Feb 2019. The Scientists from NEERI were also present. The analysis results are awaited.

Following are the recommendations from the TNPCB officials and SEC members:

1. Trees removal in the area requiring soil remediation should be done after receiving the required statutory approval from the District Authorities. The suggestions from the Indian Institute of Soil and Water Conservation, Ooty are required to be implemented. M/s HUL should consult forest department while planting native trees suited for Kodaikanal.

2. The stabilization trials analysis report to be made available to TNPCB and SEC. As requested by M/s HUL further trials with large quantity of building debris and biomass may be conducted. The SEC members asked M/s HUL to ensure the organic content in the waste mass being disposed off into the TSDF should be within the allowable CPCB norm for land filling. After receiving trial reports, the SEC will give its recommendation.

3. Mercury content, TCLP and WLT tests are required to be carried out during stabilization trials that are planned for building debris and biomass.

4. M/s HUL should ensure the remediation related activities listed above from the presentation including installation and commissioning of remediation

equipment are carried out on priority after receiving the statutory approvals so that the soil treatment process is started at the earliest.

5. The next project review meeting is scheduled tentatively during mid April depending on the progress.

6. The SEC members Dr. Thirunalasundari, Dr. Rajamani and Dr. Bhargava along with TNPCB officials visited the TSDF site in Virudhunagar on 8th Feb.2019 and were explained about the initial stabilization trials under by NEERI, ERM and Ramky. The SEC members suggested to use suitable safety chemicals and process in stabilization trials. The results of field test trials and procedure & protocol to be adopted in full-scale stabilization will be submitted by HUL for approval by SEC.

Finally, Thiru R Mathivannan DEE Dindigul thanked the SEC members and other participants and concluded the meeting.

SEC Member	Signature
Dr. S Rajamani Member – Scientific Expert Committee	
Dr P Singaram Member – Scientific Expert Committee	
Dr T Thirunalasundari Member – Scientific Expert Committee	
Dr K Dharmalingam Member – Scientific Expert Committee	
Dr SK Bhargava Member – Scientific Expert Committee	

5. Guidelines for felling permission of trees in Eco Sensitive Zone of Protected Areas. (Government of India, Ministry of Environment, Forest and Climate Change, F.No. 11-63/2012-FC(pt) dated 29.09.2016.

F. No.11-63/2012-FC (Pt.)
Government of India
Ministry of Environment, Forest and Climate Change
(Forest Conservation Division)
****

Indira Paryavaran Bhawan,
JorBagh Road, Aliganj,
New Delhi-110003,
Dated: 29th September, 2016

To,

The Principal Secretary (Forests),
All States/Union Territory Governments except Jammu and Kashmir.

Sub: Guidelines for felling permission of trees in Eco Sensitive Zone of Protected Areas-regarding.

I am directed to say that the Ministry has reviewed the guidelines issued vide F. No 11-63/2012-FC dated 7th January 2013 for diversion of forest land for non forestry purposes and felling of trees in forest areas and other provisions for regulating the tree cutting in forest areas which *inter alia* provides in para 2 of the said guideline that '*this clarification will not apply to roads located within the Protected Areas and Eco sensitive Zone around Protected Areas where impacts upon wildlife have also to be considered*'.

In order to regulate the felling of trees in the Eco Sensitive Zone of protected areas, it has been decided that:

1. There shall be no felling of trees on the forest, non-forest land or government or revenue or private lands falling within the Eco Sensitive Zone of protected areas without prior permission of the competent authority duly notified by the State Government.
2. In case there is no Competent Authority notified by the State Government in such interim period, the Principal Chief Conservator of Forests in-charge of the territorial forests shall be the competent authority for this purpose and will grant permission for tree felling on the recommendation of the Divisional Forest Officer in whose jurisdiction the ESZ falls who will recommend in accordance with the existing provisions of Central or State Act and rules made thereunder by the State Government for protection of trees in the state.

This issues with approval of the Competent Authority in this Ministry.

Yours Faithfully,

(Nisheeth Saxena)
Sr. Assistant Inspector General of Forests (FC)

Copy to:

1. Principal Chief Conservator of Forest, All State/UT Governments.
2. Nodal Officer, under the Forest (Conservation) Act, 1980, All State/UT Governments.
3. All Regional Offices, Ministry of Environment & Forests.
4. All Assistant Inspector General of Forests in Forest Conservation Division, MoEF&CC, New Delhi.
5. PSO to Cabinet Secretary, for information.
6. Shri Ajit Kumar, Deputy Secretary, PMO.
7. PPS to Principal Secretary to PM, for information.
8. Guard File.

(Nisheeth Saxena)
Sr. Assistant Inspector General of Forests (FC)

6. Application from Hindustan Unilever Ltd. to seek permission under section 3(1) of the Tamil Nadu Hill Area (Preservation of Trees) Act 1955 during the process of soil remediation

Hindustan Unilever Limited

Hindustan Unilever Limited
St. Mary's Road,
Kodaikanal - 624 101.

Tel : +91 (0) 4542 241098
Fax : +91 (0) 4542 241288
Web: www.hul.co.in
CIN : L15140MH1933PLC002030

BY HAND DELIVERY

25th February, 2019

The Chairman,
Tamil Nadu Hill Area (Preservation of Trees) Committee,
Dindugul District,
Tamil Nadu

Through: The Secretary, Tamil Nadu Hill Area (Preservation of trees) Committee,
Dindigul

Dear Sir,

SUBJECT: REQUEST FOR PERMISSION UNDER SECTION 3(1) OF THE TAMILNADU HILL AREAS (PRESERVATION OF TREES) ACT, 1955 DURING THE PROCESS OF SOIL REMEDIATION – REG.

FORM 1 is enclosed as **Annexure-A.**

We have been granted permission from Tamil Nadu Pollution Control Board (TNPCB) vide letter reference No. T2/TNPCB/F.36448/27568/ DGL/2018 dated 04.06.2018 for remediation of mercury contaminated soil within our closed thermometer factory located at St.Mary's Road in Kodaikanal. A copy of the permission granted by the TNPCB is attached herewith and marked as **Annexure -B**.

We propose to undertake the remediation work as per the directions issued by the TNPCB and the recommendations of the Supreme Court Monitoring Committee constituted Scientific Experts Committee. The work will be undertaken under the guidance of National Environmental Engineering Research Institute, Nagpur and Indian Institute of Soil and Water Conservation, Ooty. The soil remediation work is detailed in 'Soil Remediation Upscaling Plan' which is attached to this letter and marked as **Annexure-C**.

The factory site is located in a notified industrial area in Kodaikanal. The soil profile at the factory site is very shallow and the soil depth across the contaminated area varies from 1.0 m to 2.0 m on an average with a maximum of 3m to 4m in some places. The soil remediation work envisages excavation of contaminated soil to a depth of 0.3 to 0.6 m from the contaminated areas, treating the contaminated soil

Registered Office :
Hindustan Unilever Limited
Unilever House
B D Sawant Marg, Chakala,
Andheri (E), Mumbai 400 099

Sir,
Copy Received
25 FEB 2019
25-2-19

Hindustan Unilever Limited

Hindustan Unilever Limited
St. Mary's Road,
Kodaikanal - 624 101.

Tel : +91 (0) 4542 241098
Fax : +91 (0) 4542 241288
Web: www.hul.co.in
CIN : L15140MH1933PLC002030

using the remediation equipment installed at the factory shed and backfilling the cleaned soil into the excavated area.

There are 440 trees including Eucalyptus, Pine, Berry, Savakku, Rubber and Groliya trees in the remediation and work area. These trees will become unstable due the soil being excavated and backfilled into the excavated area during remediation, given the shallow soil profile. Due to this these trees will pose a very serious risk to the people engaged in remediation work. Furthermore, these trees may also get uprooted during the rain and windy season.

Considering the above, we kindly request you to grant us permission to remove the 440 trees present in the remediation and work area for completing the remediation work at our site. We are committed to plant and nurture two native trees for every tree removed during the remediation process. Details of trees that are required to be removed are given in **Annexure-D**.

Chitta & Adangal , FMB sketch of the site and Copies of Amalgamation order of Ponds(India)Limited with Hindustan Lever Limited along with name change documents from Hindustan lever Limited to Hindustan Unilever Limited are enclosed as **Annexure E** , **Annexure F** and **Annexure G**. We are also enclosing the technical report received from Assistant Director, Geo technical center Kodaikanal scheme Dindugul vide their letter reference Tc.38/2018/(GTC) DATED 11 Oct 2018 as **Annexure H** and the recommendation received from the District Forest Officer, Kodaikanal vide their letter N.K.No./5725/2017/V1 dated 25.01.2019 for undertaking soil remediation and associated civil work as **Annexure I**.

Registered Office :
Hindustan Unilever Limited
Unilever House
B D Sawant Marg, Chakala,
Andheri (E), Mumbai 400 099

Hindustan Unilever Limited

Hindustan Unilever Limited
St. Mary's Road,
Kodaikanal - 624 101.

Tel : +91 (0) 4542 241098
Fax : +91 (0) 4542 241288
Web: www.hul.co.in
CIN : L15140MH1933PLC002030

Presently, there are around 2500 trees in our factory premises and we will ensure that the total of trees increase in number once the remediation work is completed.

Thanking you,

Yours Sincerely,
For **Hindustan Unilever Limited**

HINDUSTAN UNILEVER LTD. KODAIKANAL

John George,
Factory Manager

Enclosure:

1. Annexure A : Form 1 of application under section 3(1) of the Act
2. Annexure B : Permission received from TNPCB by HUL for soil remediation vide TNPCB letter T2/TNPCB/F.36448/27568/ DGL/2018 dated 04.06.2018
3. Annexure C : Soil Remediation Upscaling Plan
4. Annexure D : Summary and Details of identified trees to be removed
5. Annexure E : Chitta & Adangal of the site
6. Annexure F : FMB Sketch of the site
7. Annexure G : Copies of Amalgamation order of Ponds(India)Limited with Hindustan Lever Limited along with name change documents from Hindustan Lever Limited to Hindustan Unilever Limited
8. Annexure H : Technical report from Geo Technical Center , Kodaikanal scheme Dindugul . Letter reference Tc.38/2018/(GTC) DATED 11 Oct 2018 for soil remediation.
9. Annexure I : Recommendation received from the District Forest Officer Kodaikanal vide their letter N.K.No./5725/2017/V1 dated 25.01.2019 for soil remediation.

Registered Office :
Hindustan Unilever Limited
Unilever House
B D Sawant Marg, Chakala,
Andheri (E), Mumbai 400 099

ANNEXURE-A

Appendix
FORM 1
Form of application under section 3(i) of the act

1.	Name and address of the applicant	: M/s Hindustan Unilever Limited, St Mary's Road Kodaikanal -624 101
2.	Survey no of the field or fields on which the tree or the trees proposed to be felled stand	: RS NO 270, 271, 272, 273, 274 and 275 and TS No 5-2
3.	Name of Village, Taluk and District where the lands on which the trees stand lie	: Kodaikanal (village), Kodaikanal (Taluk), Dindugul (District).
4.	Proof of owner ship of the tree in the case of leases	: a) Copy of Chitta adangal b) Copies of Amalgamation order of Ponds(India) Limited with Hindustan Lever Limited alongwith name change documents from Hindustan lever Limited to Hindustan Unilever Limited.
5.	Enumeration list showing the species and girth at 1.37 meters from ground level of tree or trees proposed to be felled.	: List enclosed. No of trees 440 identified to be removed for Undertaking soil remediation
6.	Whether the tree or trees proposed to be felled are proposed to be regenerated naturally from coppices or by artificial regeneration and if the later the species and number of seedlings proposed to be planted.	: Saplings of native species twice the no of trees felled will be planted and nurtured.
7.	The period within which area will be planted up.	: within 3 years (immediately post soil remediation job)

Place : Kodaikanal

Date : 25th February, 2019

Signature of Applicant

HINDUSTAN UNILEVER LTD. KODAIKANAL

I declare that the information furnished above is true to the best of my knowledge and belief. I also undertake to comply with the conditions subject to which the permission may be granted by the collector.

Signature of Applicant

HINDUSTAN UNILEVER LTD. KODAIKANAL

ANNEXURE-B

TAMIL NADU POLLUTION CONTROL BOARD

From
Thiru. Md.Nasimuddin, I.A.S.,
Principal Secretary/Chairman (FAC),
Tamil Nadu Pollution Control Board,
76, Mount Salai, Guindy,
Chennai – 600 032.

To
The Authorised Signatory,
M/s. Hindustan Unilever Ltd.,
St. Mary's Road,
Kodaikanal,
Dindigul District – 624 101

Letter No.T2/TNPCB/F.36448/27568/DGL/2018, dated:04.06.2018

Sir,

Sub: TNPCB – Industries – **M/s. Hindustan Unilever Limited** (Thermometer Factory), Kodaikanal, Dindigul District – Soil Remediation associated civil works, decontamination and disposal of machinery and materials, disposal of hazardous and contaminated wastes – reg.

Ref:
1. T/O Letter No. T14/TNPCB/F.33718/2016 dated 30.12.2016
2. Minutes of the Meeting of the Meeting of the Scientific Expert Committee held on 4.07.2017
3. The unit's report on Soil Remediation Trials - November 2017
4. T/O. Letter No. T2/TNPCB/F.36448/27568/DGL/2017 dt:29.01.2018
5. The unit's letter dated 09.02.2018
6. T/O.Letter No.T2/TNPCB/F.36448/27568/DGL/2018, dt:25.04.2018
7. The unit's letter dated 02.05.2018
8. The unit's letter dated 03.05.2018
9. The unit's letter dated 04.05.2018
10. The unit's letter dated 10.05.2018
11. T/O Letter No.T2/TNPCB/F.36448/27568/DGL/2018, dt:24.05.2018

With reference to the letter 1st cited above the unit of M/s. Hindustan Unilever Limited (Thermometer Factory), Kodaikanal, Dindigul District was issued permission to carry out soil remediation trials for a three months subject to certain conditions stipulated therein and obtaining clearance from concerned authorities. In this regard a meeting was convened by the SEC on 04.07.2017 and 05.07.2017 for inspecting the site and for deciding the procedure for the trials and it was recorded in the minutes 2nd cited. Thereafter the unit has conducted trials between 16.08.2017 and 18.11.2017. The report of the trials, 3rd cited was placed in the SEC Meeting dt:21.11.2017. The minutes of the meeting was communicated to the unit vide the reference 4th cited with an instruction to submit the soil remediation up scaling plan.

Thereafter, the unit submitted the soil remediation up-scaling plan vide reference 5th cited. The deliberations on the soil remediation up-scaling plan were made in the meeting of the SEC which was held on 19.03.2018. The minutes of the SEC meeting was communicated vide reference 6th cited.

76, MOUNT SALAI, GUINDY, CHENNAI - 600 032.
Tel :22353134, 22353135, 22353136, 22353137, 22353138, 22353139, 22353140, 22353141
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Email tnpcb@md3.vsnl.net.in www.tnpcb.gov.in

6. The performance evaluation report of the soil washing plant and the mercury vacuum retort installed is crucial for taking further decisions. Relevant performance parameters should be monitored with the involvement of National Environmental Engineering Research Institute (NEERI) and the same shall be submitted to the Board.
7 During 3 to 6 months period as above, M/s. HUL should demonstrate the performance in respect of the following:
   a. Achieve the target remediation standard of 20 mg/kg.
   b. Ensure that environmental parameters are monitored , recorded and compiled with during remediation process.
   c. Performance evaluation report of the soil washing plant and the mercury retort installed.
   d. Soil erosion and rehabilitation measures to be implemented and demonstrated
   e. Occupational Health measures to be implemented and ensure compliance.
   f. Provide detail of soil input and output including overflow and underflow in the sieves and also demonstration of the mercury distribution in the process .
8. The unit shall carry out the following civil works associated with soil remediation which are required to be carried out prior to commencing the soil remediation work.
   a. Terrace Walls construction
   b. Access Roads repair/ new road for formation
   c. Drains re-routing/ new drains construction
   d. Silt trap upgradation
   e. Silt settling tank construction

f Additional civil works comprising of
   i. Vehicle tyre wash station
   ii. Weigh bridge
   iii. Civil work for transformer
   iv. Foundation work for the equipment
   v. Demolition of old buildings and walls inside the factory premises.

9. The unit is permitted to carry out decontamination and disposal of machinery and materials by adhering to the protocol prepared by Dr. Shyam Asolekar, Indian Institute of Technology, Bombay.
10. The unit shall dispose of the hazardous and contaminated wastes including building debris as submitted to the authorised TSDF. In this regard, the unit should

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Email : tnpcb@md3.vsnl.net.in www.tnpcb.gov.in

Subsequent to the meeting, the unit submitted requests for permission for civil works associated with soil remediation vide reference 7th cited, decontamination and disposal of machinery and materials vide reference 8th cited and for disposal of the Hazardous and Contaminated wastes vide reference 9th cited. The unit also submitted the progress on action points deliberated in the SEC meeting held on 19.03.2018 vide reference 10th cited.

The Scientific Expert Committee (SEC) reviewed the progress made by M/s. Hindustan Unilever Limited (Thermometer Factory), Kodaikanal, Dindigul District and deliberated the request made by the unit for permission for civil works associated with soil remediation, decontamination and disposal of machinery and materials and for disposal of the Hazardous and Contaminated wastes. The SEC also discussed in detail the soil remediation up-scaling plan and the aspects and features of the new remediation equipment comprising of soil washing plant and mercury vacuum retort. The minutes of the SEC meeting held on 17.05.2018 was communicated to the unit vide reference 11th cited.

Based on the recommendations of the SEC, the following instructions are issued to the unit of M/s. Hindustan Unilever Limited (Thermometer Factory), Kodaikanal, Dindigul District:

1. The unit is permitted to commence the soil remediation work by installing and commissioning the new improved version of soil washing plant and mercury vacuum retort for the soil remediation work
2. The soil remediation work should be carried out as per the soil remediation up scaling plan, recommendations and other directions/ instructions issued by the Board from time to time.
3. The soil remediation work should be undertaken under the guidance of National Environmental Engineering Research Institute (NEERI), Nagpur and the Indian Institute of Soil & Water Conservation, Udhagamandalam. NEERI's representative should be present throughout the remediation period for monitoring the same.
4. Prior to commencing the remediation work, necessary approval and permission should be obtained from the concerned authorities.
5. The unit should successfully demonstrate the performance of the soil washing plant as well as the mercury vacuum retort towards fulfilling the objectives of remediation during a period of 3 to 6 months.

obtain the protocol from the TSDF operator for stabilsation and disposal of the same. Prior to disposal, the protocol should be recommended by SEC and approved by the Board.

The receipt of the letter shall be acknowledged.

08/06/18

For Chairman

08/6/18

Copy to

1. The District Environmental Engineer,
   Tamil Nadu Pollution Control Board,
   Dindigul – for necessary further action
2. The Joint Chief Environmental Engineer (Monitoring),
   Tamil Nadu Pollution Control Board,
   Madurai
3. The Member Secretary,
   Central Pollution Control Board
   Parvesh Bhavan, CBD-cum Office Complex
   East Arjun Nagar, Delhi – 110 032
4. The Regional director,
   Central Pollution Control Board,
   1st and 2nd Floors, Nisarga Bhavan,
   A-Block, Thimmaiah Main Road,
   7th D Cross, Shivanagar,
   Bengaluru – 560 079

7. Revenue Documents (Patta, Chitta, etc.,)

இ. நம்பர் 10 பிரிவு 1-1428 ஆம் பசலியில் திண்டுக்கல் ஜில்லா, கொடைக்கானல் தாலூகா,

கொடைக்கானல் கிராமத்தில் செட்டில் மெண்டு ஜமாபந்தி நபர்கள் சிட்டா.

நம்பர்

FH 916 நம்பர். Pond's India Ltd. Madras - 2

வருஷமும் விவரங் களும் (1)	புலத்தின் நம்பரும் உட் பிரிவும் (2)	புன்செய் விஸ்தீர்ணம் (3)		புன்செய் தீர்வை (4)		நன்செய் விஸ்தீர்ணம் (5)		நன்செய் தீர்வை (6)		மொத்த தீர்வை (7)		ஷரா (8)
		ஹெக் டேர்.	ஏர்.	ரூ.	பை.	ஹெக் டேர்.	ஏர்.	ரூ.	பை.	ரூ.	பை.	
	வார்டு: B											
	பிளாக்: 31											
	TS 5-2	8.10	50	185-22						185-22		

/உண்மை நகல்/

கிராம நிர்வாக அலுவலர்
கொடைக்கானல் கிராமம்
கொடைக்கானல் வட்டம்

380/2 - R.F. III-A-27—15,00,000 Cps. – G.B.P. - Mdu-7 –2017.

Page 1 of 2

Scanned by CamScanner

1428 - ஆம் பசலியில் திண்டுக்கல் மாவட்டம் கொடைக்கானல் கிராமக் கணக்கு வட்டம் கொடைக்கானல்

நில வரித் திட்டத்தின்படி புலன்களின் விபரம்.						சாகுபடியாளரின் பெயர்.	முதல் போகம்.				
நில அளவை எண்.	உட்பிரிவு எண்.	பரப்பு.	தீர்வை.	ஒரு போகம் அல்லது இரு போகம்.	கைப்பற்று தாரருடைய பெயரும் எண்ணும் அல்லது அனுபோக தாரருடைய பெயர்.	நிலத்தின் எந்த பகுதி யாவது சாகுபடியாளரால் பயிரிடப்பட்டுள்ளதா.	எந்த மாதத்தில் பயிர் செய்யப்பட்டது எந்த மாதத்தில் அறுவடை செய்யப்பட்டது.	பயிரின் பெயர்.	பயிரான / அறுவடையான பரப்பு.	உண்மையான பாய்ச்சல் ஆதாரம்.	விளைச்சல் அளவு விழுக்காடு.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
					வார்டு: B, பிளாக்: 31						
3 5	2	8.10.50	128.86 FH	916	Pond's India Ltd Madras.2	7		டேர்	ரூ.60.00		
					/உண்மைநகல்/						

கிராம நிர்வாக அலுவலர்
கொடைக்கானல் கிராமம்
கொடைக்கானல் வட்டம்

380/82-R.F. III-A-10-40,00,000 Cps.-GBP.-MDU.-7

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ANNEXURE- E

எண் 2

கிராமத்தில் வருடவாரி புலவாரி கைப்பற்று சாகுபடி அடங்கல் கணக்கு

இரண்டாம் போகம்					[illegible]	[illegible]	
எந்த மாதத்தில் பயிர் செய்யப்பட்டது எந்த மாதத்தில் அறுவடை செய்யப்பட்டது.	பயிரின் பெயர்.	பயிரான / அறுவடையான பரப்பு.	உண்மையான பாய்ச்சல் ஆதாரம்.	விளைச்சல் அளவு விகிதம்.	[illegible]	[illegible]	[illegible]
(13)	(14)	(15)	(16)	(17)	(18)	(18, அ)	(19)
					பயிர்களை, மரங்கள்		
					காலியிடம்		
					5.50.50		

8. Tree list

ANNEXURE - D

Summary of the trees that are to be removed

S No	Area	Eucalyptus	Pine	Berry	Savakku	Rubber	Groliya	Total
1	A	28	3	11	7			49
2	B	20		14	6	1		41
3	C1	1		25	5	4		35
4	C2	98	52	30	38			218
5	D	60						60
6	E	8	17		7		5	37
Total		215	72	80	63	5	5	440

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Detail of Trees that are required to be removed

Sl No	Tree Identification Number	Circumference of the tree in cm	Height of the tree in Meter	Area	Type of Tree
1	A001	81	7	Area C2	Eucalyptus
2	A002	116	10	Area C2	Eucalyptus
3	A003	247	22	Area C2	Eucalyptus
4	A004 #	430	23	Area C2	Eucalyptus
5	A005	111	15	Area C2	Eucalyptus
6	A006	133	20	Area C2	Eucalyptus
7	A007	79	7	Area C2	Eucalyptus
8	A008	63	7	Area C2	Eucalyptus
9	A009	400	28	Area C2	Eucalyptus
10	A010	240	25	Area C2	Eucalyptus
11	A011	153	22	Area C2	Eucalyptus
12	A012	250	30	Area C2	Eucalyptus
13	A013	127	8	Area C2	Eucalyptus
14	A014	91	12	Area C2	Eucalyptus
15	A015	120	15	Area C2	Eucalyptus
16	A016	240	16	Area C2	Eucalyptus
17	A017	442	22	Area C2	Eucalyptus
18	A018	112	10	Area C2	Eucalyptus
19	A019	175	12	Area C2	Eucalyptus
20	A020	65	5	Area C2	Eucalyptus
21	A021	218	17	Area C2	Eucalyptus
22	A022	68	7	Area C2	Eucalyptus
23	A025	266	17	Area C2	Eucalyptus
24	A026	160	12	Area C2	Eucalyptus
25	A027	76	7	Area C2	Eucalyptus
26	A029	66	8	Area C2	Eucalyptus
27	A031	140	15	Area C2	Eucalyptus
28	A032	138	12	Area C2	Eucalyptus
29	A033	165	14	Area C2	Eucalyptus
30	A034	255	20	Area C2	Eucalyptus
31	A035	200	20	Area C2	Eucalyptus
32	A036	89	12	Area C2	Eucalyptus
33	A037	62	7	Area C2	Eucalyptus
34	A038	126	12	Area C2	Eucalyptus
35	A039	75	10	Area C2	Eucalyptus
36	A040	62	5	Area C2	Eucalyptus
37	A045	78	10	Area C2	Eucalyptus
38	A046	160	15	Area C2	Eucalyptus
39	A048	77	12	Area C2	Eucalyptus
40	A049	88	7	Area C2	Eucalyptus
41	A051	129	17	Area C2	Eucalyptus
42	A052	65	10	Area C2	Eucalyptus
43	A053	66	7	Area C2	Eucalyptus
44	A054	140	17	Area C2	Eucalyptus
45	A055	94	12	Area C2	Eucalyptus
46	A056	82	12	Area C2	Eucalyptus
47	A057	165	23	Area C2	Eucalyptus
48	A058	86	10	Area C2	Eucalyptus
49	A059	119	15	Area C2	Eucalyptus
50	A060	170	17	Area C2	Eucalyptus
51	A063	89	10	Area C2	Eucalyptus
52	A064	75	7	Area C2	Eucalyptus
53	A065	139	13	Area C2	Eucalyptus
54	A066	96	7	Area C2	Eucalyptus
55	A067	78	7	Area C2	Eucalyptus

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Detail of Trees that are required to be removed

Sl No	Tree Identification Number	Circumference of the tree in cm	Height of the tree in Meter	Area	Type of Tree
56	A068	191	15	Area C2	Eucalyptus
57	A069	128	13	Area C2	Eucalyptus
58	A070	100	13	Area C2	Eucalyptus
59	A071	93	10	Area C2	Eucalyptus
60	A072	119	12	Area C2	Eucalyptus
61	A073	180	23	Area C2	Eucalyptus
62	A074	90	7	Area C2	Eucalyptus
63	A075	77	7	Area C2	Eucalyptus
64	A076	113	15	Area C2	Eucalyptus
65	A077	270	25	Area C2	Eucalyptus
66	A078	170	12	Area C2	Eucalyptus
67	A079	170	23	Area C2	Eucalyptus
68	A080	95	13	Area C2	Eucalyptus
69	A081	69	10	Area C2	Eucalyptus
70	A082	91	7	Area C2	Eucalyptus
71	A083	64	5	Area C2	Eucalyptus
72	A084	63	5	Area C2	Eucalyptus
73	A085	105	11	Area C2	Eucalyptus
74	A086	210	13	Area C2	Eucalyptus
75	A087	145	13	Area C2	Eucalyptus
76	A088	101	10	Area C2	Eucalyptus
77	A089	80	8	Area C2	Eucalyptus
78	A090	77	8	Area C2	Eucalyptus
79	A091	149	12	Area C2	Eucalyptus
80	A094	73	10	Area C2	Eucalyptus
81	A095	172	12	Area C2	Eucalyptus
82	A096	194	14	Area C2	Eucalyptus
83	A097	184	14	Area C2	Eucalyptus
84	A098	102	7	Area C2	Eucalyptus
85	A099	122	9	Area C2	Eucalyptus
86	A100	200	10	Area C2	Eucalyptus
87	A101	210	14	Area C2	Eucalyptus
88	A102	204	12	Area C2	Eucalyptus
89	A103	105	8	Area C2	Eucalyptus
90	A104	210	12	Area C2	Eucalyptus
91	A105	236	10	Area C2	Eucalyptus
92	A106	131	10	Area C2	Eucalyptus
93	A107	111	10	Area C2	Eucalyptus
94	A108	202	13	Area C2	Eucalyptus
95	A109	136	11	Area C2	Eucalyptus
96	A110	280	14	Area C2	Eucalyptus
97	A111	190	12	Area C2	Eucalyptus
98	A112	167	12	Area C2	Eucalyptus
99	A113	173	12	Area C1	Eucalyptus
100	A114	261	13	Area B	Eucalyptus
101	A115	124	13	Area B	Eucalyptus
102	A116	248	13	Area B	Eucalyptus
103	A117	92	9	Area B	Eucalyptus
104	A118	110	11	Area B	Eucalyptus
105	A119	166	12	Area B	Eucalyptus
106	A120	177	12	Area B	Eucalyptus
107	A121	170	12	Area B	Eucalyptus
108	A122	182	11	Area B	Eucalyptus
109	A123	158	10	Area B	Eucalyptus
110	A124	206	14	Area B	Eucalyptus

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Detail of Trees that are required to be removed

Sl No	Tree Identification Number	Circumference of the tree in cm	Height of the tree in Meter	Area	Type of Tree
111	A125	167	10	Area B	Eucalyptus
112	A126	180	12	Area B	Eucalyptus
113	A127	187	13	Area B	Eucalyptus
114	A128	292	15	Area B	Eucalyptus
115	A129	183	12	Area B	Eucalyptus
116	A130	132	10	Area B	Eucalyptus
117	A131	130	11	Area B	Eucalyptus
118	A132	160	12	Area B	Eucalyptus
119	A133	177	11	Area B	Eucalyptus
120	A134	353	18	Area A	Eucalyptus
121	A135	460	22	Area A	Eucalyptus
122	A136	275	15	Area A	Eucalyptus
123	A137	91	6	Area A	Eucalyptus
124	A138	295	15	Area A	Eucalyptus
125	A139	144	10	Area A	Eucalyptus
126	A140	180	13	Area A	Eucalyptus
127	A141	213	17	Area A	Eucalyptus
128	A142	132	10	Area A	Eucalyptus
129	A143	117	9	Area A	Eucalyptus
130	A144	248	17	Area A	Eucalyptus
131	A145	278	17	Area A	Eucalyptus
132	A146	209	13	Area A	Eucalyptus
133	A147	125	8	Area A	Eucalyptus
134	A148	111	11	Area A	Eucalyptus
135	A149	129	13	Area A	Eucalyptus
136	A150	170	12	Area A	Eucalyptus
137	A151	160	12	Area A	Eucalyptus
138	A152	76	6	Area A	Eucalyptus
139	A153	69	6	Area A	Eucalyptus
140	A154	160	13	Area A	Eucalyptus
141	A155	139	10	Area A	Eucalyptus
142	A156	141	8	Area A	Eucalyptus
143	A157	75	9	Area A	Eucalyptus
144	A158	146	10	Area A	Eucalyptus
145	A159	248	17	Area A	Eucalyptus
146	A160	101	5	Area A	Eucalyptus
147	A161	110	7	Area A	Eucalyptus
148	A162	146	15	Area D	Eucalyptus
149	A163	125	8	Area D	Eucalyptus
150	A164	200	13	Area D	Eucalyptus
151	A165	82	7	Area D	Eucalyptus
152	A166	315	15	Area D	Eucalyptus
153	A167	287	25	Area D	Eucalyptus
154	A168	80	4	Area D	Eucalyptus
155	A169	180	12	Area D	Eucalyptus
156	A170	113	10	Area D	Eucalyptus
157	A173	140	12	Area D	Eucalyptus
158	A174	167	13	Area D	Eucalyptus
159	A180	157	20	Area D	Eucalyptus
160	A181	158	20	Area D	Eucalyptus
161	A187	225	15	Area D	Eucalyptus
162	A190	147	10	Area D	Eucalyptus
163	A192	283	14	Area D	Eucalyptus
164	A193	173	12	Area D	Eucalyptus
165	A194	83	7	Area D	Eucalyptus

Detail of Trees that are required to be removed

Sl No	Tree Identification Number	Circumference of the tree in cm	Height of the tree in Meter	Area	Type of Tree
166	A195	112	8	Area D	Eucalyptus
167	A196	228	17	Area D	Eucalyptus
168	A197	159	10	Area D	Eucalyptus
169	A198	194	12	Area D	Eucalyptus
170	A199	128	9	Area D	Eucalyptus
171	A200	317	17	Area D	Eucalyptus
172	A202	64	6	Area D	Eucalyptus
173	A203	221	15	Area D	Eucalyptus
174	A204	85	9	Area D	Eucalyptus
175	A205	74	7	Area D	Eucalyptus
176	A206	380	25	Area D	Eucalyptus
177	A207	88	8	Area D	Eucalyptus
178	A208	89	9	Area D	Eucalyptus
179	A209	72	5	Area D	Eucalyptus
180	A210	100	8	Area D	Eucalyptus
181	A211	66	6	Area D	Eucalyptus
182	A212	345	25	Area D	Eucalyptus
183	A213	73	5	Area D	Eucalyptus
184	A214	99	8	Area D	Eucalyptus
185	A215	159	11	Area D	Eucalyptus
186	A216	128	20	Area D	Eucalyptus
187	A217	99	3	Area D	Eucalyptus
188	A218	246	25	Area D	Eucalyptus
189	A219	113	8	Area D	Eucalyptus
190	A220	85	6	Area D	Eucalyptus
191	A221	134	8	Area D	Eucalyptus
192	A222	114	7	Area D	Eucalyptus
193	A223	62	3	Area D	Eucalyptus
194	A224	277	25	Area D	Eucalyptus
195	A225	133	10	Area D	Eucalyptus
196	A226	154	10	Area D	Eucalyptus
197	A227	70	8	Area D	Eucalyptus
198	A228	284	25	Area D	Eucalyptus
199	A229	270	10	Area D	Eucalyptus
200	A230	122	10	Area D	Eucalyptus
201	A231	105	10	Area D	Eucalyptus
202	A232	105	10	Area D	Eucalyptus
203	A233	289	27	Area D	Eucalyptus
204	A234	129	8	Area D	Eucalyptus
205	A235	286	25	Area D	Eucalyptus
206	A236	208	10	Area D	Eucalyptus
207	A237	229	12	Area D	Eucalyptus
208	A238	289	20	Area E	Eucalyptus
209	A244	314	25	Area E	Eucalyptus
210	A245	172	25	Area E	Eucalyptus
211	A246	273	25	Area E	Eucalyptus
212	A247	216	25	Area E	Eucalyptus
213	A248	235	27	Area E	Eucalyptus
214	A249	176	25	Area E	Eucalyptus
215	A250	230	25	Area E	Eucalyptus
216	B001	86	4	Area C2	Berry
217	B002	104	4	Area C2	Berry
218	B003	69	3	Area C2	Berry
219	B004	63	4	Area C1	Berry
220	B005	62	3	Area C1	Berry

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Detail of Trees that are required to be removed

Sl No	Tree Identification Number	Circumference of the tree in cm	Height of the tree in Meter	Area	Type of Tree
221	B006	68	5	Area C1	Berry
222	B007	57	4	Area C1	Berry
223	B008	82	5	Area C1	Berry
224	B009	94	5	Area C1	Berry
225	B010	65	4	Area C1	Berry
226	B011	106	7	Area C1	Berry
227	B012	96	4	Area C1	Berry
228	B015	127	5	Area C1	Berry
229	B016	97	5	Area C1	Berry
230	B017	109	5	Area C1	Berry
231	B018	107	5	Area C1	Berry
232	B019	123	6	Area C1	Berry
233	B020	117	6	Area C1	Berry
234	B021	74	5	Area C2	Berry
235	B022	100	5	Area C2	Berry
236	B023	88	6	Area C2	Berry
237	B024	150	6	Area C1	Berry
238	B025	83	5	Area C1	Berry
239	B026	101	4	Area C1	Berry
240	B027	62	4	Area C1	Berry
241	B029	129	5	Area C2	Berry
242	B030	115	5	Area C2	Berry
243	B031	91	4	Area C1	Berry
244	B032	101	4	Area C1	Berry
245	B033	124	5	Area C1	Berry
246	B034	73	4	Area C1	Berry
247	B035	76	4	Area C1	Berry
248	B036	86	4	Area C1	Berry
249	B037	108	5	Area C2	Berry
250	B038	107	5	Area C2	Berry
251	B039	130	5	Area C2	Berry
252	B040	130	5	Area C2	Berry
253	B042	89	4	Area C2	Berry
254	B043	108	5	Area C2	Berry
255	B044	115	4	Area C2	Berry
256	B045	143	6	Area C2	Berry
257	B046	90	4	Area C2	Berry
258	B047	134	5	Area C2	Berry
259	B048	170	6	Area C2	Berry
260	B049	132	6	Area C2	Berry
261	B050	124	4	Area C2	Berry
262	B051	116	4	Area C2	Berry
263	B052	136	5	Area C2	Berry
264	B053	109	4	Area C2	Berry
265	B054	132	6	Area C2	Berry
266	B055	160	7	Area C2	Berry
267	B058	180	6	Area C2	Berry
268	B059	149	4	Area C2	Berry
269	B060	147	5	Area C2	Berry
270	B061	144	6	Area C2	Berry
271	B062	164	6	Area A	Berry
272	B063	132	5	Area A	Berry
273	B064	117	5	Area A	Berry
274	B065	129	4	Area A	Berry
275	B066	117	4	Area A	Berry

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Detail of Trees that are required to be removed

Sl No	Tree Identification Number	Circumference of the tree in cm	Height of the tree in Meter	Area	Type of Tree
276	B067	101	3	Area A	Berry
277	B068	111	4	Area A	Berry
278	B069	85	6	Area A	Berry
279	B070	79	5	Area A	Berry
280	B071	61	4	Area A	Berry
281	B072	89	5	Area A	Berry
282	B073	67	2	Area B	Berry
283	B074	80	4	Area B	Berry
284	B075	69	3	Area B	Berry
285	B076	79	3	Area B	Berry
286	B077	92	3	Area B	Berry
287	B078	93	2	Area B	Berry
288	B079	88	3	Area B	Berry
289	B080	84	2	Area B	Berry
290	B081	94	2	Area B	Berry
291	B082	110	2	Area B	Berry
292	B083	160	3	Area B	Berry
293	B084	162	4	Area B	Berry
294	B085	126	3	Area B	Berry
295	B086	120	3	Area B	Berry
296	C001	58	6	Area C1	Savakku
297	C002	78	7	Area C1	Savakku
298	C003	90	5	Area C1	Savakku
299	C004	110	12	Area C1	Savakku
300	C006	142	13	Area C1	Savakku
301	C010	198	14	Area C2	Savakku
302	C011	68	7	Area C2	Savakku
303	C012	204	17	Area C2	Savakku
304	C013	62	8	Area C2	Savakku
305	C014	84	10	Area C2	Savakku
306	C015	70	7	Area C2	Savakku
307	C016	50	5	Area C2	Savakku
308	C017	60	3	Area C2	Savakku
309	C018	108	7	Area C2	Savakku
310	C019	99	7	Area C2	Savakku
311	C020	57	5	Area C2	Savakku
312	C021	261	12	Area C2	Savakku
313	C022	80	4	Area C2	Savakku
314	C023	78	8	Area C2	Savakku
315	C024	72	8	Area C2	Savakku
316	C025	71	3	Area C2	Savakku
317	C026	68	7	Area C2	Savakku
318	C027	72	6	Area C2	Savakku
319	C028	83	4	Area C2	Savakku
320	C029	78	6	Area C2	Savakku
321	C030	63	7	Area C2	Savakku
322	C031	67	8	Area C2	Savakku
323	C032	62	4	Area C2	Savakku
324	C033	65	5	Area C2	Savakku
325	C034	65	4	Area C2	Savakku
326	C035	70	7	Area C2	Savakku
327	C036	84	8	Area C2	Savakku
328	C037	74	7	Area C2	Savakku
329	C038	72	7	Area C2	Savakku
330	C039	80	8	Area C2	Savakku

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Detail of Trees that are required to be removed

Sl No	Tree Identification Number	Circumference of the tree in cm	Height of the tree in Meter	Area	Type of Tree
331	C040	65	3	Area C2	Savakku
332	C041	95	9	Area C2	Savakku
333	C042	100	9	Area C2	Savakku
334	C043	73	7	Area C2	Savakku
335	C044	68	3	Area C2	Savakku
336	C045	70	6	Area C2	Savakku
337	C046	97	8	Area C2	Savakku
338	C047	69	7	Area C2	Savakku
339	C048	75	7	Area B	Savakku
340	C049	63	4	Area B	Savakku
341	C054	77	7	Area B	Savakku
342	C055	78	5	Area B	Savakku
343	C056	71	4	Area B	Savakku
344	C057	80	6	Area B	Savakku
345	C058	76	5	Area A	Savakku
346	C059	87	4	Area A	Savakku
347	C060	102	5	Area A	Savakku
348	C061	68	5	Area A	Savakku
349	C062	98	6	Area A	Savakku
350	C063	86	5	Area A	Savakku
351	C064	131	4	Area A	Savakku
352	C068	72	4	Area E	Savakku
353	C079	114	5	Area E	Savakku
354	C080	85	3	Area E	Savakku
355	C081	196	12	Area E	Savakku
356	C082	182	10	Area E	Savakku
357	C083	160	15	Area E	Savakku
358	C084	102	8	Area E	Savakku
359	D002	97	4	Area C1	Rubber
360	D003	83	3	Area C1	Rubber
361	D004	116	5	Area C1	Rubber
362	D005	73	7	Area C1	Rubber
363	D006	154	7	Area B	Rubber
364	E001	180	9	Area C2	Pine Tree
365	E002	138	7	Area C2	Pine Tree
366	E003	61	6	Area C2	Pine Tree
367	E004	75	5	Area C2	Pine Tree
368	E005	195	12	Area C2	Pine Tree
369	E006	81	5	Area C2	Pine Tree
370	E007	129	9	Area C2	Pine Tree
371	E008	205	10	Area C2	Pine Tree
372	E009	165	9	Area C2	Pine Tree
373	E010	67	7	Area C2	Pine Tree
374	E011	61	4	Area C2	Pine Tree
375	E012	77	9	Area C2	Pine Tree
376	E013	92	10	Area C2	Pine Tree
377	E014	124	5	Area C2	Pine Tree
378	E015	128	5	Area C2	Pine Tree
379	E016	66	5	Area C2	Pine Tree
380	E017	140	10	Area C2	Pine Tree
381	E018	116	5	Area C2	Pine Tree
382	E019	69	4	Area C2	Pine Tree
383	E020	133	6	Area C2	Pine Tree
384	E021	125	8	Area C2	Pine Tree
385	E022	106	6	Area C2	Pine Tree

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Detail of Trees that are required to be removed

Sl No	Tree Identification Number	Circumference of the tree in cm	Height of the tree in Meter	Area	Type of Tree
386	E023	62	4	Area C2	Pine Tree
387	E024	77	7	Area C2	Pine Tree
388	E025	87	8	Area C2	Pine Tree
389	E026	141	10	Area C2	Pine Tree
390	E027	85	4	Area C2	Pine Tree
391	E028	89	6	Area C2	Pine Tree
392	E029	170	8	Area C2	Pine Tree
393	E030	170	8	Area C2	Pine Tree
394	E031	136	8	Area C2	Pine Tree
395	E032	135	8	Area C2	Pine Tree
396	E034	165	10	Area C2	Pine Tree
397	E035	83	7	Area C2	Pine Tree
398	E036	308	11	Area C2	Pine Tree
399	E037	80	4	Area C2	Pine Tree
400	E038	139	10	Area C2	Pine Tree
401	E039	144	10	Area C2	Pine Tree
402	E045	64	5	Area C2	Pine Tree
403	E046	68	6	Area C2	Pine Tree
404	E048	89	7	Area C2	Pine Tree
405	E049	82	5	Area C2	Pine Tree
406	E050	142	7	Area C2	Pine Tree
407	E051	74	7	Area C2	Pine Tree
408	E052	142	5	Area C2	Pine Tree
409	E053	77	7	Area C2	Pine Tree
410	E054	66	4	Area C2	Pine Tree
411	E055	60	4	Area C2	Pine Tree
412	E056	73	6	Area C2	Pine Tree
413	E057	66	4	Area C2	Pine Tree
414	E058	69	7	Area C2	Pine Tree
415	E059	163	9	Area C2	Pine Tree
416	E060	73	4	Area A	Pine Tree
417	E061	73	4	Area A	Pine Tree
418	E062	118	8	Area A	Pine Tree
419	E063	133	8	Area E	Pine Tree
420	E064	112	7	Area E	Pine Tree
421	E065	127	7	Area E	Pine Tree
422	E066	114	8	Area E	Pine Tree
423	E067	225	18	Area E	Pine Tree
424	E068	117	9	Area E	Pine Tree
425	E069	132	10	Area E	Pine Tree
426	E070	150	10	Area E	Pine Tree
427	E071	255	12	Area E	Pine Tree
428	E073	70	6	Area E	Pine Tree
429	E075	108	8	Area E	Pine Tree
430	E076	142	9	Area E	Pine Tree
431	E077	76	5	Area E	Pine Tree
432	E078	69	5	Area E	Pine Tree
433	E079	84	5	Area E	Pine Tree
434	E080	69	5	Area E	Pine Tree
435	E086	175	7	Area E	Pine Tree
436	F001	72	4	Area E	Grolia
437	F002	130	5	Area E	Grolia
438	F003	113	5	Area E	Grolia
439	F005	88	7	Area E	Grolia
440	F006	77	6	Area E	Grolia

9. Tamil Nadu Hill Area (Preservation of Trees) Act 1955 Committee Order

திண்டுக்கல் மாவட்ட மலைத்தள (மரங்கள் பாதுகாப்பு) குழுவின் தலைவர் மற்றும் மாவட்ட ஆட்சித்தலைவர் அவர்களின் செயல்முறைகள்

முன்னிலை: திருமதி மு.விஜயலட்சுமி, இ.ஆ.ப.,

SR. 66/2019/ இ3 நாள்: 18 .10.2019.

பொருள்: மரங்கள் - தமிழ்நாடு மலைதள (மரங்கள் பாதுகாப்பு) சட்டம் 1955 - கொடைக்கானல் வட்டம், வார்டு பி, பிளாக் 21, நகரளவை .எண் 5/2-ல் உள்ள 440 பல்வகை மரங்களை வெட்டுவதற்கு மேலாளர் இந்துஸ்தான் யுனிலிவர் கம்பெனி என்பவர் மனுச்செய்தது - ஆணைகள் பிறப்பித்தல் - தொடர்பாக.

பார்வை :
1. மேலாளர், இந்துஸ்தான் யுனிலிவர் கம்பெனி, கொடைக்கானல் என்பவர் மனு நாள் : 25.02.2019
2. கொடைக்கானல் மாவட்ட வன அலுவலர் கடிதம் ந.க.எண். 1182/19/டி நாள் : 10.05.2019
3. திண்டுக்கல் செயற்பொறியாளர் (வேளாண்மை பொறியியல் துறை) கடித எண். அ/721/2019 நாள்: 29.07.2019
4. கொடைக்கானல் வட்டாட்சியர் கடிதம் ந.க.எண். 817/2019/அ2 நாள் : 30.07.2019
5. திண்டுக்கல் மாவட்ட மலைத்தள (மரங்கள் பாதுகாப்பு) குழு கூட்ட நடவடிக்கைக் குறிப்புகள் ப.வெ.எண். 324/2019/இ3 நாள் : 16.10.2019

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ஆணைகள்:

திண்டுக்கல் மாவட்டம், கொடைக்கானல் வட்டம், வார்டு பி, பிளாக் 21,நகரளவை எண் எண் 5/2-ல் , யூகலிப்டஸ் 215, பைன் 72, பெரி 80, சவுக்கு 63, ரப்பர் 5, குளோரியா 5 ஆக மொத்தம் 440 மரங்களை வெட்ட அனுமதி கேட்டு மேலாளர், **இந்துஸ்தான் யுனிலிவர் கம்பெனி** என்பவர் பார்வை 1-ல் காணும் மனுவில் விண்ணப்பித்திருந்தது தொடர்பாக பார்வை 2 முதல் 4 வரையிலான குறிப்புகளின்படி மாவட்ட மலைத்தள பகுதி (மரங்கள் பாதுகாப்பு) குழு உறுப்பினர்களின் பரிந்துரை அறிக்கைகள் பெறப்பட்டுள்ளது.

2) திண்டுக்கல் மாவட்டத்தில் உள்ள அறிவிக்கப்பட்ட மலைப்பகுதிகளில் ஒரே நேரத்தில் அதிக எண்ணிக்கையில் மரங்கள் வெட்டப்படுவது மலைப்பகுதிகளில் இயற்கை அழகை கெடுக்கும் என்பதோடு, இது மழைப் பொழிவை வெகுவாக குறைக்கும் என்பதாலும் மண் அரிப்பை அதிகரித்து நிலச் சரிவை ஏற்படுத்தி உயிர்களுக்கும், உடமைகளுக்கும் மிகுந்த சேதத்தை ஏற்படுத்தும் என்பதாலும், சுற்றுச் சூழலின் இயற்கைத் தன்மையின் நிலைபாட்டினை சேதப்படுத்தி உயிர்களின் வாழ்க்கை முறையையும் வெகுவாக சேதப்படுத்தும் என்பதாலும் மனுதாரரின் கோரிக்கையை நன்கு பரிசீலனை செய்து எடுத்த முடிவின்படி, **கொடைக்கானல் வட்டம், வார்டு பி, பிளாக் 21, நகரளவை எண் 5/2-ல் யூக்கலிப்டஸ் 215, பைன் 72, பெரி 80, சவுக்கு 63, ரப்பர் 5, குளோரியா 5 ஆக மொத்தம் 440 மரங்களை கீழ்க்கண்ட நிபந்தனைகளுக்குட்பட்டு வெட்டிக் கொள்வதற்கு தமிழ்நாடு மலைதள (ம.பா) சட்டம், 1955, பிரிவு 3(1)(சி)-ன் கீழ் அனுமதி வழங்கி உத்தரவிடப்படுகிறது.**

1. வெட்டப்படும் மரங்களுக்கு ஈடாக வெட்டப்பட்ட இனத்தைச் சேர்ந்த மரக்கன்றுகள், சம அளவில் மனுதாரரால் நடப்பட வேண்டும். அதன்பொருட்டு காப்புத் தொகையாக, வெட்ட அனுமதிக்கப்பட்ட ஒவ்வொரு மரத்திற்கும் ரூ.100/- அல்லது ஹெக்டேருக்கு ரூ.3000/- இதில் எது குறைவோ அதனை மரங்களை வெட்டுவதற்கு முன்னதாக கொடைக்கானல் மாவட்ட வன அலுவலரிடம் செலுத்த வேண்டும்.

2. அரசாணை நிலை எண் 102, சுற்றுச்சூழல் மற்றும் வனத்துறை,நாள் 3.9.2007-ல், தனியார் நிலங்களில் வளர்க்கப்படும் தடிமரங்களை மற்றொரு இடத்திற்கு எளியவகையில்

எடுத்துச்செல்வதற்கு வழிவகை செய்யும்பொருட்டு, பலா, நாவல், மூங்கில், வேம்பு, இலவம், மா, மலைவேம்பு, யூக்கலிப்டஸ் (கருப்புர மரம் தவிர) போன்ற 36 வகை மரங்களுக்கும், அரசாணை நிலை எண் 194, சுற்றுச்சூழல் மற்றும் வனத்துறை, நாள் 1.8.2012-ன்படி சில்வர் ஓக் மரத்திற்கும் , 1968-ம் ஆண்டைய தமிழ்நாடு டிம்பர் ட்ரான்ஸிட் விதிகளில் இருந்து விலக்களித்து அரசு உத்திரவிட்டுள்ளதால், மேற்சொன்ன அரசாணைகளில் கவரப்பட்ட மரங்களுக்கு, வனத்துறையிடம் அனுமதி படிவம்-2 (Form-II permit) பெறவேண்டியதில்லை.

3. மனுதார் தனக்கு மரங்களை வெட்டிக்கொள்ள வழங்கப்பட்ட அனுமதியின்பேரில், மரங்களை வெட்டி அப்புறப்படுத்திக்கொள்ள வேறு நபருக்கு பவர் பத்திரம் அளிக்கக்கூடாது. அவ்வாறு பவர் பத்திரம் அளித்துள்ளதாக தெரியவந்தால், இந்த அனுமதி எந்தவித முன்னறிவிப்புமின்றி ரத்து செய்யப்படும்.
4. மரம் வெட்ட அனுமதி பெற்றவர் மரங்களை வெட்டுவதற்கு முன்னதாக வனத்துறையினருக்கு தகவல் தெரிவித்து, அனுமதிக்கப்பட்ட மரங்களை முறையாக வரிசை முறையில் வரிசைக் கிரமமாக வெட்ட வேண்டும். மேலும், அனுமதி அளிக்கப்பட்ட மொத்த மரங்களையும் எந்தெந்த தேதிகளில் எத்தனை மரங்கள் வெட்டப்பட்டது என்பதற்கான பதிவேட்டினை பராமரித்து, வனத்துறையினர் மற்றும் வருவாய்த்துறையினர் தனிக்கையின்போது அதனை ஆஜர்படுத்த வேண்டும்.
5. மரங்களை வெட்டும் போது அருகிலுள்ள நிலங்களிலுள்ள நிலை மரங்களுக்கு(Standing trees) சேதம் உண்டாக்கக் கூடாது.
6. மரம் வெட்ட அனுமதிக்கப்பட்ட பகுதியிலிருந்து 400 மீட்டர் சுற்றெல்லைக்குள் ஏற்படக்கூடிய முறைகேடான மரவெட்டுக்கு மரம் வெட்ட அனுமதி பெற்றவரே பொறுப்பாவார். இத்தகைய முறையற்ற மரவெட்டு இருக்குமேயானால் மாவட்ட வன அலுவலர் விதிக்கும் இழப்பீடு அபராதத்தொகை செலுத்த மரவெட்டு அனுமதி பெற்றவர் ஆயத்தமாக இருக்க வேண்டும்.
7. மரம் வெட்ட அனுமதி பெற்றவர் தமது எல்லைக்கோட்டை சுற்றிலும் 2 மீட்டர் இடைவெளிவிட்டு தெளிவாக வைத்துக்கொள்ள வேண்டும்.
8. நிலப்பகுதியில் எல்லைப்புறங்களிலும், பலத்த காற்றிலிருந்து பாதுகாக்கும் பொருட்டு மரம் வெட்ட அனுமதி பெற்றவர் 5 வரிசை நிலைநிறுத்தும் மரங்களை தொடர்ந்து வைத்துக்கொள்ள வேண்டும்.
9. மேலே குறிப்பிட்ட பட்டா நிலங்களுக்கு அணுகுசாலை அமைக்க வனம் மற்றும் வருவாய்த்துறை வன நிலங்களில் அரசு அனுமதி வழங்கப்படமாட்டாது. மாவட்ட குழு முடிவின்படி மரங்களை வெட்ட அனுமதி உத்தரவில் குறிப்பிட்டுள்ள காலக்கெடுவிற்குள் அனுமதிக்கப்பட்டுள்ள மரங்களை வெட்டி அப்புறப்படுத்த வேண்டும். அவ்வாறு வெட்டி அப்புறப்படுத்தவில்லை எனில் மீண்டும் மாவட்டக் குழுவின் அனுமதி பெறவேண்டும்.
10. வெட்டப்பட்ட மரங்களுக்கு ஈடாக சமஅளவு மரக்கன்றுகள் நடுவதற்கு முன்னர் வேளாண்மைப் பொறியியல் துறையினரின் விபரக் குறியீட்டின்படி அடுத்து மேடை பற்றுச்சுவர் கட்டுதல் போன்ற மண்வளப் பாதுகாப்பு நடவடிக்கைகளை செயற்பொறியாளர் (வேளாண்மைப் பொறியியல்) மன நிறைவு கொள்ளும் வகையில் செய்து முடிக்க வேண்டும்.
11. அனுமதிக்கப்பட்ட மரங்களை வெட்டி மண்வளப்பாதுகாப்பு நடவடிக்கை முடிந்தவுடன் வெட்டப்படும் மரங்களுக்கு ஈடாக சமஅளவு மரக்கன்றுகள் நடப்பட வேண்டும். அவ்வாறு நடப்படவில்லையெனில், மனுதார் செலுத்திய காப்புத்தொகையினை அரசுக்கு பறிமுதல் செய்து, வனத்துறைசார்பில் கன்றுகள் நடப்படும்.
12. தமிழ்நாடு மலைப்பகுதி (மரங்கள் பாதுகாப்பு)விதிகள்,1957, விதி 9(4)-ன்படி, மரம் வெட்டிய தேதியில் இருந்து 3 வருடங்கள் கழித்தபின்னர், வைப்புத் தொகையினை திரும்பவும் மனுதாருக்கு வழங்குவதற்கு முன்னர் மாவட்ட மலைத்தளக் குழுவின் இசைவினை பெற வேண்டும்.

13. மரங்களை வெட்ட இவ்வானைகளின்படி விதிக்கப்பட்டுள்ள நிபந்தனைகளை மனுதார் செம்மையாக கடைபிடிக்கிறாரா என்பதையும், அனுமதிக்கப்பட்ட புல எண்களில் அனுமதிக்கப்பட்ட எண்ணிக்கையிலான மரங்களை மட்டும் மனுதார் வெட்டுகிறாரா என்பதற்கு உறுதிபடுத்திக் கொள்ளும்படி, கொடைக்கானல் மாவட்ட வன அலுவலர் கேட்டுக்கொள்ளப்படுகிறார். .இவ்வானையின் அடிப்படையில் மாவட்ட வன அலுவலர் பிறப்பிக்கும் ஆனைகளின் நகல் ஒன்று இவ்வலுவலகத்திற்கு தவறாமல் அனுப்ப வேண்டும்.

14. மரங்களை மீண்டும் உண்டாக்கும் பணியை ஆரம்பிக்கும் முன்னர் மரவெட்டு அனுமதி பெற்ற உரிமைதாரர் தேவையான அனைத்து மண் வளப் பாதுகாப்பு நடவடிக்கைகளை எடுத்துக் கொள்கிறாரா என்பதை வேளாண்மைப் பொறியியல் துறையினர் உறுதிசெய்திடவேண்டும்.

15. இந்த உத்திரவு 20 .10.2019 முதல் 15.02.2020 வரை மட்டுமே செல்லத்தக்கது. இந்த தேதிக்குப் பின்னர், மாவட்ட ஆட்சித் தலைவர் அவர்களிடம் கால அவகாசம் கோரி மனுச்செய்து உரிய அனுமதிபெறப்பட்ட பின்னரே, மரங்களை வெட்டவோ அல்லது வெட்டிய மரங்களை அப்புறப்படுத்தவோ வேண்டும்.

ஒம்/- மு.விஜயலெட்சுமி
மாவட்ட மலைதள (ம.பா)
குழுவின் தலைவர் மற்றும்
மாவட்ட ஆட்சித் தலைவர்,
திண்டுக்கல்.

/உ.ந.உ.ப/

கண்காணிப்பாளர் 21/10/19

பெறுநர்
மேலாளர்,
இந்துஸ்தான் யுனிலிவர் கம்பெனி,
செயின்ட்மேரிஸ் ரோடு,
கொடைக்கானல் 624 101

நகல்: வட்டாட்சியர், கொடைக்கானல்
நகல்: செயற்பொறியாளர் (வேளாண்மை பொறியியல்), திண்டுக்கல்
நகல்: மாவட்ட வன அலுவலர், கொடைக்கானல்

10.Advice from DFO on Security deposit

ந.க.எண்: 1182/2019/டி,

மாவட்ட வன அலுவலகம் (ம)
வனஉயிரின சரணாலயம்,
கொடைக்கானல்
நாள்: 04.11.2019.

8/11/19.
2.30pm

பொருள்- மரங்கள் - தமிழ்நாடு மலைதள (மரங்கள் பாதுகாப்பு சட்டம் 1955 - கொடைக்கானல் வட்டம், வார்டு பி, பிளாக் 21, நகரளவை எண்.5/2-ல் உள்ள 440 பலஜாதி மரங்களை வெட்டுவதற்கு மேலாளர், இந்துஸ்தான் யுனிலிவர் கம்பெனி, கொடைக்கானல் என்பவர் சார்பில் மனுச் செய்தது - ஆணைகள் வரப்பெற்றது - காப்புத் தொகை செலுத்துவது - தொடர்பாக.

பார்வை - 1) மேலாளர், இந்துஸ்தான் யுனிலிவர் கம்பெனி, கொடைக்கானல் மனு நாள்: 25.02.2019.
2) மாவட்ட ஆட்சித் தலைவர், திண்டுக்கல் எஸ்.ஆர்.எண். 66/2018/இ3, நாள்: 18.10.2019.

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மேற்காண் பார்வை 1ல் காணும் கடிதம் மூலம் கொடைக்கானல் வட்டம், வார்டு பி, பிளாக் 21, நகரளவை எண்.5/2-ல் உள்ள யூக்கலிப்டஸ் 215, பைன் 72, பெரி 80, சவுக்கு 63, ரப்பர் 5, குளோரியா 5 ஆக மொத்தம் 440 மரங்களை வெட்ட அனுமதி கேட்டு மேலாளர், இந்துஸ்தான் யுனிலிவர் கம்பெனி, கொடைக்கானல் அவர்கள் விண்ணப்பம் செய்ததை தொடர்ந்து பார்வை 2-ல் காணும் மாவட்ட ஆட்சித் தலைவர், திண்டுக்கல் அவர்கள் தமிழ்நாடு மலைதள (ம.பா) சட்டம் 1955 பிரிவு 3(1) (சி) -ன் கீழ் வார்டு பி, பிளாக் 21, நகரளவை எண்.5/2-ல் உள்ள யூக்கலிப்டஸ் 215, பைன் 72, பெரி 80, சவுக்கு 63, ரப்பர் 5, குளோரியா 5 ஆக மொத்தம் 440 மரங்களை வெட்ட அனுமதி வழங்கி உத்தரவு வழங்கப்பட்டுள்ளது.

அவ்வாணையில் வெட்டப்படும் மரங்களுக்கு ஈடாக, வெட்டபட்ட இனத்தை சேர்ந்த மரக்கன்றுகள் சமஅளவில் மனுதாரரால் நடப்பட வேண்டும். அதன் பொருட்டு காப்புத் தொகையாக அனுமதிக்கப்பட்ட ஒவ்வொரு மரத்திற்கும் ரூ.100/- அல்லது ஹெக்டேருக்கு ரூ.3000/- இதில் எது குறைவோ அதனை மரங்களை வெட்டுவதற்கு முன்னதாக கொடைக்கானல், மாவட்ட வன அலுவலரிடம் செலுத்த வேண்டும். தங்களது பட்டா நிலத்தில் 440 மரங்களுக்கு 440 x 100 வீதம் ரூ.44000/- அல்லது 8.10.50 ஹெக்டேருக்கு 8.10.50 x 3000 வீதம ரூ.24315/-. இவற்றில் குறைவான தொகை ரூ.24315/- காப்புத் தொகையாக கொடைக்கானல் அஞ்சலகத்தில் மாவட்ட வன அலுவலர் பெயரில் செலுத்தி பத்திரங்களை உடன் இவ்வலுவலகத்தில் சமர்ப்பிக்குமாறு அறிவுறுத்தப்படுகிறது.

ஒம்/-எஸ்.என்.தேஜஸ்வி
மாவட்ட வன அலுவலர்(ம)
வனஉயிரினகாப்பாளர்
வனஉயிரின சரணாலயம்
கொடைக்கானல்

பெறுநர்
மேலாளர், இந்துஸ்தான் யுனிலிவர் கம்பெனி, செயின் மேரிஸ் சாலை, கொடைக்கானல்.
//உ.ந.உ.ப//

5.11.19
கண்காணிப்பாளர்.

5.11.19

Scanned by CamScanner

11. District Forest Officer, Kodaikanal Tree cutting permission letter

Original Received by hand - 13/12/19 - 7PM by Mr. TM @ DFO office Kodaikanal

கொடைக்கானல் கோட்ட வன அலுவலரின் செயல்முறைகள்
முன்னிலை - திரு.எஸ்.எஸ்.தேஜஸ்வி, இ.வ.ப.,
மாவட்ட வன அலுவலர் (ம) வன உயிரின காப்பாளர்

ந.க.எண். 1182/2019/டி நாள். 13.12.2019.

பொருள் தமிழ்நாடு மலைப்பகுதி (மரங்களை பாதுகாப்பு) சட்டம் 1955 - கொடைக்கானல் வட்டம், வார்டு-பி, பிளாக்-21, நகரவரவை எண்.8/2-ல் உள்ள பட்டா நிலத்தில் உள்ள மரங்களை வெட்ட ஆணை வழங்க அனுமதி வழங்கியது - ஆணை வழங்குதல் - குறித்து.

பார்வை 1) மேலாளர், இந்துஸ்தான் யுனிலிவர் கம்பெனி, கொடைக்கானல் விண்ணப்பம் மனு நாள்.இல்லை.
2) மாவட்ட ஆட்சித்தலைவர், திண்டுக்கல் சி.பா.எண். 64/2013/இ3 நாள்.18.10.2019.

திண்டுக்கல் மாவட்டம், கொடைக்கானல் வட்டம், வார்டு-பி, பிளாக்-21, நகரவரவை எண்.8/2-ல் உள்ள மேலாளர், இந்துஸ்தான் யுனிலிவர் கம்பெனி, கொடைக்கானல் என்பவருக்கு சொந்தமான பட்டா நிலத்தில் உள்ள குங்குலியம் 215, பைன் 72, பேரி 80, சவுக்கு 63, ரப்பர் 5, குலோரியா 5 ஆகமொத்தம் 440 மரங்களை வெட்டுவதற்கு மாவட்ட ஆட்சித் தலைவர், திண்டுக்கல் அவர்களிடம் அனுமதி வேண்டியதற்கு தமிழ்நாடு மலைப்பகுதி (மரங்கள் பாதுகாப்பு) சட்டம் விதிகளின் படி பார்வையில் கண்ட மாவட்ட ஆட்சித் தலைவர் திண்டுக்கல் அவர்களின் செயல்முறை குறிப்பில் குறிப்பிடப்பட்ட நிபந்தனைகளின் படியும் கீழ்கண்ட நிபந்தனைகளின் படியும் தமிழ்நாடு மலைப்பகுதி (மரங்கள் பாதுகாப்பு) குழுவின் முடிவின் படியும் மேலும் கீழ்கண்ட நிபந்தனைகளின் படியும் அதிகபட்சம் முதிர்ச்சியடைந்த சுற்றளவு கொண்ட குங்குலியம் 215, பைன் 72, பேரி 80, சவுக்கு 63, ரப்பர் 5, குலோரியா 5 ஆகமொத்தம் 440 மரங்களை மட்டும் வெட்ட அனுமதிக்கப்படுகிறது.

1) ஐந்து வருட கால பொறுப்புத் தொகையான ரூ.25,000/-க்கான பணம் நிலக்கோட்டை அஞ்சலகத்தில் செலுத்தி கணக்கு புத்தகம் எண். 4642472300 மொத்தம் ரூ.25,000/-க்கு பத்திரம் சமர்பித்துள்ளார். இப்பத்திரம் காப்புத்தொகை பதிவேடு பக்க எண். 22 வ.எண். 10-ல் பதியப்பட்டுள்ளது.

நிபந்தனைகள்.

1) மரம் வெட்ட அனுமதி பெற்றவர் அனுமதிக்கப்பட்ட முதிர்ந்த மரங்களை மட்டும் முறையாக வரிசை முறையில் சம்பந்தப்பட்ட வனவர் முன்னிலையில் வெட்ட வேண்டும்.

2) அனுமதிக்கப்பட்ட மரங்களை மட்டும் **15.02.2020**-ம் தேதிக்குள் வெட்டி உரிய விதிப்படி அப்புறப்படுத்திக்கொள்ள வேண்டும்.

3) மரங்களை வெட்டும் போது அருகில் உள்ள நிலை மரங்களுக்கு சேதம் உண்டாக்கக் கூடாது. இவ்வாறு நேரிடுமாயின் பட்டாதாரர் மீது மலைவளப்பாதுகாப்பு சட்டத்தின் கீழ் வனக்குற்றம் பதிவு செய்யப்படும்.

4) மரம் வெட்ட அனுமதிக்கப்பட்ட பகுதியிலிருந்து 400 மீட்டர் சுற்றெல்லைக்குள் ஏற்படக்கூடிய முறைகேடான மரவெட்டுகளுக்கு மரம் வெட்ட அனுமதி பெற்றவரே பொறுப்பானவர். முறையற்ற மரவெட்டு இருக்குமானால் உரிய விதிகளின்படி மேல்நடவடிக்கை எடுக்கப்படும்.

5) மரம் வெட்ட அனுமதி பெற்றவர் தமது எல்லைக்கோட்டை சுற்றிலும் 2 மீட்டர் இடைவெளியில் புதர்களைச் சுத்தம் செய்து எல்லைக்கோட்டை தெளிவாக வைத்துக் கொள்ள வேண்டும்.

6) நிலப்பகுதியில் மண் அரிமானத்தைத் தடுக்கும் வகையிலும், இயற்கை எழிலைப்பாதுகாக்கும் வகையிலும் பிரதான சாலையையொட்டிய பகுதியில் மரம் வெட்ட அனுமதி பெற்றவர் 5 வரிசைகள் நிலை மரங்களை தொடர்ந்து வெட்டாமல் வைத்துக் கொள்ள வேண்டும்.

7) மரங்களை வெட்ட அனுமதிக்கப்பட்ட கால அளவிற்கு மேல் கால நீட்டிப்பு வழங்கப்படமாட்டாது.

8) மேலே குறிப்பிட்டுள்ள பட்டா நிலங்களுக்கு, வனம் மற்றும் வருவாய்த்துறை நிலங்களில் அணுகு சாலை அமைக்க அனுமதி வழங்கப்படமாட்டாது.

9). கட்டிடம் மற்றும் தளவாடச்சாமான்கள் செய்ய உபயோகமாகும் மரக்கட்டை மற்றும் எரிபொருளாகப் பயன்படும் மரங்களை பொதுவாக தமிழ்நாட்டுக்கு அப்பால் எடுத்துச் செல்ல கூடாது வெட்டுப் பொருட்கள் அனைத்தும் தமிழ்நாட்டில் மட்டுமே விற்பனை செய்ய வேண்டும்.

10) மாவட்ட கமிட்டியினால் விதிக்கப்பட்ட நிபந்தனைகளின்படியும், உச்ச நீதிமன்ற தீர்ப்பு 202/95 படியும், வெட்டப்பட்ட மரங்களுக்கு ஈடாக உரிய காலத்திற்குள், *TAMIL NADU HILL AREAS (PRESERVATION OF TREES) RULES 1957, Rule No. 9(1) (i) & b*-ன்படி மரக்கன்றுகளை மரம் வெட்டப்பட்ட அதே இடத்தில் (வார்டு-பி, பிளாக்-21, நகரவரைவ எண்.8/2-ல்) நட வேண்டும். தவறும் பட்சத்தில் அதன் பொருட்டு மேற்கொள்ளப்படும் அனைத்து சட்டரீதியான நடவடிக்கைகளுக்கும் கட்டுப்பட வேண்டும் என்றும் தெரிவிக்கப்படுகிறது.

11) மாவட்ட ஆட்சி தலைவர் அவர்களின் உத்தரவில் கண்ட நிபந்தனை எண்.17ல் குறிப்பிட்டுள்ள படிவத்தில், பதிவேடு பராமரித்து இதனை அலுவலர்கள்/ பணியாளர்களின் தணிக்கைக்கு எந்த நேரமும் ஆஜர்படுத்த வேண்டும்.

12) அனுமதிக்கப்பட்ட மரங்களை தவிர வேறு மரங்களை வெட்டக்கூடாது.

13) தரை மட்டத்திலிருந்து 15 செ.மீ உயரத்திற்குள் மரங்களை வெட்ட வேண்டும். அடுத்து வரும் தணிக்கையில் இது சரிபார்க்கப்படும்.

14) விலக்கு அளிக்கப்பட்ட மரவகைகள் தவிர இதர வெட்டுப் பொருட்களை முறையான அனுமதிச் சீட்டின் பேரின் தான் கொண்டு செல்ல வேண்டும். விறகுகளை 1 மீட்டர் உயரம் 1 மீட்டர் நீளம் 1 மீட்டர் அகலம் என்ற முறையில் அட்டி போட வேண்டும். வெட்டுப் பொருட்களின் அளவுகளுடன் அனுமதிச்சீட்டு வேண்டி சம்பந்தப்பட்ட வனச்சரகருக்கு விண்ணப்பம் செய்ய வேண்டும். உரிய தணிக்கைக்கு பின்னரே அனுமதிச்சீட்டுகள் வழங்கப்படும்.

15) மரம் வெட்டப்பட்ட இடத்தில் மேற்படி இன மரங்களை உச்ச நீதிமன்ற தீர்ப்பு 202/95-ல் கண்டபடி நடுவதைத் தவிர மேற்படி இடங்களை மலைத்தோட்டப்பயிர் சாகுபடி அல்லது மாற்று விவசாயம் செய்யப் பயன் படுத்தக் கூடாது.

16) மரங்களை வெட்டி எடுத்துச் செல்ல, தமிழ்நாடு மரம் எடுத்துச் செல்லும் விதி 1968 ஐத் தவறாது கடைப்பிடிக்க வேண்டும். மரங்களை எடுத்துச் செல்ல வெட்ட அனுமதிக்கப்பட்ட காலத்திற்குள் தனியாக விண்ணப்பிக்க வேண்டும்.

17) உச்ச நீதிமன்றத்தீர்ப்பு 202/95 தவறாது பின்பற்றப்பட வேண்டும். இல்லாத பட்சத்தில், உச்ச நீதிமன்ற அனுமதிப்பு வழக்கிற்கு ஆளாக வேண்டும்.

18) மேற்படி புலத்தில் வெட்டு வேலைகள் ஆரம்பிக்கும் முன் புல எல்லைகள் சரியாக வரையறுத்து தெளிவாக தெரியும் வகையில் வெள்ளை/பெயிண்ட் அடித்து, வெட்டு வேலைகள் முடியும் வரை அழியாமல் பாதுகாக்க மனுதாரர் கேட்டுக்கொள்ளப்படுகிறார்.

19) மேலே விவரிக்கப்பட்ட நிபந்தனைகளை கடைப்பிடிக்க தவறினால் அனுமதி ஆணைகள் விலக்கிக் கொள்ளப்படும் என்றும், அதன்மீது மேற்கொள்ளப்படும் அனைத்து நடவடிக்கைகளுக்கும் மனுதாரரே பொறுப்பாவார் என தெரிவிக்கப்படுகிறது.

ஒம்-எஸ்.என்.தேஜஸ்வி
மாவட்ட வன அலுவலர் (ம)
வன உயிரின காப்பாளர்,
வன உயிரின சரணாலயம்,
கொடைக்கானல்

பெறுநர்

மேலாளர், இந்துஸ்தான் யுனிலிவர் கம்பெனி, கொடைக்கானல்,
செயின்மேரீஸ் சாலை, கொடைக்கானல்.

நகல். மாவட்ட ஆட்சித்தலைவர், திண்டுக்கல்.
நகல். உதவி வனப்பாதுகாவலர், வனப்பாதுகாப்புப்படை, திண்டுக்கல்.
நகல். உதவி வனப்பாதுகாவலர், கொடைக்கானல்
நகல். வனச்சரக அலுவலர், கொடைக்கானல்.

இவர் அனுமதிக்கப்பட்ட மரங்களை மட்டும், அனுமதிக்கப்பட்ட இடத்தில் வெட்டுகிறாரா? என்பதையும், வேறு ஏதேனும் ஒழுங்கீனங்கள் ஏற்படுகின்றனவா என்பதையும் கண்காணித்து ஒழுங்கீனம் ஏற்படாமல் தக்க நடவடிக்கை எடுக்க வேண்டியது. ஒவ்வொரு முறை லாரியில் மரங்கள் ஏற்றும் போது அனுமதிக்கப்பட்ட மரக்கட்டைகள் தவிர இதர மர வகைகள் ஏற்றப்படுகிறதா என்பதை தக்க பணியாளரை வைத்து கண்காணிக்கவும், அனுமதி சீட்டு தேவைப்படாத இம்மரவகைகளுக்கு லாரிக்கு 8 டன்னுக்கு மேல் பாரம் ஏற்றாமல் கண்காணிக்கவும் சரகருக்கு அறிவுரை வழங்கப்படுகிறது.

ஒம்-எஸ்.என்.தேஜஸ்வி
மாவட்ட வன அலுவலர் (ம)
வன உயிரின காப்பாளர்,
வன உயிரின சரணாலயம்,
கொடைக்கானல்

/உண்மை நகல்/உத்தரவுப்படி/

கண்காணிப்பாளர்.

13/12/2019

12.Hindustan Unilever Limited Letter on completion of tree felling

Hindustan Unilever Limited

Hindustan Unilever Limited
St. Mary's Road,
Kodaikanal - 624 101.

Tel : +91 (0) 4542 241098
Fax : +91 (0) 4542 241288
Web: www.hul.co.in
CIN : L15140MH1933PLC002030

19th February, 2020

The Chairman,
Tamil Nadu Hill Area (Preservation of Trees) Committee,
Dindigul District,
Tamil Nadu

Through: The Secretary, Tamil Nadu Hill Area (Preservation of Trees) Committee, Dindigul

Dear Madam,

Sub: Cutting of trees at our factory site in preparation for soil remediation - Reg

Ref: 1. Proceedings of the Chairman of Dindigul District Hill Area (Preservation of Trees) Committee and the District Collector , No.SR.66/2019/C3 dt. 18.10.2019
2. Permission for tree cutting from the District Forest Officer, No.1182/ 2019/D dt. 13.12.2019

This is in reference to the permission granted by the Chairman of Hill Area (Preservation of Trees) Committee and the District Collector, dt. 18.10.2019 and the District Forest Officer, Kodaikanal dt.13.12.2019 for cutting 440 trees at our factory site in preparation for soil remediation. A copy of above referred letters are attached herewith and marked as Annexure 1 and Annexure 2.

We would like to inform you that we have carried out tree cutting adhering to the conditions stipulated in the above referred letters. We have commenced tree cutting on 2nd January 2020 and completed on 31st January 2020. We have cut 425 trees as against 440 tress for which permission was granted (Eucalyptus 205 out of 215, Savukku 61/63, Pine 69 /72, Berry 80/80, Grolia 5/5, Rubber 5/5, Totalling 425 trees out of 440 trees). The balance 15 trees could not be cut since they are near electrical installation and civil structures. If any need arises later while undertaking soil remediation, we will seek your approval for removal of trees.

Further, we would like to submit that the logs of the cut trees are not removed but stored at our site. Tree trunk and branches of the cut trees are sized and stacked within our premises. We are required to remove the cut trees from the site before 15th February 2020 as per the permission granted to us. As you are aware, soil remediation at our site is undertaken following the directions from the Tamil Nadu Pollution Control Board (TNPCB). Clearance from the TNPCB is required for removal of material from our site. We will submit an application to the Hill Area (Preservation of Trees) Committee for removal of logs of the cut trees from our factory after receiving clearance from the TNPCB.

We are committed to re-plant the trees at our site after soil remediation is completed.

Thanking you,

Yours sincerely,

For Hindustan Unilever Ltd,

R. John George,
Factory Manager.

Enclosure : As above.

Copy to : The District Forest Officer,
Kodaikanal.

13.Report of CSIR – National Environmental Engineering Research Institute, Nagpur

Site Assessment of Pambar Shola and Pambar River in the Down Gradient Direction of the Mercury Contaminated Site of Hindustan Unilever Ltd. Closed Thermometer Factory, Kodaikanal

CSIR- National Environmental Engineering Research Institute
Nehru Marg, Nagpur – 440 020

August 2021

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1.0 Introduction

A mercury thermometer manufacturing factory at Kodaikanal was set up by Ponds India Ltd. in 1983. The factory commenced production in January 1984, and it came under the management of Hindustan Unilever Limited (HUL) in September 1998, consequent upon the merger of Ponds India Ltd. with HUL. The factory was a 100 % export oriented unit. The clinical thermometers manufactured were mainly exported to the countries such as Australia, Europe, South America and USA. The factory produced around 9 million thermometers per year, and about 165 million pieces were exported between 1984 and 2001.

Detection of glass scrap with residual mercury at a scrapyard at Moonjikal, Kodaikanal and the consequent mercury contamination issues and regulatory actions led to the closure of the factory operations in March 2001. Remedial measures were initiated by HUL immediately, which included (i) retrieval of glass scrap with residual mercury from the scrapyard, (ii) environmental site assessment and risk assessment of mercury, (iii) construction of silt traps to prevent discharge of contaminated soil from the factory site, (iv) comprehensive medical examination of employees, and (v) export of all mercury bearing materials such as glass scrap, finished and semi-finished thermometers, elemental mercury, and effluent treatment plant (ETP) sludge totalling about 290 metric tons (MT) to M/s Bethlehem Apparatus, USA with prior consent and approval of Tamil Nadu Pollution Control Board (TNPCB) and Ministry of Environment, Forest and Climate change (MoEF&CC).

The Supreme Court Monitoring Committee (SCMC) on hazardous waste management visited the HUL factory site in September 2004 and directed the Tamil Nadu Pollution Control Board (TNPCB) to take immediate steps towards assessment and remediation of mercury-contaminated areas. The SCMC also directed the TNPCB to involve CSIR-National Environmental Engineering Research Institute (CSIR-NEERI), Nagpur during the assessment and remediation of mercury-contaminated areas. Keeping in view of the directive of SCMC, the TNPCB requested CSIR-NEERI, Nagpur, to get associated with the studies on decontamination of the machineries, equipment and materials and

remediation of soil and biomass contaminated with mercury. TNPCB also directed HUL, to finalize the proposals for decontamination of plant and machinery and remediation of mercury-contaminated areas in consultation with CSIR-NEERI. The decontamination and disposal of plant and machinery were completed in 2006 under the guidance of CSIR-NEERI.

CSIR-NEERI prepared a detailed document "Protocol for Remediation of Mercury contaminated site at HUL Thermometer Factory, Kodaikanal (February 2007)". The protocol delineated the approach, methodology, and technical aspects to be considered during the remediation of mercury-contaminated areas at the site. The protocol recommended soil washing followed by thermal retorting for treating the contaminated soils. It also envisages that treatment of impacted soils shall be carried out within the facility itself, with the treated soils backfilled on the site, once the remediation criteria have been met. The protocol was submitted to TNPCB for approval. The Protocol was reviewed by the Scientific Experts Committee (SEC) constituted by the SCMC. Based on SEC recommendations, the TNPCB set a remediation criterion of 20 mg/kg for the site with a 95 % confidence level to be implemented with none of the treated soils to exceed 25 mg/kg.

The proposed technology for remediation of mercury-contaminated soil consists of soil washing to selectively concentrate elemental mercury into the fine soil fraction, followed by vacuum thermal retorting of the fine soil fraction. The Detailed Project Report (DPR) was presented to the TNPCB and the SEC. The TNPCB approved the DPR on the recommendation of the SEC. Further, the remediation standard was set to 20 mg/kg by TNPCB based on further study and additional inputs.

Following the approval from TNPCB, pilot-scale soil remediation trials were undertaken at the site between August and November 2017. Based on the results of the soil remediation trials, and the discussions held in the meeting TNPCB/ SEC in November 2017, the TNPCB/ SEC directed HUL to submit a "Soil Remediation Upscaling Plan" that details the soil remediation activities to be undertaken at the site. The TNPCB granted permission to HUL in June, 2018 for soil remediation to the remediation standard of 20 mg/kg. Further, the

TNPCB order granting permission was challenged in NGT. However, the NGT in its order dated 01 November 2018 cleared remediation of the contaminated site to the SSTL of 20 mg/kg. In addition, the NGT ordered to carry out a detailed offsite assessment in the down gradient of the HUL site *viz.* Pambar Shola to ascertain the extent of contamination, and if required to conduct an Ecological Risk Assessment study. The NGT order was challenged in the Supreme Court. After hearing the matter, the Supreme Court dismissed the petition and thereby clearing the soil remediation to the SSTL of 20 mg/kg.

CSIR- NEERI has been associated with HUL site remediation work, on the direction of SCMC. Hence, CSIR-NEERI was assigned to conduct the offsite assessment in compliance with the NGT order dated 01 November 2018.

2.0 Scope of the Study

The NGT in its order dated 01 November 2018 directed HUL to clean up the mercury-contaminated site to the SSTL of 20 mg/kg, and also to carry out offsite assessment study in Pambar Shola. The relevant portion of NGT order is reproduced verbatim.

i. "*To permit remediation of mercury contaminated soil in the premises of closed thermometer factory and its adjoining areas to the recommended remediation target level of 20 mg/kg (total mercury) with valid authorization from Tamil Nadu Pollution Control Board.*

ii. *Considering the reported environmental impacts in Pambar Shola river in the down gradient direction of closed thermometer factory, it is proposed that a detailed site assessment be carried out to ascertain the extent of contamination and if required, an ecological risk assessment study also be carried out.*"

2.1 Objectives

1. To carry out site reconnaissance survey in Pambar Shola forest area and Pambar river.
2. Develop a grid/transect based sampling plan and collect representative samples of soil, tree bark, lichen, moss, leaves, bush, and grass across the Pambar Shola forest area. Develop a zone-based sampling plan and collect representative samples of river water, soil, sediment, and receptor species such as lichen, moss, algae and fish along the Pambar river.
3. Analysis of environmental and receptor species samples for total mercury.
4. To compare the observed mercury concentrations with the applicable screening standards (Tier I) as per the Ministry of Environment, Forests & Climate Change (MoEF & CC) guidance document on contaminated site assessment (2015).
5. To assess the need for undertaking an Ecological Risk Assessment study.

3.0 Study Area

3.1 HUL Mercury Contaminated Site

The HUL owned closed thermometer factory site (hereafter referred to as HUL site) is located in the hill station of Kodaikanal, Dindigul district, Tamil Nadu. The area forms part of Palani Hills, the easternmost part of Western Ghats and covered under Survey of India toposheet Nos. 58 F/8 and 58 F/12. The HUL site is located at an elevation of approximately 2,180 m above mean sea level (amsl), and the annual mean temperature ranges between 8 and 24 °C. The area receives an annual rainfall of about 1650 mm. The HUL site is irregular in shape and occupies an area of approximately 85,000 m^2. The southern boundary of the site slopes steeply into the reserved forest called Pambar Shola. A narrow access path, called "Levinge path" (named after the then Collector of Madurai), runs parallel to the site's southern boundary. This path lies immediately above the precipitous slopes and is primarily on bedrock with only a thin veneer of soil. The general land use to the north and east of the site is largely low density private residential properties along Saint Mary's Road.

Kodaikanal Lake is located 500 m north of HUL site, but within a different catchment area.

The access road to the HUL site, St. Mary's Road, forms the drainage divide between the Pambar river sub-catchment to the south, which includes the factory site, and the Kodaikanal Lake catchment to the north. Drainage across the site is primarily *via* a small stream, which originates at the north-eastern corner of the site and flows in a southwest direction and falls in the Levinge path, traverses about 300 m, and joins the Pambar river.

The Pambar river, locally called Levinge stream, originates from the reservoir located about 4 km west of the HUL site. It flows approximately 300 m south of the HUL site boundary and flows in a south-east direction through the dense forest Pambar Shola, part of Kodaikanal Wildlife Sanctuary, and reaches the Periyakulam plains. Pambar river has several waterfalls, notable ones are Vattakanal falls, situated about 1.5 km upstream side, and Kumbakarai falls, situated about 15 km south of HUL site in the downstream side. The Pambar Shola ends at Kumbakarrai falls and thereafter, the river flows through the plains and forms several distributaries that feed a series of tanks. The mainstream joins with Varahanathi, a tributary of Vaigai river at Periyakulam. The Varahanathi joins with Vaigai river, about 10 km after Vaigai Dam. The length of Pambar river is about 25 km, out of which it traverses about 15 km through Pambar-Shola forest area. The location map of the study area is given in Figure 1.

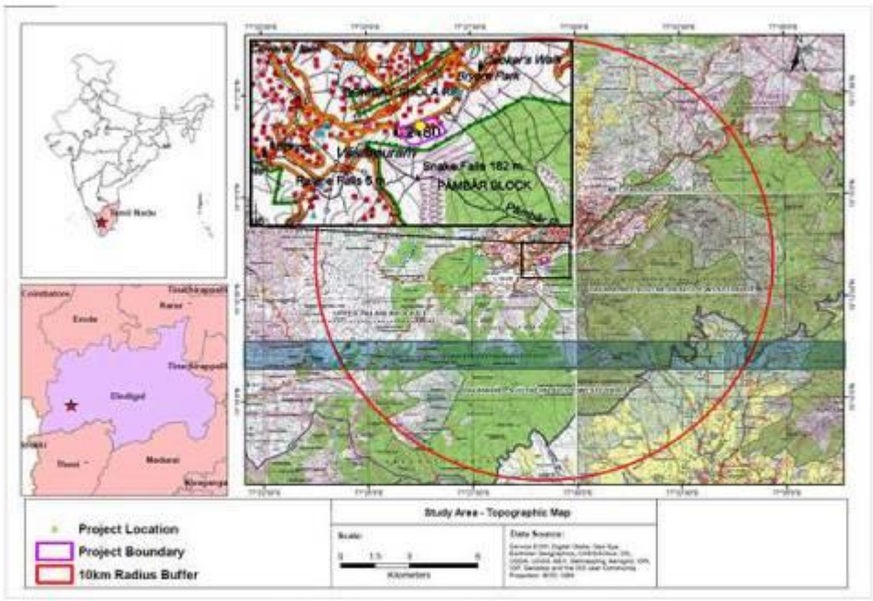

Figure 1: Location Map of the Study Area

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3.1.1 Site Geology

The whole site is underlain by shallow Archaean bedrock, mainly granite gneiss and charnockite, which is impermeable apart from limited fracture porosity, related to vertical and sub-horizontal joints and exfoliation joints in the uppermost weathering profile. The soil profile is very shallow, comprises a few centimetres of predominantly sandy material in the upper part of the site, grading down into densely vegetated peaty soils in the south. The maximum thickness of soil across the site varies between 1.5 and 3.0 meters. Two shallow dug wells are present in the HUL site, where groundwater occurs under unconfined to semi-confined conditions. Groundwater is generally available in these wells throughout the year.

3.2 The Sholas – An Overview

Shola forests are a characteristic feature of the Western Ghats. They are found in the Anamalais, Nilgiris and Palani hills of Tamil Nadu and in the high ranges of Kerala and Karnataka. From the bio-geographical point of view, the Nilgiris hills form an important component of the southern Western Ghats complex. Altitude, climate and rainfall have combined to make the Sholas a particularly rich habitat for plants and animals. A Shola is an evergreen forest of the Western Ghats, located along the streams and are in hollows and surrounded by large tracts of Savanna. The Sholas are low forest of the plateau, which protects the hill slopes from erosion and conserves the springs and water sources.

3.2.1 General Characteristics

Southern montane wet temperate forests are generally referred to as Sholas under the classification 11A/C1 by Champion and Seth (1968). Sholas have unique vegetation and are important from the point of phytogeographic studies. The streams that originate in the sholas form the lifeline of the villages of the Upper Palnis as well as important source of irrigation in the plains. Hence, these Shola forests are valuable, and their preservation is of great importance. Sholas harbour and houses many micro and macro faunas that have a complex food web and constitute a fragile ecosystem. The Sholas are generally confined

to the sheltered valleys, glens, hollows and depressions owing to their fastidiousness as regards to soil moisture (Ranganathan, 1938).

3.2.2 Factors Governing the Distribution of Sholas

Shola patches occur as a rule at the heads of streams in the folds of converging slopes, concave inclinations and depressions caused by landslips on the slopes of the hills. The Sholas require an adequate amount of soil moisture for their growth. A dense layer of humus in varying stages of decomposition overlying a black soil of loose texture with a high proportion of organic matter is the characteristic feature of Sholas. This, in turn, increases the soil water content by holding up the water received by precipitation and preventing too rapid runoff.

Shola forests are distributed from 1,500 m to 2, 550 m altitude, where the rainfall varies from 1,000 to 7,500 mm per annum. The actual quantity of rainfall is not a determining factor, but the temperature and soil moisture play a vital role for its sustenance. Shola species are shallow-rooted to the maximum of 90 cms even where the soil depth is more. Shola species grow on all kinds of soils of Nilgiris irrespective of their chemical and mechanical composition, exhibiting a very wide tolerance. The underlying rocks are Archaen igneous origin consisting of minerals such as silica, feldspar, muscovite and biotite with small amount of accessory ferromagnesium minerals. The Shola soils are rich in organic matter, and the soil pH ranges from 4.13 to 5.34.

3.2.3 The Palanis

The Palanis are an Eastern offshoot of the Western Ghats with roughly 65 km East-West with a maximum height of around 2,200 m above mean sea level (amsl) in Kodaikanal. Because of the geographical position, this mountain range gets the benefits of both the South-West and North-East monsoons. The indigenous vegetation of the Palani hills consists of Sholas and grasslands. These Sholas once occupied the undulating plateau over 75 % of the Upper Palanis (Srivastava, 2001). In Kodaikanal, Sholas generally commence at about 1500 m and ascend to the summit of the ranges. These forests have the richest assemblage of evergreen trees, forming a close canopy. Most of the

trees attain a height of 20-30 m, and at higher altitudes, the trees are stunted. There is a gradual change in the composition of Shola vegetation in the Palanis. Some of the notable branched trees are *Rhododendron nilagiricum*, *Gaultheria fragrantissima*, *Vaccinium leschenaultii*, *V. nilgherrense*, *Turpinia nepalensis* and shrubs *viz. Ulex europenus*, *Cytisus scoparius*, *Eupatorium glandulosum*, *Sarothamus scoparius* and *Rubus ellipticus* are common in Sholas of Kodaikanal (Bir and Chantha, 1987). Important characteristics of Sholas in Palanis are given in **Table 1**.

Table 1

Important Characteristics of Sholas in the Palanis (Srivastava, 1999)

Sl. No	Characteristics/Trees	Area (hectares)
1	Total extent of the shola under good shola vegetation	2,366.92
2	Area under partially degrades sholas	886.11
3	Area under degraded sholas	1,569.40
4	Total area under grassland and swamps, rocks etc.	18,799.71
5	Wattle	7,720.51
6	Pine	1,872.73
7	Blue gum	624.44
8	Other Eucalyptus species	4,414.10
9	Other miscellaneous species	2,574.56
	Total	**17,188.34**

The Sholas and grasslands of Palani hills safeguard the watershed of the Amaravathi and Vaigai basins. The grasslands retain 3% of the rainwater, whereas the flora of Sholas packed with decaying leaves and due to its richness in humus, retain 33% of the rainwater. Through sponge action, they release the retained water gradually. When this thick mat of the soil profile is destroyed, it leads to instant runoff accompanied by soil erosion and floods in the Palanis. **Table 2** gives the details of Sholas in the upper Palanis in Tamil Nadu.

Table 2

List of Sholas in the Palanis and their Details (Subbarayalu, 1997)

Sholas	Elevation (m)	Area (ha)
Bear shola	2,065	22.00
Berijam	2,100	177.00
Blackbourne shola	1,700	9.46
Gundar shola	2,100	120.00
Mannavanur	1,980	70.00
Pambar shola	1,920	618.00
Vembadi	2,500	4.00

3.2.4 Pambar Shola

Pambar Shola, a reserve forest of the Tamil Nadu forest department, is home to some of the most threatened and endemic species of flora and fauna. It is the largest Shola of the Palanis and has an aerial extent of 618 ha. While some species have close relatives only in the evergreen of northeast India or southeast Asia, some others are found nowhere else in the world.

3.2.5 Floral Diversity

Pambar shola comprises 56 different species of plants like trees, shrubs and herbs, which plays a vital role in ecological balance. Pambar Shola is home to about 17 species of plants on the red data list (threatened species) that are found only in these forests and not anywhere else in the world.

3.2.6 Avifaunal Diversity

Almost all the high altitude endemics of the Western Ghats are seen in Pambar Shola. Interestingly, the threatened and endemic Nilgiri Wood-Pigeon *Columba Elphinstonii*, which was rare during the 1980s, has now become quite common and found to breed in these Shola patches. No decline has been observed in other endemic species, including *White-bellied Shortwing, Brachypteryx major* and Nilgiri Flycatcher *Eumyias albicaudata*,

which is evident from their common occurrence in the gardens and campuses of Kodaikanal town. From the Bombay Natural History Society (BNHS) ringing data of the last 30 years, it was found that the Black-and-Orange Flycatcher *Ficedula Nigrorufa* and White-bellied Shortwing from neighboring forest patches (Poombarai) have shown a steady increase in the total bird catch since the 1970s. However, the Nilgiri *Pipit Anthus nilghiriensis* has decreased, mainly due to the plantation of exotic trees in Shola grasslands (Balachandran et al. 2003). Of the 16 restricted-range species of the Western Ghats (Stattersfield et al. 1998), seven have been reported from this Important Bird and Biodiversity Area (IBA).

3.2.7 Faunal Diversity

The major predators are the Tiger *Panthera tigris* and Leopard *Panthera pardus* but the sightings of these two predators have become rare in these sholas due to human disturbance. Barking Deer *Muntiacus muntjak* is the commonest ungulate. The Gaur *Bos frontalis* and Wild Boar *Sus scrofa* population show increase. Wild Dog *Cuon alpinus* and Sambar *Cervus unicolor* have decreased. Indian Giant Squirrel *Ratufa indica* is found in all suitable forest patches. The Bonnet Macaque *Macaca radiate* has increased to pest proportion as tourists feed the animals.

4.0 Methodology

A team of CSIR-NEERI scientists, which include Contaminated Site Assessment Experts and Forestry Experts conducted the offsite reconnaissance survey with the permission of the Principal Chief Conservator of Forest, and Chief Wildlife Warden, Chennai and District Forest Officer, Kodaikanal during September-October 2020 (Premonsoon) and March 2021 (Postmonsoon).

The offsite assessment in Pambar-Shola was planned based on the information collected from previous studies, data collected from District Forest Office, Kodaikanal, toposheets etc., on the extent of the Pambar Shola, its flora and fauna etc. Broadly, the study encompasses two key ecosystems, *viz.* Pambar watershed and Pambar Shola. Since, the Pambar river flows through the

Pambar Shola (hence the name), the Shola and other forest areas collectively form the Pambar watershed. Accordingly, the assessment of the two ecological units were carried out simultaneously.

4.1 Methodology Adopted for Sampling

4.1.1 Forest Sampling Methodology

Pambar-Shola is a dense forest and most of the areas are inaccessible. Further, considering the steep slopes and presence of wild animals, transect sampling method was followed. The trekking path from Shenbaganur to Kumbakarai falls (about 15 km length) is the only accessible way to the Pambar Shola. This transect runs parallel to Pambar river with a maximum distance of about 7 km from Shenbaganur, and slowly it converges towards Kumbakarai falls. Sampling locations were selected close to the river. Forest samples were collected from 44 locations and consist of soil, lichen, moss, grass, bush/leaves and tree bark. Soil samples were composite of 5 grab samples collected from an area of 2 × 2 m from each site. All samples were collected in zip-lock bags, preserved in ice boxes and brought to the lab for analysis. Details of samples collected from Pambar Shola forest area are given in the **Table 3,** and sampling locations in Pambar Shola forest area shown in **Figure 2.**

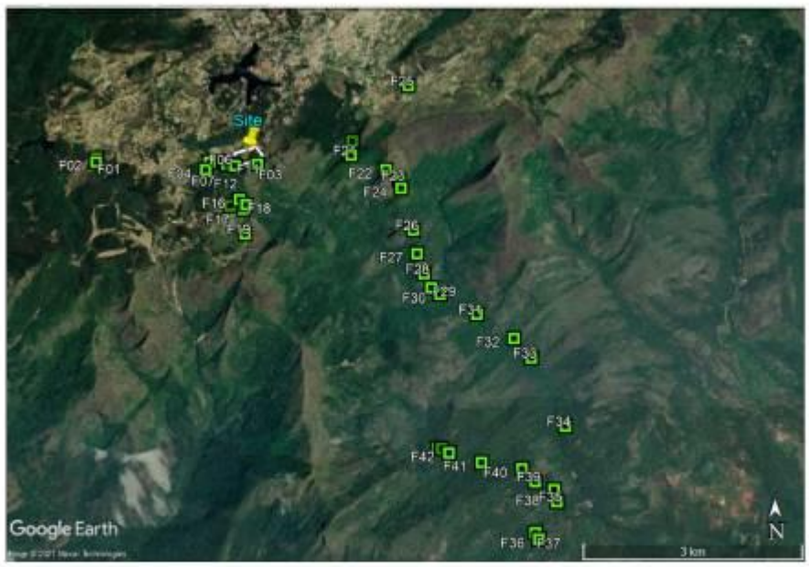

Figure 2: Sampling Locations in Pambar Shola Forest Area

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Table 3

Number of Samples Collected from Pambar-Shola Forest Area

Sl. No	Matrix	Pambar Shola
1	Soil	44
2	Bark	44
3	Lichen	41
4	Moss	31
5	Leaf	44
6	Bush	4
7	Grass	27

4.1.2 Pambar River

The entire stretch of Pambar river, *i.e.* from the origin to its confluence point with Varaghanathi river, and further to the confluence point of Vaigai river, has been divided into three zones *viz.*

- Zone-I: origin of Pambar river to HUL factory site approx. 5 km upstream i.e. (sampling locations R2 to R6),
- Zone-II: HUL factory site to Kumbakarai falls (~15 km), (sampling locations R7 to R 14), and
- Zone-III: Kumbakarai falls to the confluence point with Varaganathi and further to the confluence point of Vaigai river (~15 km) (sampling locations R 15 to R 23).

The Pambar river stretch, after the meeting point of HUL factory stream outlet, runs through a very steep valley (about 800 m depth), hence this middle stretch is not accessible (about 7 km downstream of HUL site). From each sampling location, water, sediment, algae, river bank soil, lichen, and moss samples were collected.

Samples of water were collected from the main current of the river in glass bottles directly from the undisturbed water flow. Glass bottles were rinsed thrice

with a portion of river water before collection. Samples were acidified on site using 1 ml ultrapure nitric acid (1:1) to pH <2.

Soil samples were collected from the river bank at a depth of 0-10 cm, after removing surface debris and dried leaf, if any. From each sampling point, soil samples were collected from an area of 2 × 2 m, one from each corner and one from the centre. The five grab samples were composited at site, and the composited sample was packed in zip-lock bags, preserved in iceboxes and brought to the lab for analysis.

Sediment samples were collected using Van-Veen sediment grab sampler/scoop. Sediment samples were collected from each site, drained to reduce water content, packed in zip-lock bags, preserved in ice boxes, and brought to the lab.

Algae samples were collected from the river sampling points based on their availability. Lichen and moss samples were collected from the trees close to river flow. Lichen, moss and algae samples were packed in zip-lock bags at the site immediately, kept in ice boxes and brought to the lab for analysis. Details of samples collected from Pambar river watershed are given in **Table 4,** and the sampling locations along Pambar river shown in **Figure 3.**

4.1.3 Fish Sampling

Fish population is generally less in Pambar river. Only small fishes of length 3-5 cm were spotted in select places, where flow of water is slow. Fishes were caught using folded cloths and brought live to the camp by keeping them in water-filled polythene bags. From each site 5 to 10 fishes were caught and the weight of fishes ranged between 10-15 g. Subsequently, they were preserved in dry ice, packed in icebox and sent by courier to CSIR-NEERI, Nagpur for analysis.

4.1.4 Sample Preservation

Water samples were collected in 250 ml glass bottles with PTFE cap liner and were preserved on site with the addition of 1 ml of 1:1 suprapure HNO_3 to pH <2. Samples were not filtered as total mercury content was desired. Samples

were kept in ice box with ice packing and shipped to CSIR-NEERI, Nagpur for analysis. Similarly, soil, sediment, algae, lichen, moss, bush/leaves, grass samples were packed in zip-lock bags, kept in ice boxes and shipped to CSIR-NEERI for analysis.

Table 4

Number of Samples Collected from Pambar River Watershed

Sl. No	Matrix	Pambar River	
		Premonsoon	Postmonsoon
1	Water	23	23
2	Soil	23	23
3	Sediment	22	22
4	Moss	4	10
5	Algae	8	8
6	Fish	–	7

'–' Indicates 'no sample collected'

Figure 3: Sampling Locations along Pambar River

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5.0 Sample Preparation for Mercury Analysis

5.1 Soil and Sediment

Soil and sediment samples were prepared according to US EPA method 3050 B. Samples were air-dried in a clean room and homogenized thoroughly to < 2 mm size. An aliquot of 1 g of sample was taken in a clean 250 ml beaker, and 10 ml of 1:1 HNO_3 was added and digested in a hot plate at 80-85 ºC for 2 h. The contents were cooled, and 2 ml of deionized water and 3 ml of H_2O_2 were added. The solution was digested for another 2 h, and volume reduced to 2 ml. The contents of the beaker were cooled to room temperature and made up to 100 ml using 0.1 % HNO_3 prepared in 18 mΩ.cm ultrapure water. Blank samples were prepared in the same way with pure sand, which was previously digested with HNO_3 and found to have no detectable mercury content. Results are reported on dry weight basis.

5.2 Bark, Lichen, Moss, Leaves, and Grass Samples

Lichen, moss, leaves, grass and bark samples were prepared according to the method of ICP vegetation survey (2015) and other published methods (Lodenius and Tulisalo, 1995). Lichen and moss samples were cleaned to remove the root portion, and samples were rinsed with deionized water. Samples were dried in oven at 60 ºC to remove moisture completely. The dried samples were ground using mortar and pestle, homogenized and a 0.2 g portion was digested at 95 ºC with 1.5 ml of HNO_3 and 0.5 ml of H_2O_2, for about 2 h till a clear solution was obtained. Results are reported on dry weight basis.

5.3 Water Samples

Water samples were digested with HNO_3 + HCl by following US EPA method 200.8. To a 100 ml portion of well mixed water sample, 2 ml of 1:1 ultrapure HNO_3 and 1 ml of 1:1 HCl were added and digested on hot plate at 80-85 ºC for about 2 h till the volume is reduced to 20 ml. The contents were cooled and diluted to 50 ml with deionized water.

5.4 Fish Samples

Fish samples were thawed at room temperature and washed with tap water and then with deionized water. Since the size of the fishes were very small, after the removal of scales and fins, the whole fish was further processed. Samples were oven dried at 70-80 ºC, homogenized and digested by the method of Yan et al. (2010). A 1.0 g portion of homogenized fish sample was weighed into 100 ml volumetric digestion flask and a mixture of 10 ml HNO_3–H_2SO_4 (7:3) was added. The mixture was then digested at 95 ºC for about 3-4 h until the solution was clear. The sample solution was then cooled and diluted to 100 ml with deionized water. Moisture content was determined in another portion of the sample and the results are reported as wet weight basis.

5.5 Instrumental Analysis

Total mercury in all the samples were determined by ICP-MS (Perkin Elmer, Nexion 300, ICP-MS) following US EPA method 6020 A. The instrument was optimized as per manufacturer's instructions. External calibration standards were prepared in the range of 5- 25 µg/l and the instrument was optimized for maximum sensitivity. Calibration blank and sample blanks were run before sample analysis.

5.6 Quality Control and Quality Assurance

Stringent Quality Control and Quality Assurance (QA/QC) procedures were followed during sample collection, sample preparation and instrumental analysis. Blank samples were run between every 10 samples. Spiked samples were run for every 20 samples and the recovery of added spikes were in the range of 85-110 %.

Three soil certified reference materials *viz.* CRM021-100G (4.70±0.179 mg/kg), sandy loam soils CRM 043-50G (22.4±0.889 mg/kg), CRM025-50G (99.80±10.7 mg/kg), were used and the obtained values were in the range of 75-115 %. Method detection limits (MDL) and limit of quantitation (LOQ) were calculated from the corresponding blank results as 3 and 10 standard deviations i.e. 3σ and 10 σ, respectively. Results below the LOQ were reported

as "not detected (ND)". However, for statistical calculations, 'ND' was replaced by MDL/2 values. **Table 5** gives MDL and LOQ of different matrices.

Table 5

Method Detection Limit and Limit of Quantitation of Different Sample Matrices

Sl. No	Sample matrix	Method detection limit (MDL) mg/kg or mg/l	Limit of quantitation (LOQ) mg/kg or mg/l	Replacement value used for statistics mg/kg or mg/l
1	Water	0.0009	0.0030	0.0004
2	Soil/Sediment	0.0030	0.0100	0.0015
3	Lichen, Moss, Leaf, Bush, Algae	0.0024	0.0080	0.0012
4	Bark	0.0015	0.0050	0.0007
5	Fish	0.0020	0.0066	0.0010

6.0 Screening Standards and Guidelines

Most of the developed countries have established guideline values/screening criteria (called by various terms, depending on the country; Intervention Value (Netherlands), Guideline Value (UK) Soil Environmental Quality Guideline (Canada), Regional Screening Level (US)) for contaminants to allow the regulator to determine whether a site is potentially contaminated or not and poses a risk to human and/or ecological receptors. A brief discussion of standards used across the world are given below.

6.1 Dutch Soil Remediation Circular

The 'Dutch Ministry of Public Housing, Land-use and Environmental Guidelines - Soil and Groundwater Standards' framework is described in the Soil Remediation Circular (2000). They are risk-based standards wherein the contaminants are subdivided into two categories *viz.* Target values ('T') and Intervention values ('I'), depending upon the concentrations and classified as follows:

- The target values indicate the level at which there is sustainable soil quality. It represents the background concentration of a chemical constituent in uncontaminated soils. Target values give an indication of the benchmark for environmental quality in the long term on the assumption of negligible risks to the ecosystem. However, Target values are not clean-up criteria standards.
- Intervention values define sites where some form of intervention is required. Exceeding an Intervention value is taken to indicate significant soil contamination, which may have a serious impact on human health and/or the environment, depending upon the presence of sensitive receptors. Intervention values are a trigger for the assessor to investigate further whether the concentrations of the contaminant of concern pose a human and/ or ecological risk. Exceedance of an Intervention value does not necessitate remediation, and the general approach adopted by Dutch/ Canadian standards is to undertake a site specific risk assessment.
- The Dutch Intervention Value for mercury in soil is 36 mg/kg.
- The Dutch Intervention Value for mercury in sediment is not specified.
- The Dutch Intervention Value for mercury in surface water is 0.3 ug/L.

Currently there are no guidelines for mercury in vegetation matrices such as bark, moss, lichen, leaf, bush, and grass.

6.2 Canadian Environmental Quality Guidelines

Canadian Environmental Quality Guidelines (EQGs, CCME, 1999) are defined as numerical concentrations or narrative statements that are recommended as levels that should result in negligible risk to biota, their functions, or any interactions that are integral to sustaining the health of ecosystems and the designated resource uses they support. The EQGs have evolved to address the protection of atmospheric, aquatic, and terrestrial resources, including air quality, marine water quality, marine and freshwater sediment quality, tissue quality for the protection of wildlife, aquatic life, and soil quality for agricultural, residential/parkland, commercial, and industrial land uses.

EQGs need not to be considered as blanket values for national environmental quality. Variations in environmental conditions will affect environmental quality in different ways. Therefore, the users of EQGs may need to consider local conditions and other supporting information (e.g., sites specific background concentrations of naturally occurring substances) during the implementation of EQGs. Exceedance of EQGs does not signify immediate intervention/remediation, but the Canadian guidelines typically recommend a risk assessment to be undertaken so that regulators will take appropriate interventions.

- The Canadian Soil Quality Guideline (SQG) for the protection human health is 6.6 mg/kg for agricultural and residential/ parkland use. The SQG for environmental health is 12 mg/kg for agricultural, residential and parkland land use. However, if one were to undertake a Tier I screening of the Pambar Shola analytical data with respect to environmental health, the screening guideline in that case would be 12 mg/kg.
- The Canadian screening standard for mercury in sediment is 0.486 mg/kg.
- The Canadian screening standard for mercury in surface water is 0.026 µg/l.

Currently, there are no guidelines for mercury in vegetation matrices such as bark, moss, lichen, leaf, bush, and grass.

6.3 USEPA Screening Levels

The United States Environmental Protection Agency (USEPA, 2021) Screening Levels (SLs) are risk-based contaminant concentrations derived from standardized equations combining exposure information assumptions with USEPA toxicity data. These are generic tables for individual contaminants in air, drinking water and soil. Regional Screening Levels (RSLs) are considered by the USEPA to be protective for humans (including sensitive groups) over lifetime period. They were developed to standardize and accelerate the evaluation and cleanup of contaminated soils and were primarily focussed on identifying and defining areas and contaminants. At sites where the contaminant concentration is below SL, no further action is warranted, and

when it exceeds the SL, further assessment or investigation involving receptor species is required.

- The USEPA screening standard for mercury in soil is 11 and 46 mg/kg for resident and industrial soils, respectively.
- The USEPA screening standard for probable effect concentration of mercury in sediment is 0.486 mg/kg.
- The USEPA maximum contaminant level (MCL) for mercury in tap water is 2.00 ug/L.

6.4 MoEF & CC Guidelines

The Ministry of Environment, Forest, and Climate Change, through a detailed assessment (undertaken by a renowned Global Environmental Consultancy) of guidelines and screening criteria adopted by other countries, have adopted the Canadian SQGs as a proxy screening criteria for India, in the absence of any country specific guidelines (MoEF, 2012). The same guidelines have also been used in the MoEF&CC (2015) document "Inventory and Mapping of Probably Contaminated Sites in India". Therefore, in the present study, the Canadian SQGs have been primarily used, although we have also screened the mercury monitoring data against other conservative screening standards set out in the USEPA Regional Screening Levels and the Dutch Intervention Standards.

- The MoEF&CC screening level for mercury in soil is 6.6 mg/kg.
- The MoEF&CC screening level for waste water discharge into surface water bodies is 0.010 mg/l.
- The BIS limit for drinking water quality is 0.001 mg/l.

7.0 Risk Assessment Methodology

7.1 Risk Assessment Based on Screening Level

A key component of sustainable environmental management is a risk-based approach focused on whether or not site related impacts pose unacceptable current or likely future risks to critical species residing on the site or near the site. The risk-based approach incorporates a tiered approach with the

completion of screening level based (Tier 1), and quantitative site-specific risk assessment (Tier 2) that inform decision making regarding further actions.

7.2 Screening Level Tier I Risk Assessment

Tier 1 screening, is the first step in a tiered risk-based site assessment approach to help narrow down the range of contaminants requiring further assessment or remediation. The screening level (Tier 1) assessment will provide an evaluation of the potential risks and the need for further assessment.

A screening level Tier 1 risks assessment includes comparison for site characterisation data (e.g. soil) to established national or international risk-based screening levels. In addition, background concentrations can be an important part of a screening level (Tier 1) risk assessment as risk-based standards are based on generic understanding of fate and transport modelling and laboratory toxicity testing. This approach for developing screening levels often results in the calculation of screening levels that are below background level and do not account for ecological and receptors that can develop that cannot be accounted for laboratory conditions. Accordingly, a robust screening level Tier 1 risk assessment consider both risk-based criteria and background concentrations.

Typically, available risk-based criteria and/or background data are limited to soil. Therefore, a screening level risk assessment is typically limited to assessing measured soil concentrations against relevant screening levels and/or background concentrations.

7.3 Tier II Risk Assessment

If a screening level Tier 1 indicates impact greater than risk-based screening levels, a Tier 2 risk assessment may be warranted. A Tier 2 ecological risk assessment will be developed considering these key elements:

- Ecological Survey and Identification of Representative Ecological Receptors
- Identification of Significant Dietary Exposure Pathways

- Site Soil and Biota Sampling
- Contaminant fate and transport information (e.g. mobility, plant uptake)
- Critical or at-risk habitats present at the Site.
- Identification of Assessment Endpoints
- Exposure Assessment
- Receptor-Specific Exposure Parameters
- Exposure Dose Calculation
- Ecological Toxicity Reference Values
- Ecological Risk Characterization

8.0 Results and Discussion

8.1 Pambar-Shola Forest Area

The mercury analysis results of soil, bark, lichen, moss, leaves, and bush samples collected from Pambar Shola forest area are given in Annexure I.

8.1.1 Concentration of Mercury in Soil

Mercury concentrations in 44 soil samples collected from the Pambar shola forest area ranged between ND and 0.950 mg/kg, with an average concentration of 0.141 ± 0.241 mg/kg. Mercury concentrations of all the soil samples were less than the MoEF&CC guideline value of 6.6 mg/kg, for residential/agricultural purposes. Further, the soil mercury concentrations did not exceed the Canadian soil quality guideline value of 12 mg/kg for Environmental Health. Summary of soil mercury concentrations, and screening levels are given in **Table 6**.

Table 6
Summary of soil mercury concentrations from Pambar-Shola and applicable screening values

Soil	Hg concentration, Range (mg/kg)	Hg, mean concentration ±SD (mg/kg)
Pambar Shola	ND – 0.950	0.141±0.241
MoEF&CC Screening levels	6.6	
Canadian Guideline value	6.6	
Dutch Intervention Value	36	
USEPA	40	

SD: standard deviation; ND: not detected

8.1.2 Concentration of Mercury in Bark, Lichen, Moss, Leaves, Bush, and Grass Samples

Vegetation in the forest area are important receptor species exposed to mercury in air, soil and water. Species of lichen and moss are good indicators of atmospheric mercury concentration. Trees generally store heavy metals in bark; hence, tree bark is a matrix for several heavy metal contamination studies, including mercury. Though age, and inter species differences influence accumulation levels, observed mercury levels can be useful for ecological risk assessment. The concentration of mercury found in lichen, moss, leaf, bark and grass samples collected from Pambar Shola are given Annexure I. Summary of mercury results of Pambar Shola are given in **Table 7**.

Table 7

Summary of vegetation samples collected from Pambar Shola

	Lichen	Moss	Leaf	Bush	Bark	Grass
Pambar Shola samples Range (mg/kg)	ND–0.528	ND–0.250	ND–0.065*	0.095-0.227	0.067-0.736	ND#
Mean±SD (mg/kg)	0.044 ±0.086	0.050 ±0.065		0.159 ±0.059	0.200 ±0.119	

SD: standard deviation; ND: not detected
* Only two values were above detection limit, hence average and standard deviation were not calculated; # all sample results are ND

In general, the concentrations of mercury in the vegetation samples collected from the Pambar Shola, are less than 1 mg/kg. There are no guideline values/standards for mercury levels in vegetation samples.

In lichens, mercury ranged between ND and 0.528 mg/kg, the highest concentration was reported from a location (F 44) on Vellakavi to Kumbakarai footpath, about 6 km south of Vellakavi village. All bark samples had low concentration of mercury ranging between 0.067-0.736 mg/kg. Leaf samples generally reported below the detection limit. Moss samples of Pambar Shola showed almost similar distributions i.e. ND–0.250 mg/kg; mean 0.050 ±0.065 mg/kg. Bush samples from Pambar Shola had similar mercury levels, indicating no appreciable enrichment in bush species.

Overall, the mercury accumulation levels and patterns indicate, relatively low concentrations of mercury in vegetation samples, with no exceedance of 1.0 mg/kg in any of the species.

8.2 Pambar River Watershed

8.2.1 Concentration of Mercury in Water Samples

Concentration of total mercury in water, sediment, soil, moss, algae collected from Pambar river during pre and postmonsoon periods are given in Annexure II and III. Summary of total mercury concentration in water samples and applicable screening standards are given in **Table 8**.

Table 8

Summary Results of Water Samples Collected from Pambar River

	Hg concentration Range (mg/l)	Hg Average Concentration ± SD (mg/l)
River water (premonsoon)	ND	–
River water (post monsoon)	ND	–
Levinge Pathway (premonsoon)	ND	–
Levinge Pathway (postmonsoon)	ND	–
MoEF&CC guideline value for discharge into surface water bodies	0.010 mg/l	
BIS 10500:2012, Drinking water standards	0.001 mg/l	
Canadian Guideline value	0.000026 mg/l	
Dutch Intervention Value	0.0003 mg/l	
USEPA Regional Screening Level (MCL)	0.002 mg/l	

SD: standard deviation; ND: not detected; MCL: maximum contaminant level; BIS: Bureau of Indian Standards

During the premonsoon period, twenty-three were samples were collected from the Pambar river and all samples had mercury below the detection limit and reported as "not detected". During postmonsoon period also, all river water samples had mercury below detection limit. The samples collected from HUL factory stream discharge point (R 01) showed "ND", during pre and postmonsoon periods. This indicates, the concentration of mercury in all the water samples were less than the applicable screening standards (MoEF&CC and BIS; USEPA RSL's). The screening levels of CCME and Dutch Standards are lower than the detection limits of the analytical methodology followed in this study (0.0009 mg/l, cf. Table 5).

8.2.2 Concentration of Mercury in Fish Samples

The concentration of total mercury in the seven fish samples collected from various locations of Pambar river ranged from 'not detected' (ND) in three

sample to 0.009 mg/kg (Table 9). As per the FSSAI (2011) guideline, the concentration of mercury in fish should not exceed 0.5 mg/kg. All the fish samples reported total mercury concentrations below this limit.

Table 9

Concentration of Mercury in Fish Samples

Sl. No	Sample Code	Location GPS		Location	Mercury (mg/kg) wet weight basis
		North	East		
1	F 01	10.08.517	77.33.232	Pambarru river down stream at Chota Dam - Vatta Pallam	0.008
2	F 02	10.10.782	77.31.856	Kumbakarai main falls	0.009
3	F 03	10.10.836	77.31.796	50 m above from Kumbakarai main falls	0.007
4	F 04	10.10.926	77.31.778	50 m further above from F 04	ND
5	F 05	10.11.403	77.31.249	Near bridge (Vellakavi trekking path to Kumbakarai - R 09	0.008
6	F 06	10.08.802	77.32.921	Pambarru river - Near Temple (R - 18)	ND
7	F 07	10.10.379	77.32.267	Kumbakarai falls - Kartar village (Kila Vadagarai) (R - 11)	ND

ND: not detected

8.2.3 Concentration of Mercury in Soil Samples

The results of soil samples collected from river bank as well as river sediments during pre and post monsoon periods are given in Annexures II & III. Summary statistics of soil mercury levels, and applicable screening levels are summarized in the following **Table 10**.

Table 10

Summary of Soil Samples Collected from Pambar River

	Hg concentration Range (mg/kg)	Hg Average Concentration ± SD (mg/kg)
Pambar river (premonsoon)	ND–0.966	0.082 ± 0.205
Pambar river (post monsoon)	ND–0.340	0.031±0.086
Levinge Pathway (premonsoon)	4.700	–
Levinge Pathway (postmonsoon)	0.438	–
MoEF&CC Screening levels	6.6 mg/kg	
Canadian SQG for human health	6.6 mg/kg	
Canadian SQG for environmental health	12.0 mg/kg	
Dutch Intervention Value	36 mg/kg	
USEPA	40	

SD: standard deviation; ND: not detected

Table 10 indicates, the premonsoon soil mercury concentrations ranged between ND and 0.966 mg/kg, with an average of 0.082 ± 0.205 mg/kg, whereas the postmonsoon mercury concentrations ranged between ND and 0.340 mg/kg, with an average concentration of 0.031 ± 0.086 mg/kg. All the soil samples collected along the Pambar river, during both the pre and post-monsoon sampling periods were below the MoEF&CC screening criteria of 6.6 mg/kg.

The soil sample collected near HUL Site stream discharge point on the Levinge pathway, had mercury concentration of 4.700 mg/kg during premonsoon, whereas the postmonsoon period concentration was 0.438 mg/kg. This variation could be due to the heterogeneous nature of the contamination. The mercury concentration of soil from Levinge path location, is slightly elevated, but less than MoEF&CC screening level of 6.6 mg/kg. On perusal of DPR and the Soil Remediation upscaling plan, this area has already been included in

remediation plan. Therefore, the soils form this area may be removed during the remediation phase of the project and treated at the site.

8.2.4 Concentration of Mercury in Sediment Samples

River sediments buildup contaminants transported by river water over a period of time. Sediment mercury levels more than the guideline values pose risk to sediment dwelling organisms and other aquatic flora and fauna. Summary of sediment mercury concentrations, and screening levels are given in **Table 11**.

The sediment mercury concentrations during the premonsoon season was in the range of ND–0.412 mg/kg; average 0.076 ± 0.104, and that during the post monsoon season was ND–0.256 mg/kg; average 0.019 ± 0.059 mg/kg. Mercury concentrations in the sediment samples collected from Levinge pathway were 0.099 mg/kg during the pre-monsoon season and 0.015 mg/kg during the post monsoon period. Of the twenty-three sediment samples collected both during the premonsoon and postmonsoon season all sediment samples were reported at concentrations less than the most conservative screening criteria of the Canadian Guidelines of 0.486 mg/kg. Given the low concentration of mercury in the sediment samples not exceeding the Canadian guidelines, no/negligible risk is expected for sediment dwelling organisms.

Table 11

Summary of Sediment Samples Collected from Pambar River

	Hg concentration Range (mg/kg)	Hg Average Concentration ± SD (mg/kg)
Pambar river (premonsoon)	ND– 0.412	0.076 ± 0.104
Pambar river (post monsoon)	ND– 0.256	0.019 ± 0.059
Levinge Pathway (premonsoon)	0.099	–
Levinge Pathway (postmonsoon)	0.015	–
MoEF&CC guideline value for sediment	Not specified	
Canadian Guideline value	0.486 mg/kg	
Dutch Intervention Value	Not specified	
USEPA	0.486 mg/kg	

SD: standard deviation; ND: not detected

8.2.5 Concentration of Mercury in Moss and Algae Samples

Moss species are good indicators of atmospheric pollutants, including mercury. From the river sampling sites, four moss samples were collected and the mercury concentration in these samples ranged between 0.02 and 6.36 mg/kg. The highest concentration of 6.36 mg/kg was reported from the moss sample collected from the HUL stream discharge point (R 01). During postmonsoon season, mercury levels in moss samples were in the range of ND–1.148 mg/kg and the highest concentration was reported from the HUL stream discharge point. Summary of moss and algae samples collected from Pambar river is given in **Table 12**.

Table 12

Summary of Moss and Algae Samples Collected from Pambar River

Sl No	Type of Sample	No. of Samples		Concentration Range (mg/kg)		Average ± SD (mg/kg)	
		Pre	Post	Pre	Post	Pre	Post
1	Moss	4	10	0.022–6.360	ND–1.148	1.697±3.113	0.212±0.375
2	Algae	8	8	ND–1.200	0.028–0.083	0.155±0.422	0.045±0.017

SD: standard deviation; ND: not detected; 'Pre' and 'Post' indicate premonsoon and postmonsoon, respectively.

During premonsson, algae samples collected from 8 locations in Pambar river showed mercury concentration in the range of ND–1.2 mg/kg. During postmonsoon, mercury in algae ranged between 0.028–0.083 mg/kg. During postmonsoon, algae were absent in the HUL site discharge point. No enrichment of mercury was observed in moss and algae samples in the downstream direction.

9.0 Requirement of Detailed Risk Assessment of Pambar Shola

The process of ecological risk assessment is conducted in phases with the progression to a subsequent phase based on the outcome of the previous phase indicating a potential risk that warrants further assessment.

For the mercury-contaminated HUL site, a Tier I Risk Assessment was originally undertaken in by URS Dames & Moore (2002). However, the SCMC directed TNPCB to undertake a Site Specific Risk Assessment at the site (which is also known as a Tier II Risk Assessment) for determining the remediation standard. A Risk Assessment was originally undertaken by NEERI in 2006. This Site Specific Risk Assessment included a Tier III probabilistic Risk Assessment to determine the ultimate remedial criteria to be adopted for the site remediation. Thereafter, a validation of Site Specific Risk Assessment was undertaken by the Indian Institute of Technology (IIT), Delhi, in 2010, as decided by TNPCB based on the concerns raised by a few stakeholders. The IIT Delhi report (2010) also carried out Risk Assessment study on ecological receptors such as sparrows and quails.

The MoEF&CC (2012) adopted the Canadian Soil Quality Guidelines for determining soil contamination status at sites across India, thereby bringing in the Canadian Soil Quality Guidelines (for Human Health and Environmental Health) for the site investigation and risk assessment.

All these lines of evidence consider the phases of comparison of site data to generic ecological screening level (CCME[1]) as well as to the SSTLs.

9.1 Canadian Council of Ministers of the Environment (CCME) Screening Level

The first stage of risk assessment is typically the comparison of site data to existing guidelines. The Canadian Council of Ministers of the Environment (CCME) have established an ecological screening level of 12 mg/kg that is protective for direct exposures of ecological receptors to the soil. In this study, the data has been screened against the more protective Canadian Soil Quality Guideline for the protection of Human Health (6.6 mg/kg).

9.2 Site Specific Target Levels

An ecological risk assessment was conducted by IIT, Delhi in 2010 to derive ecological target soil values that were protective of ecological species dietary exposure to mercury, due to uptake of mercury from soil into biota (e.g. plants, insects etc.). The assessment identified the avian receptors quail and sparrow would be the most sensitive ecological receptor for dietary exposures. The assessment considered exposure to soil, insects and earthworms. The assessment modelled the uptake of mercury from soil into insects and earthworms. The soil targets were calculated to be 36 mg/kg and 22 mg/kg for the quail and sparrow, respectively. The Risk Assessment is considered to be very conservative (an order of magnitude is estimated) as it has purposefully omitted the ratio of the contaminated area to the home range of the species for the direct soil exposures.

9.3 Pambar Shola/ River Soil Data Comparison

Comparison of soil mercury concentration of Pambar Shola and Pambar river of this study with the screening levels CCME and IIT Delhi showed that all the soil samples were within the SSTL or CCME SQG for environmental health or the more conservative CCME SQG for Human Health. A summary of the data with comparison to the CCME and IIT soil levels are presented in Table 13.

Table 13

Summary of Pambar Shola/ River Soil Mercury Concentrations (mg/kg)

Total No. of Soil Samples	Pambar Shola and Pambar river Soil mercury concentration					Soil Risk Based Levels (mg/kg)	
Samples	Not Detected	Detected	Min (mg/kg)	Max (mg/kg)	95% UCL (mg/kg)	CCME	IIT
90	42	48	0.014	4.700	0.396[2]	6.6	22.4

UCL: Upper confidence limit; CCME: Canadian Council of Ministers for Environment; IIT: Indian Institute of Technology, Delhi

The mercury concentrations in all soil samples are all below the CCME and IIT soil criteria. The risk-based levels consider both direct toxicity of mercury in soil to ecological receptors and dietary exposure of mercury due to bioaccumulation within the food chain. Regulatory agencies such as US EPA (2007), EPA-Australia (2007) etc. use the 95 % upper confidence level (UCL) of the mean to estimate the probable risk to receptors. The 95 % UCL of soil mercury concentration of Pambar Shola and Pambar river is 0.396 mg/kg, which is over an order of magnitude less compared to CCME SQG of 6.6 mg/kg.

10.0 Conclusions

Based on the off-site assessment study undertaken and the mercury monitoring data, the following conclusions are drawn.

Pambar Shola Forest

- Samples of soil, bark, lichen, moss, bush, grass and leaves were collected from 44 locations from Pambar Shola forest area and analyzed for total mercury.

[2] The 95 percent upper confidence limit (95% UCL) of the mean provides a better estimate of the long term average ecological receptor exposure to soil. The 95% UCL was calculated using the USEPA ProUCL statistical software.

- The mercury concentrations in soil samples collected across the Pambar Shola forest were below the MoEF&CC guideline value of 6.6 mg/kg and the CCME SQG of 12 mg/kg for the protection of human and environmental health, respectively.
- The mercury concentrations in vegetation samples such as bark, lichen, moss, bush, grass and leaves collected across the Pambar Shola forest area are generally less. There is no visible evidence of distress to vegetation, flora and fauna was noticed.

Pambar River

- Samples of water, sediment, algae, fish and river bank soil, lichen, and moss, were collected from 23 locations both pre and post monsoon periods from the entire 25 km stretch of Pambar river and analyzed for total mercury.
- All water samples collected from Pambar river showed mercury below detectable levels.
- The concentrations of mercury in soil samples were low and less than 1.0 mg/kg during pre and postmonsoon periods, with the exception of the location at the Levinge path. All soil mercury concentrations are below the MoEF&CC guideline value of 6.6 mg/kg.
- All sediment samples from Pambar river showed mercury below the Canadian Guidelines of 0.486 mg/kg.
- Mercury concentrations in lichen, moss, algae and fish samples were less and did not show appreciable enrichment.

Risk Assessment

- Screening level based Ecological Risk Assessment (Tier 1) of soil, sediment and water indicated no/negligible risk to flora and fauna, as the observed concentrations are far less than the screening levels.
- Based on the offsite field observations, sampling and analysis, Tier I Screening Level Risk Assessment, and review of the previous Risk Assessment studies, it is observed that HUL site is not likely to pose any off-site ecological risks, particularly to the ecologically sensitive Pambar Shola forest area.

- In conclusion, considering the recommendations of international regulatory agencies, the weight of evidence on the current and past mercury monitoring data, and the screening standards, a further detailed risk assessment of the Pambar Shola is not deemed necessary.

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Annexure I

Results of total mercury in samples collected from Pambar Shola Forest Area

Sl. No	Sample Location	Location Code	Latitude	Longitude	Soil mg/kg	Bark mg/kg	Lichen mg/kg	Leaf mg/kg	Bush mg/kg	Grass mg/kg	Moss mg/kg
1	Saleth Madha Church behind	F 01	10.13.393	077.28.970	0.084	0.197	ND	ND	-	-	0.017
2	Levinge Path - factory fencing starting	F 02	10.13.366	077.28.080	0.053	0.274	0.084	ND	-	ND	0.191
3	LP - towards eastern side 150 m from factory stream outlet	F 03	10.13.346	077.29.322	0.095	0.409	0.025	ND	-	ND	0.081
4	From Vattakanal falls towards eastern side	F 04	10.13.305	077.28.924	0.117	0.325	0.039	ND	0.095	-	0.119
5	Vattakanal falls - before Lion Cave - River bank	F 05	10.13.352	077.28.986	0.098	0.243	0.135	ND	-	ND	0.105
6	50 m towards Northern side from F 06	F 06	10.13.346	077.29.089	0.142	0.099	ND	ND	0.186	-	0.073
7	50 m towards Eastern side from F 06	F 07	10.13.363	077.28.953	0.086	0.267	ND	ND	-	ND	0.159
8	From Vattakanal falls to 30 m uphill	F 08	10.13.370	077.29.029	0.097	0.402	0.101	ND	-	ND	-
9	Pambar shola 100 m from factory fencing	F 09	10.13.361	077.29.074	0.283	0.133	0.075	ND	-	ND	0.101
10	From Levinge Path 100 m downhill	F 10	10.13.350	077.29.135	0.077	0.195	0.143	ND	0.126	-	0.071
11	Further 50 m down	F 11	10.13.335	077.29.150	0.950	0.498	0.076	0.012	-	ND	0.114
12	Towards eastern side downhill to falls side	F 12	10.13.341	077.29.127	0.145	0.190	0.025	ND	-	ND	0.046

Sl. No	Sample Location	Location Code	Latitude	Longitude	Soil mg/kg	Bark mg/kg	Lichen mg/kg	Leaf mg/kg	Bush mg/kg	Grass mg/kg	Moss mg/kg
13	Towards southern side from factory fence (Church back side) towards falls	F 13	10.13.356	077.29.071	0.431	0.248	0.024	ND	0.227	-	0.019
14	Upper side of Vattkanal falls - Shurbudin compound down path	F 14	10.13.030	077.29.115	0.017	0.139	0.017	ND	-	ND	0.250
15	Downhill towards falls from F 14	F 15	10.13.067	077.29.172	0.128	0.248	0.059	ND	-	ND	ND
16	Another 50 m down closed Lion Cave	F 16	10.13.077	077.29.187	0.088	0.736	0.080	ND	-	-	0.077
17	Shurbudin Compound End	F 17	10.13.004	077.29.219	0.850	0.196	0.072	ND	-	-	ND
18	New view point - 50 m from Shurbuin house	F 18	10.13.038	077.29.238	ND	0.181	ND	ND	-	ND	ND
19	Near Dolphin Nose	F 19	10.12.817	077.29.233	0.015	0.147	0.017	ND	-	ND	-
20	Shenbaganur to Kumbakari trekking path - 1 km down	F 20	10.13.522	077.30.062	ND	0.188	ND	ND	-	-	0.021
21	50 m downhill from R 20 - trekking path	F 21	10.13.414	077.30.044	0.035	0.210	0.047	ND	-	-	ND
22	Further 100 m downhill	F 22	10.13.303	077.30.311	0.253	0.242	0.043	ND	-	-	ND
23	Further 100 m downhill	F 23	10.13.222	077.30.414	0.027	0.287	ND	ND	-	-	ND
24	Further 100 m downhill	F 24	10.13.161	077.30.428	ND	0.165	0.019	ND	-	-	ND
25	Further 125 m downhill towards south	F 25	10.12.949	077.30.485	0.155	0.194	0.024	ND	-	ND	ND
26	Further 100 m downhill towards south	F 26	10.12.844	077.30.522	ND	0.109	ND	ND	-	-	0.079

Sl. No	Sample Location	Location Code	Latitude	Longitude	Soil mg/kg	Bark mg/kg	Lichen mg/kg	Leaf mg/kg	Bush mg/kg	Grass mg/kg	Moss mg/kg
27	Further 100 m downhill towards south	F 27	10.12.664	077.30.549	0.085	0.224	0.061	ND	-	ND	ND
28	Further 100 m downhill towards south	F 28	10.12.513	077.30.602	0.747	0.161	ND	ND	-	ND	-
29	Further 100 m downhill towards south	F 29	10.12.408	077.30.656	0.049	0.121	0.062	ND	-	ND	ND
30	Further 100 m downhill towards south	F 30	10.12.369	077.30.724	ND	0.187	ND	0.065	-	ND	ND
31	Further 100 m downhill towards south	F 31	10.12.209	077.31.004	ND	0.114	ND	ND	-	ND	ND
32	Further 100 m downhill towards south	F 32	10.12.028	077.31.284	0.817	0.067	ND	ND	-	ND	ND
33	Further 100 m downhill towards south	F 33	10.11.883	077.31.514	0.102	0.093	ND	ND	-	ND	ND
34	Puliyan Plot -Vengaya parai	F 34	10.11.377	077.31.666	ND	0.122	ND	ND	-	-	ND
35	Northern side of Kumbakari main falls	F 35	10.10.824	077.31.595	ND	0.195	-	ND	-	-	-
36	100 m uphill towards north from Kumbakari falls	F 36	10.10.550	77.31.457	0.053	0.086	ND	ND	-	ND	-
37	Further 100 m towards uphill	F 37	10.10.588	77.31.431	ND	0.134	ND	ND	-	-	-
38	Kumbakarai - Vellakavi trekking path other side of the falls	F 38	10.10.912	077.31.575	ND	0.149	ND	ND	-	ND	-
39	100 m uphill towards Vellakavi	F 39	10.10.970	077.31.433	0.020	0.067	-	ND	-	ND	-

Sl. No	Sample Location	Location Code	Latitude	Longitude	Soil mg/kg	Bark mg/kg	Lichen mg/kg	Leaf mg/kg	Bush mg/kg	Grass mg/kg	Moss mg/kg
40	Way to Vannathi parai Forest range	F 40	10.11.064	077.31.334	0.031	0.075	ND	ND	-	ND	-
41	150 m up hill (Mile stone 6 km to Vellakavi)	F 41	10.11.111	077.31.030	ND	0.142	0.011	ND	-	ND	-
42	Vannathi parai - Kazhuthai Oodai	F 42	10.11.181	077.30.786	0.060	0.214	0.016	ND	-	ND	-
43	100 m upward towards Vellakavi	F 43	10.11.213	077.30.731	ND	0.113	-	ND	-	ND	-
44	100 m upward towards Vellakavi	F 44	10.11.218	077.30.697	ND	0.101	0.528	ND	-	-	-

LOQ: Soil/Sediment: 0.010 mg/kg, Lichen, Moss, Leaves, Bush, Grass, Algae: 0.008 mg/kg, Bark: 0.005 mg/kg; "–" indicate sample not collected

Annexure II
Results of total mercury in samples collected from Pambar water shed (Premonsoon period)

Sl. No	Sample Location	Location Code	Latitude	Longitude	Water mg/l	Soil mg/kg	Sediment mg/kg	Moss mg/kg	Algae mg/kg
1	Levinge Path - Factory stream outlet	R 01	10.13.313	077.29.224	ND	4.700	0.099	6.360	1.200
2	Fairy Falls	R 02	10.13.418	077.28.029	ND	0.014	0.142	0.380	-
3	Pamber Falls - Opp. St. Peter's school	R 03	10.13.278	077.28.471	ND	0.053	ND	-	0.022
4	Vattakanal Falls	R 04	10.13.227	077.28.890	ND	ND	0.036	-	ND
5	50 m towards down falls	R 05	10.13.324	077.28.935	ND	0.218	ND	-	ND
6	150 m towards down falls (before Lion Cave)	R 06	10.13.338	077.28.993	ND	0.966	0.054	-	ND
7	Vengaya Parai	R 07	10.11.759	077.31.543	ND	0.107	ND	-	-
8	100 m from main falls towards up	R 08	10.11.744	077.31.436	ND	ND	0.149	-	-
9	Near Bridge (Vellakavi trekking path to Kumbakarai)	R 09	10.11.403	077.31.249	ND	0.073	0.037	0.030	ND
10	Before main falls	R 10	10.10.831	077.31.836	ND	ND	0.077	0.022	-
11	Kumbekarai Falls - Kartar village (Kila Vadagarai)	R 11	10.10.379	077.32.267	ND	0.059	0.168	-	-
12	100 m towards main falls	R 12	10.10.556	077.32.098	ND	ND	ND	-	-
13	Further 100 m towards main falls	R 13	10.10.667	077.31.949	ND	ND	0.040	-	-
14	Kumbekarai Main falls	R 14	10.10.782	077.31.856	ND	0.069	ND	-	-
15	Near Alaguparai	R 15	10.09.877	077.32.246	ND	0.020	0.122	-	-
16	Velankulam - Behind Banyan Tree 3 km from Alaguparai	R 16	10.08.515	077.32.320	ND	ND	0.412	-	-
17	Pamberru Culvert - Batalagundu - Periyakulam Road (Minor bridge)	R 17	10.07.649	077.33.088	ND	ND	-	-	-

Sl. No	Sample Location	Location Code	Latitude	Longitude	Water mg/l	Soil mg/kg	Sediment mg/kg	Moss mg/kg	Algae mg/kg
18	Pambaru river - Near Angalaparmeswari temple - (Kumbakarai - Periyakulam Road) 3 km from Kumbakarai tea shop	R 18	10.08.804	077.32.920	ND	0.136	0.251	-	-
19	Kazhuthai Oodai - adjusant Kumbakarai falls	R 19	10.10.775	077.31.728	ND	ND	ND	-	ND
20	Vannathi Parai	R 20	10.11.101	077.30.889	ND	0.044	ND	-	ND
21	100 m uphill towards Vellakavi - Kazhuthai Oodai	R 21	10.11.181	077.30.786	ND	ND	0.089	-	-
22	After confluence in Vaigai river	R 22	10.06.715	077.47.022	ND	ND	ND	-	-
23	Varaha nadhi mouth	R 23	10.06.681	077.46.982	ND	0.025	ND	-	-

LOQ: Water 0.003 mg/l, Soil/Sediment: 0.010 mg/kg, Lichen, moss, leaves, algae: 0.008 mg/kg, Bark: 0.005 mg/kg; "–" indicate sample not collected

Annexure III
Results of total mercury in samples collected from Pambar water shed (Postmonsoon period)

Sl. No	Sample Location	Location Code	Latitude	Longitude	Water mg/l	Soil mg/kg	Sediment mg/kg	Moss mg/kg	Algae mg/kg
1	Levinge Path - Factory stream outlet	R 01	10.13.313	077.29.224	ND	0.438	ND	1.148	-
2	Fairy Falls	R 02	10.13.418	077.28.029	ND	ND	0.256	0.448	0.045
3	Pamber Falls - Opp. St. Peter's school	R 03	10.13.278	077.28.471	ND	ND	ND	0.068	0.036
4	Vattakanal Falls	R 04	10.13.227	077.28.890	ND	ND	ND	ND	-
5	50 m towards down falls	R 05	10.13.324	077.28.935	ND	ND	ND	0.008	0.028
6	150 m towards down falls (before Lion Cave)	R 06	10.13.338	077.28.993	ND	0.237	ND	ND	0.044
7	Vengaya Parai	R 07	10.11.759	077.31.543	ND	ND	ND	ND	-
8	100 m from main falls towards up	R 08	10.11.744	077.31.436	ND	ND	0.108	ND	-
9	Near Bridge (Vellakavi trekking path to Kumbakarai)	R 09	10.11.403	077.31.249	ND	ND	ND	0.435	-
10	Before main falls	R 10	10.10.831	077.31.836	ND	0.072	ND	-	0.083
11	Kumbakarai Falls - Kartar village (Kila Vadagarai)	R 11	10.10.379	077.32.267	ND	ND	ND	-	-
12	100 m towards main falls	R 12	10.10.556	077.32.098	ND	ND	ND	-	-
13	Further 100 m towards main falls	R 13	10.10.667	077.31.949	ND	ND	ND	-	-
14	Kumbakarai Main falls	R 14	10.10.782	077.31.856	ND	ND	ND	-	-
15	Near Alaguparai	R 15	10.09.877	077.32.246	ND	ND	ND	-	0.045
16	Velankulam - Behind Banyan Tree 3 km from Alaguparai	R 16	10.08.515	077.32.320	ND	ND	ND	-	-

Sl. No	Sample Location	Location Code	Latitude	Longitude	Water mg/l	Soil mg/kg	Sediment mg/kg	Moss mg/kg	Algae mg/kg
17	Pambarru Culvert - Batalagundu - Periyakulam Road (Minor bridge)	R 17	10.07.649	077.33.088	ND	0.340	-	-	-
18	Pambarru river - Near Angalaparmeswari temple - (Kumbakarai - Periyakulam Road) 3 km from Kumbakarai tea shop	R 18	10.08.804	077.32.920	ND	ND	ND	0.009	0.031
19	Kazhuthai Oodai - adjacent Kumbakarai falls	R 19	10.10.775	077.31.728	ND	ND	ND	-	0.050
20	Vannathi Parai	R 20	10.11.101	077.30.889	ND	ND	ND	-	-
21	100 m uphill towards Vellakavi - Kazhuthai Oodai	R 21	10.11.181	077.30.786	ND	ND	ND	-	-
22	After confluence in Vaigai river	R 22	10.06.715	077.47.022	ND	ND	ND	-	-
23	Varaha nadhi mouth	R 23	10.05.681	077.46.982	ND	ND	ND		

LOQ: Water 0.003 mg/l, Soil/Sediment: 0.010 mg/kg, Lichen, moss, leaves, algae: 0.008 mg/kg, Bark: 0.005 mg/kg; "–" indicate sample not collected

14.

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Soil Bioavailability and Native Plant Uptake of Mercury in the Contaminated Sites at Kodaikanal, India

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Authors' contributions

This work was carried out in collaboration among all authors. Author RS as a part of a doctoral thesis under the guidance of authors SA and VD is responsible for the preparation of the manuscript, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors KSPB, CNC and US provided technical guidance. All authors read and approved the final manuscript.

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ABSTRACT

This paper presents the evaluation of soil contamination with bioaccumulation and bioavailability of mercury in the surroundings of a former thermometer factory at Kodaikanal in connection with several other soil chemical characteristics. Mercury (Hg), a rare earth element, evolves to be the global concern because of its solubility and its persistence in nature. It is also widely known as a potential neurotoxin since it has the ability to bind with the thiol functional groups in the living system because of the accumulation in food chain and its biomagnifications. The Study was carried out at Department of Environmental Sciences, Tamil Nadu Agricultural University, Coimbatore, India during 2018-2020. Geo-coded soil and plant samples were collected in and around the former thermometer factory in different possible direction. The total mercury content in the soil ranged from 0.19 to 4.7 mg kg^{-1} and the water soluble mercury fraction ranged from 0.01 to 0.07 mg kg^{-1} in

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various sampling sites. The total mercury of the samples ranged from 0.24 to 3.80, 0.84 to 1.55, 0.45 to 1.67 and 0.19 to 4.97 mg kg^{-1} in east, north, south and west directions, respectively whereas the water soluble mercury fraction ranged from 0.01 to 0.07 and 0.01 to 0.04 mg kg^{-1} in east and west direction, respectively corresponding to 0.5 to 5.36 % of the total. Despite this analysis, other chemical parameters were also studied to determine their extent of influence on mercury accumulation and availability. Among those parameters, pH was found to be having significant correlation with total mercury and water soluble mercury. The concentration of total mercury and water soluble mercury recorded were less than the permissible limit set by International standards (Canadian Soil Quality Guidelines). Among different plant species, Roots of *Sterculia sp.* was found to accumulate 1.19 mg kg^{-1} whereas mercury content was found to be below detectable limits in other plants. Based on the results obtained from Potential Ecological Risk Index, it was concluded that risk associated with soil mercury contamination is low in the study area at Kodaikanal.

Keywords: Soil contamination; bioaccumulation; bioavailability; total mercury; water soluble mercury; potential ecological risk index.

1. INTRODUCTION

Mercury (Hg) is always considered as non-essential element since it has no potential biological functions. But its presence in the living system is found to be toxic owing to the various complex reactions involving the living system. Agency for Toxic Substances and Disease Registry [1] reported this neurotoxin as third element in the "Priority list of hazardous substances". The introduction of mercury into such environment is governed by both natural and anthropogenic factors. Soil which is supposed to be the life supporting medium is being contaminated with various pollutants including heavy metals, pesticides and other trace elements. Besides these cases, the mercury within the soil interacts with the other living component and gets bioaccumulated in flora, macro and micro fauna existing in the soil. It can volatilize into the atmosphere in the form of elemental mercury and can be transported to long distances. Foliage has the capacity to absorb the elemental mercury volatilized either form the soil or from the other sources. Thus, Mercury is persistent in the environment and its form of existence alone tends to change.

Kodaikanal mercury poisoning is one of the well-chronicled cases of toxic pollution in the world. Kodaikanal situated at 2133 metres above mean sea level lying on the eastern side of Western Ghats. Kodaikanal Pollution is a proven case of mercury contamination by the process of making mercury thermometers for export around the world. The exposure of the environmental abuse led to the closure of the factory in 2001 which opened up a series of issues. The mercury contamination in Kodaikanal originated at a thermometer factory that was owned by Hindustan Unilever. This is located on St Mary's road in Kodaikanal, this factory is surrounded by Pambar Shola – a thick bio-diverse forest that was designated a sanctuary. Ambient levels of mercury in air of 1.32 mg m^{-3} were found immediately outside the factory premises [2], while lichen (*Parmelia sulcata*) and moss (*Funaria hygrometrica*) samples collected from different places over the hill station showed significantly higher concentrations of mercury than another similarly situated hill station in the same state of Tamil Nadu. Lichen and moss samples collected from trees surrounding Berijam Lake, situated as far as 20 km from the factory in a pristine forest area showed 0.2 mg kg^{-1} [2].

Karunasagar et al. [3] has determined Hg pollution in waters, sediment and fish samples of Kodai Lake, which suffered Hg contamination due to emissions and waste from a thermometer factory. Total Hg of 356–465 ng L^{-1}, and 50 ng L^{-1} of Hg in Methyl mercury form were found in the Kodai waters. Total Hg concentrations in sediment ranged from 276 to 350 mg kg^{-1} and Methyl Hg constitute 6% of Total Hg. Total Hg in fish ranged from 120 to 290 mg kg^{-1} which ascertains the cause and the effect of mercury poisoning due to the thermometer factory. So far various studies were carried out in determining the different forms of mercury contamination in various lakes and places situated in different side of Kodaikanal. The present study aims to quantify the current level of mercury in the soil and plants of Kodaikanal. This study involves collection of soil and plant samples from different direction with respect to the former thermometer factory at Kodaikanal and the accumulated mercury was determined using ICP-OES.

2. MATERIALS AND METHODS

2.1 Collection of Samples

The sample collection has been carried out along 4 sides of the former thermometer factory location (10° 13' 26" N 77° 29' 11" E, 2084 Mean Sea Level) at Kodaikanal (Fig. 1) using GPS after obtaining permission from Principal Chief Conservator of Forests, Chennai. The grid images of factory area were prepared to collect soil and plant samples. D1, D2, D3 and D4 represent the east, north, south and west direction of the factory, respectively. In order to quantify the total mercury content in the soil and plants, soil samples were collected from the top layer (0-15 cm) and plant samples were also collected from slope area of the factory. Grab samples were collected and mixed together to get a representative composite sample. Sampling points are illustrated in Fig. 2 with the assistance of Google My Maps. Collected samples were shade dried, sieved through 2mm sieve and stored in polyethylene containers for further analysis. Plant samples collected from the different directions from the factory were *Pteris aspercaulis* (Fern), *Eupatorium perfoliatum* (Fever wort) and *Sterculia* sp. Plant samples collected were shade dried, powdered and stored in polyethylene containers for further analysis.

2.2 Analytical Techniques

ICP-OES (Thermo iCAP 7200 Duo Inductively coupled Plasma – Optical emission Spectrometer) functioning at Department of Sustainable Organic Farming, Tamil Nadu Agricultural University, Coimbatore was utilized for the quantification of total mercury and water soluble mercury fractions in the collected samples as per the method described by US EPA 3050 B [4]. Mercury standard solution from NIST Hg $(NO_3)_2$ 1000 ppm Hg CertiPUR were purchased and used as standard in the estimation of mercury in ICP-OES. Processed soil sample of Known quantity was taken for digestion with 10 ml of 50% HNO_3 for 2 h. It was allowed to cool for few minutes and then 2 ml of Hydrogen peroxide and Millipore water was added in drops. The mixture was heated till the effervescence ceases followed by the addition of 10 ml of HCl. The digested extracted was allowed to rest for few hours and then it was filtered through Whatman No. 42 filter paper and made upto known volume (50 ml). This extract was used for the quantification of total mercury in the soil samples.

Soil sample of Known quantity was taken and added with 25 ml of Millipore water. The Sample was kept in end to end shaker followed by centrifuging process. The centrifuged samples were filtered through Whatman No. 42 filter paper and it was utilized for the estimation of mercury as water soluble fraction. Known quantity of powdered plant samples was taken and 5-7 ml of 50% HNO_3 added. It was allowed to cool for few minutes and add 0.5 ml of Hydrogen peroxide in drops with constant shaking and placed it again for digestion. The digested extract was allowed to cool and made upto known volume as per the method described by US EPA which was used in the determination of bioaccumulated mercury. The pH and Electrical Conductivity (EC) of the soil was measured by the pH meter and conductivity meter in the soil suspension of 1:2.5 ratio and the organic carbon was determined by the method of Walkley and Black [5].

2.3 Statistical Analysis

Statistical data processing was carried out using Minitab software version 19. Principal Component Analysis and Cluster Analysis were used in this study to the variability in soil chemical composition and their contribution in Hg variability. According to the Kaiser criterion only the PC's with eigenvalue > 1.0 was retained and subjected to varimax rotation. Factor loadings were classified as strong, moderate and weak corresponding to the absolute loading values of >0.75, 0.50-0.75, and in the range 0.30-0.50, respectively [6,7]. Cluster analysis uses Euclidean distance as a measure of similarity to group chemical parameters into different classes. Pearson correlation analysis was used to study the correlation between the variables [8].

2.4 Pollution Index Analysis

2.4.1 Potential ecological risk index (PERI)

Hakanson's approach [9] was used to evaluate the contamination or enrichment factor (Cf) and the PERI (Eri). While comparing with other methods, this method involves toxicity response factor of the given substance and is computed by

$$Cf = \frac{C_0}{C_1}$$

$$Er^1 = Tr^1 X\, C_f$$

Where Cf = contamination or enrichment factor for the studied metal, Co is the background concentration of mercury [10,11] (in µg Kg^{-1}) , Ci is the concentration of heavy metal studied (in µg Kg^{-1}) , Er^i is the PERI for the studied metal, Tr^i is the biological toxicity factor (Hg=40 from Yuan et al. [12]). If Cf is greater than 1, enrichment exists. If Er^i < 40, the risk is low, 40-80 then it is moderate, 80-160 then it is considerable, 160-320 – high and ≥320 then it is very high.

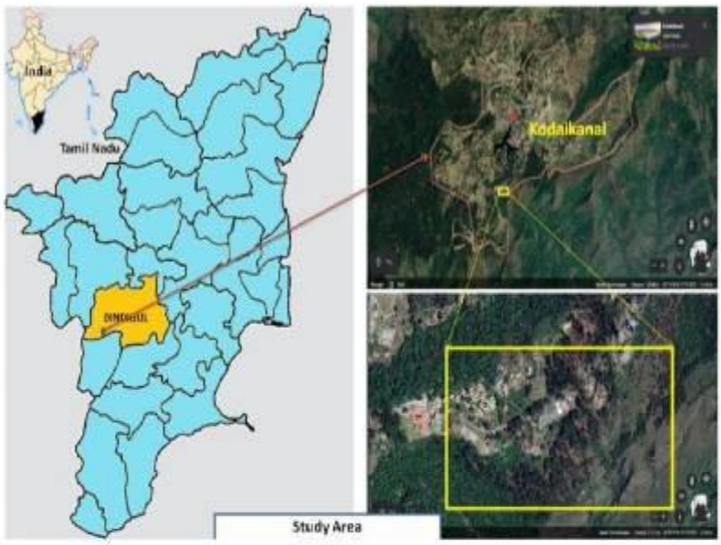

Fig. 1. Location of study area

Fig. 2. Sampling points in and around the premises of thermometer factory
*(*indicates the thermometer factory and the numbers represents the sampling points)*

3. RESULTS AND DISCUSSION

Geocoded soil samples were collected from each of four sides of the Thermometer Factory owned by Hindustan Unilever which is located on St Mary's road in Kodaikanal. D1, D2, D3 and D4 represent the east, north, south and west direction of the factory, respectively. The samples collected were analysed for pH, EC, organic carbon content, total and available mercury. The results obtained are presented in Table 1 along with its descriptive statistics. The pH of the soil samples ranged from 4.14 to 6.16, 3.26 to 4.68, 4.27 to 6.32 and 3.38 to 4.64 in D1, D2, D3 and D4, respectively. Similar results were recorded by He et al. [13] with pH ranged from 4.08 to 5.67 in forest soils. Low soil pH promotes metal solubility and their availability to plants which emphasizes it as an important factor in metal uptake [14,15]. Apart from this, it is also stated that lesser pH contributes in leaching of Hg from soil in Hg^{2+} form and in contrast the higher pH also results in the generation of more soluble mercury species such as mercurous and mercuric sulphate [16]. The EC of the soil ranged from 0.08 to 0.44, 0.03 to 0.35, 0.07 to 0.25 and 0.02 to 0.22 dSm^{-1}, whereas the organic carbon ranged from 3.83 to 7.50, 4.12 to 7.11, 3.20 to 4.44, 3.20 to 5.36 and 0.66 to 5.34 % in D1, D2, D3 and D4, respectively. Dense canopy and thick forest undercover resulting in increased soil organic carbon in the form of litter fall and also resulted out due to the rapid decomposition of forest litter [17]. Similar results have been found in Oladoye [18] and Divya et al. [19]. Considering the organic carbon content, the highest mean organic carbon content of 5.66 % was recorded in D2 (northern side) whereas the lowest organic carbon content of 2.69 % was recorded in D3 (western side). Decrease in soil organic matter increases the metal availability reducing the fewer binding sites present [20]. Soil pH and Organic carbon are considered to be interrelated since they predict the availability of the element for the plant uptake [14].

Total mercury (TM) and Water soluble mercury fraction (WM) was estimated in the soil samples collected from the different sides of the factory. The total mercury of the samples ranged from 0.24 to 3.80, 0.84 to 1.55, 0.45 to 1.67 and 0.19 to 4.97 mg kg^{-1} in D1, D2, D3 and D4, respectively whereas the water soluble mercury fraction ranged from 0.01 to 0.07 and 0.01 to 0.04 mg kg^{-1} in D1 and D4, respectively corresponding to 0.5 to 5.36 % of the total. These results were correlated with the findings of He et al. [13] and Rieder et al. [21]. The soil mercury content recorded was less than the prescribed permissible limit by Canadian Soil Quality Guidelines which holds 6.6 mg kg^{-1} for residential as well as agricultural area and 50 mg kg^{-1} for industrial area [22]. The mean total mercury content was higher in D1 (1.89 mg kg^{-1}) followed by D4 (1.39 mg kg^{-1}) whereas lower content was observed in D3 (0.06 mg kg^{-1}) direction. The frequency of mercury distribution is higher in D1 with 100 % followed by 64% in D4. Frequency of mercury distribution is sparse in D2 and D3 standing with 22 and 30 % on comparing with D1 and D4. Under more alkaline conditions, Hg^{2+} is increasingly converted into Hg $(OH)^{+}$ or Hg $(OH)_2$ in favoring the adsorption of mercury to the soil minerals [23] & [24] which supports the lesser availability and accumulation of mercury in the sampling sites. In High organic matter containing soils, high amount of mobile and available mercury forms are relatively higher when compared to low organic matter containing soils which relates the trend of water soluble mercury along with organic matter [25].

From Table 1, the contamination or enrichment factor ranged from 0.01 to 0.36 and it is evident that samples analysed recorded below 1 which confirms the lack of enrichment. Likewise PERI ranged from 0.74 to 14.4 which is less than 40 implying low risk in the sampling sites. Based on the results exhibited in Fig. 3, we found a significant correlation between pH and mercury content in the soil samples. The distance between the specified parameters signifies the correlation among the parameters. In that case, the distance between organic carbon content and the soil mercury concentration is found to be higher than the other results which signify the least degree of correlation between them. Soil pH has a crucial role in mobilizing mercury from the soil. Low dissolution of the target metal was observed at pH 3 which indicates the strong bond between mercury and soil constituents mainly the functional groups associated with organic matter fractions. The reason was ascribed due to the precipitation of soil organic matter at this pH and the affinity of mercury towards organic matter [26]. At pH 5-7, desorption of mercury was witnessed because of the competition between Hg^{2+} and hydronium ions (H_3O^{+}) for adsorption sites on the soil properties at acidic pH. Retention of mercury was achieved at a pH 7-9 indicating remarkable decline in mercury dissolution which increases the quantity of negative charges of soil particles. And the results obtained from the analysis are in line with the findings of Xu et al. [26].

Pearson correlation analysis was performed between all the variables and the matrix was obtained to distinguish the positive and negative relationship of mercury content with respect to other parameters. Based on the matrix formed from Pearson correlation analysis (Table 2), it was found that pH, EC, Total mercury and Water soluble mercury was found to be positively correlated whereas organic carbon content was found to be negatively correlated with pH, Total Mercury and Water soluble Mercury. Apart from this, Principal component analysis results in various loading factors which emphasize the degree of variability of soil chemical parameters and mercury in the soil. From Table 3, Principal Component 1 contains Total mercury (TM) and Water soluble mercury concentration (WM) which have moderate influence in soil variability whereas pH, EC and OC have weak influence. In Principal Component 2, EC had strong influence, OC had moderate and TM and WM had weak influence. Likewise in other components, mostly chemical parameters has moderate to weak influence in determining the soil variability. Based on the various principal components, the different clusters were formed with varying similarity percentages which is exhibited as dendrogram in Fig. 4. Two major clusters were formed with more than 33 per cent similarity including various sampling sites.

Various plant parts such as leaf, stem and root were analysed to study the pattern and accumulation nature of mercury within the Plant system. From the analysed results from Table 4, Hg accumulation was recorded in the roots of *Sterculia* sp. whereas it was found to be below detectable limits in other plant species in the concerned directions. The mercury content was found to be 1.19 mg kg^{-1} in the roots of tree (*Sterculia* sp.) which supports the mercury contamination in southern side of Thermometer Factory at Kodaikanal. Even though the concentration of Hg was found to be present in plant, the availability of mercury from the soil to the plant was very low in concentration.

Mercury tends to accumulate more in roots than any other aerial parts of the plant [27] which is also supported by the root mercury accumulation in five plant sp. *viz., Opuntia stricta, Aloe vera, Setcreasea purpurea, Chlorophytum comosum* and *Oxalis corniculata* reported by Liu et al. [28] and in two plant sp. *viz.,* Amaranthus and Marigold by Sinduja et al. [29]. Their translocation to the shoot is limited by the presence of mercury in blocking the aquaporin [30] and thus roots itself act as a barrier in mercury uptake resulting in minimized uptake by the plant. And in some case, plant itself acts as excluder for Hg thereby restricting the uptake of mercury within the plant system [31] and minimum accumulation in shoot results out due to the direct absorption of mercury in vapor form [32].

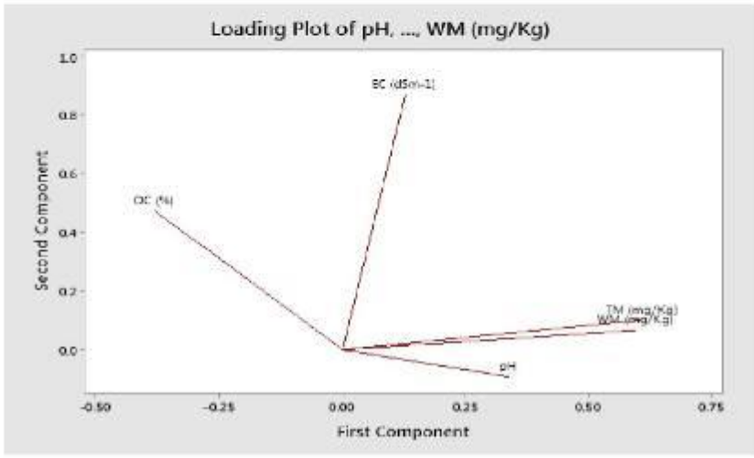

Fig. 3. Principal component analysis loading plot of sampling sites and mercury concentration, pH, EC and organic carbon content in the collected soil samples

Table 1. pH, EC (dSm^{-1}), OC (%) , Total mercury concentration (mg Kg^{-1}), water soluble mercury concentration (mg Kg^{-1}), Contamination factor and Potential Ecological Risk Index (PERI)

Sampling Direction	Sample site	pH	EC (dSm^{-1})	OC (%)	Total Mercury Concentration (mg kg^{-1})	Water Soluble mercury Concentration (mg kg^{-1})	Contamination factor (Cf)	Potential Ecological Risk Index (PERI)
D1	1	6.16	0.20	3.83	3.80	0.06	0.02	0.74
	2	6.10	0.13	3.83	3.27	0.07	0.02	0.86
	3	4.59	0.12	6.10	0.25	0.00	0.29	11.41
	4	4.14	0.09	6.19	0.48	0.00	0.15	5.81
	5	4.70	0.44	4.29	3.37	0.03	0.02	0.83
	6	4.44	0.08	7.19	1.78	0.01	0.04	1.57
	7	5.56	0.32	7.50	0.24	0.00	0.29	11.48
D2	8	3.43	0.14	5.43	0.00	0.00	0.00	0.00
	9	3.26	0.11	6.10	0.00	0.00	0.00	0.00
	10	4.67	0.04	7.11	0.00	0.00	0.00	0.00
	11	4.10	0.11	6.42	0.00	0.00	0.00	0.00
	12	4.38	0.14	6.33	0.00	0.00	0.00	0.00
	13	3.80	0.35	5.32	0.84	0.00	0.08	3.32
	14	3.84	0.03	5.21	0.00	0.00	0.00	0.00
	15	5.20	0.04	4.12	1.55	0.00	0.05	1.81
	16	4.68	0.04	5.12	0.00	0.00	0.00	0.00
D3	17	4.27	0.10	4.14	0.00	0.00	0.00	0.00
	18	4.52	0.14	4.44	0.71	0.00	0.10	3.96
	19	6.32	0.07	3.24	1.67	0.00	0.04	1.67
	20	6.13	0.08	3.67	0.00	0.00	0.00	0.00
	21	5.35	0.15	3.20	0.00	0.00	0.00	0.00
	22	4.41	0.09	4.27	0.00	0.00	0.00	0.00
	23	4.39	0.25	3.84	0.00	0.00	0.00	0.00
	24	3.75	0.10	5.36	0.45	0.00	0.16	6.24
	25	4.11	0.18	5.32	0.00	0.00	0.00	0.00
	26	3.67	0.10	4.56	0.00	0.00	0.00	0.00
D4	27	3.90	0.09	5.34	0.19	0.01	0.36	14.44
	28	3.88	0.09	4.29	0.58	0.01	0.12	4.87

Sampling Direction	Sample site	pH	EC (dSm^{-1})	OC (%)	Total Mercury Concentration (mg kg^{-1})	Water Soluble mercury Concentration (mg kg^{-1})	Contamination factor (Cf)	Potential Ecological Risk Index (PERI)
	29	4.29	0.02	4.66	2.15	0.03	0.03	1.30
	30	4.15	0.05	5.32	0.00	0.00	0.00	0.00
	31	3.38	0.22	4.62	1.60	0.00	0.04	1.75
	32	4.64	0.09	4.08	0.00	0.00	0.00	0.00
	33	4.30	0.10	0.66	4.97	0.04	0.01	0.56
	34	3.77	0.10	2.34	0.00	0.00	0.00	0.00
	35	4.02	0.07	1.76	1.72	0.01	0.04	1.63
	36	3.94	0.08	2.11	1.40	0.01	0.05	1.99
	37	5.46	0.08	3.24	0.00	0.00	0.00	0.00
	Mean	4.48	0.13	4.60	0.84	0.008	0.05	2.06
	SE Mean	0.13	0.014	0.250	0.208	0.003	0.014	0.586
	StDev	0.81	0.09	1.52	1.27	0.017	0.09	3.56
	Minimum	3.26	0.02	0.66	0.00	0.00	0.00	0.00
	Median	4.30	0.10	4.56	0.19	0.00	0.01	0.56
	Maximum	6.32	0.44	7.50	4.97	0.069	0.36	14.4
	Skewness	0.90	1.92	-0.35	1.74	2.54	2.27	2.28
	Kurtosis	0.14	3.95	0.31	2.57	5.87	4.67	4.80

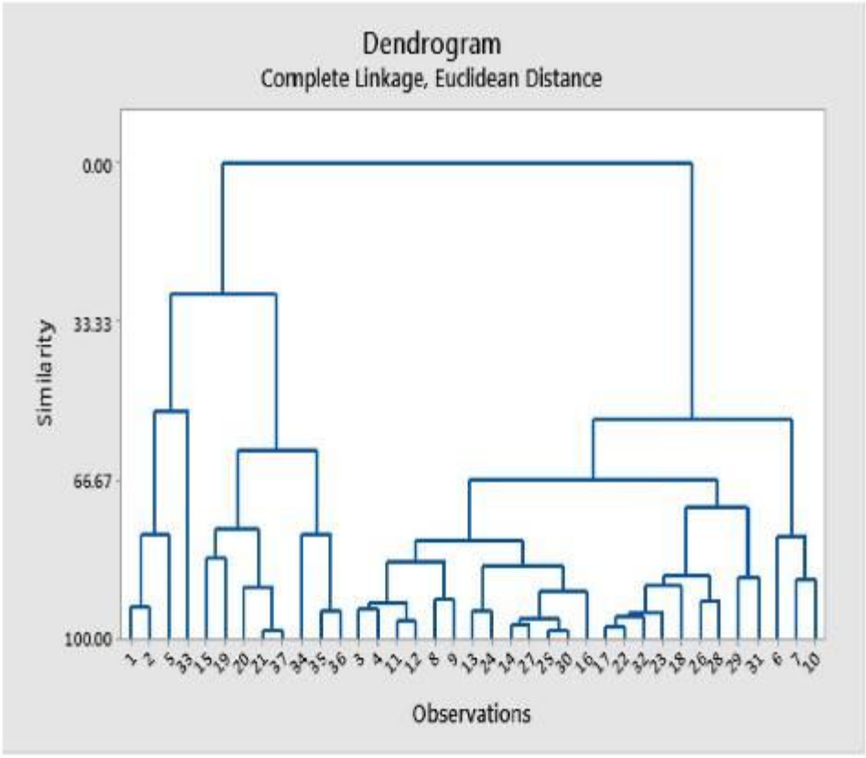

Fig. 4. Dendrogram showing the clustering of sampling sites

Table 2. Correlation matrix of mercury content and other chemical parameters

	pH	EC (dSm^{-1})	OC (%)	TM (mg/Kg)	WM (mg/Kg)
pH	1.00				
EC (dSm^{-1})	0.01	1.00			
OC (%)	-0.14	0.11	1.00		
TM (mg/Kg)	0.28	0.22	-0.44	1.00	
WM (mg/Kg)	0.36	0.13	-0.33	0.84	1.00

Table 3. Factor loading after Varimax rotation describing variability of soil chemical composition

Variable	PC1	PC2	PC3	PC4	PC5
pH	0.338	-0.092	-0.871	-0.338	-0.063
EC (dSm^{-1})	0.128	0.867	0.126	-0.453	0.102
OC (%)	-0.380	0.474	-0.438	0.648	-0.137
TM (mg/Kg)	0.608	0.101	0.180	0.252	-0.724
WM (mg/Kg)	0.596	0.066	0.004	0.445	0.665

Table 4. Bioaccumulation of Hg in native plant species of Kodaikanal

Plant species	Direction	Plant part analyzed	Hg concentration (mg kg^{-1})
Pteris aspercaulis	East	Leaf	BDL
		Stem	BDL
		Root	BDL
	North	Leaf	BDL
		Stem	BDL
		Root	BDL
	South	Leaf	BDL
		Stem	BDL
		Root	BDL
	West	Leaf	BDL
		Stem	BDL
		Root	BDL
Eupatorium perfoliatum	North	Leaf	BDL
		Stem	BDL
		Root	BDL
	West	Leaf	BDL
		Stem	BDL
		Root	BDL
Sterculia sp	South	Bark	BDL
		Leaf	BDL
		Root	1.19

4. CONCLUSION

In the present study, the results of soil mercury content analysis strengthen the bioaccumulation and bioavailability of mercury. The total mercury and the water soluble mercury contamination were prominent in east and southern direction with respect to the former thermometer factory. Based on various analysis, it was evident that pH of the soil tends to play a significant role in determining the availability of mercury to the living system. However, soil mercury content recorded was less than the permissible limit (Residential area - 6.6 mg kg^{-1} and Industrial area – 50 mg kg^{-1}) prescribed by Canadian Soil Quality Guideline and poses low risk as per the interpreted results based on Potential Ecological Risk Index. In addition to this, mercury was recorded only in *Sterculia sp*. which supports the mercury contamination in southern side and signifies the implication in accumulation and translocation of mercury in the plant system.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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15. Tree planting at Mother Teresa University campus

Phone : (O) 0091 - 4542 - 241122 (P)
(G) 0091 - 4542 - 241685

MOTHER TERESA WOMEN'S UNIVERSITY
Kodaikanal - 624 102

Date :

Dr.A.Suganthi
Registrar

Lr. No.01/MTWU/Rr/2020, dated: 01.09.2020

To
The Factory Manager,
Hindustan Unilever Ltd.,
Kodaikanal-624 101.

Sir,

Greetings from Mother Teresa Women's University!

I am pleased to note that Hindustan Unilever Ltd., Kodaikanal has successfully accomplished planting of 500 tree saplings in our University campus. I record my appreciation and gratitude for this generous gesture and look forward to your support in future.

Thanking You

REGISTRAR

17. Kodaikanal Wildlife Sanctuary Notification G.O.No. 143 E&F Depat. Dated 20.09.2013.

ABSTRACT

Forests – Wildlife – Formation of Kodaikanal Wildlife Sanctuary – Notification under Section 26 A 1 (b) of Wildlife (Protection) Act, 1972 (Central Act 53 of 1972) – Orders – Issued.

ENVIRONMENT AND FORESTS (FR.5) DEPARTMENT

G.O.(Ms.) No.143 **Dated: 20.09.2013**
விஜய, புரட்டாசி 4
திருவள்ளுவர் ஆண்டு 2044

Read:

From the Principal Chief Conservator of Forests and Chief Wildlife Warden letter No.WL5/76747/2006, dated 31.10.2012. and 30.4.2013

ORDER:-

The Government accept the proposal of the Principal Chief Conservator of Forests and Chief Wildlife Warden received in the letter read above for the declaration of Kodaikanal Wildlife Sanctuary under section 26 A1(b) of Wildlife (Protection) Act, 1972 (Central Act 53 of 1972). The Notification appended to this order shall be published both in English and Tamil in the Tamil Nadu Government Gazette and in Tamil in the District Gazette of the Dindigul and Theni Districts.

2. The Tamil Development, and Information Department is requested to send immediately a Tamil Translation of the Notification to the Works Manager, Government Central Press, Chennai for publication in the Tamil Nadu Government Gazette and in the District Gazette of Theni and Dindigul.

3. The Works Manager, Government Central Press, Chennai is requested to send 20 copies of each of the Notification to Government and to the Principal Chief Conservator of Forests and Chief Wildlife Warden and to the Collector of Theni and Dingidul Districts as soon as the Notification is published.

(BY ORDER OF THE GOVERNOR)

MOHAN VERGHESE CHUNKATH
ADDITIONAL CHIEF SECRETARY TO GOVERNMENT

To
The Works Manager,
Government Central Press, Chennai-79.
The Principal Chief Conservator of Forests,Chennai.15
The Principal Chief Conservator of Forests and
Chief Wildlife Warden, Chennai-15.

The Tamil Development and Information Department,
Chennai-9.
The Secretary to Government of India,
Ministry of Environment and Forests,
Paryavaran Bhavan, CGO Complex,
Lodhi Road, New Delhi-110 003.

Copy to:-
The Law Department., Chennai 9
The Collector, Theni District.
The Collector, Dindigul District.

/FORWARDED BY ORDER/

SECTION OFFICER

/3/

APPENDIX

NOTIFICATION

In exercise of the powers conferred by clause (b) of sub-section (1) of section 26-A of the Wildlife (Protection) Act, 1972 (Central Act 53 of 1972), the Governor of Tamil Nadu, having considered that the area declared as reserved forest under the Tamil Nadu Forest Act, 1882 (Tamil Nadu Act V of 1882), the boundaries of which are specified in the Schedule below is of adequate ecological, faunal, floral, geomorphological, natural and zoological significance for the purpose of protecting, propagating and developing wildlife and its environment hereby declares that the said area as a Kodaikanal Wildlife Sanctuary on and from the 20.09.2013.

THE SCHEDULE

1. Name of the district	:	(1) Dindigul district and (2) Part of Theni district.
2. Name of the taluks	:	(1) Kodaikanal (2) Palani (3) Periyakulam
3. Name of Wildlife Sanctuary	:	Kodaikanal Wildlife sancturay.
4. Area in extent	:	60895.482 Hectares or 608.95 Sq.Km as detailed in the Annexures.

/4/

ANNEXURE – I

Name of the district : Dindigul

Name of the taluk : Palani

Extent : 18463.44 Hectares

Serial Number	Name of the reserved forest	Area Extent in Hectares	Area excluded for tourists site in Hectares	Area excluded for Roads in Hectares	Area excluded for Leased out in Hectares	Area after exclusion in Hectares
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Kudhiraiyar	4344.53	--	--	--	4344.53
2	Oliyanuthu	1761.25	--	--	--	1761.25
3	Poombarai Vilpatty	7165.45	--	13.0	--	7152.45
4	Velancombai	67.59	--	--	--	67.59
5	Andipatti	5155.42	--	--	17.80	5137.62
	Total	18494.24	--	13.0	17.80	18463.44

Boundary Description

North.- Starting from the northern most junctions of the Anamalai reserved forest and Andipatti reserved forest. Thence, the boundary runs generally towards east along the northern and eastern boundary of the Andipatti reserved forest till it meets the Kudhiraiyar River and then cuts across and generally runs along northern and eastern boundary of Andipatti reserved forest till it meets the Pachaiyar River and then cuts across and runs along northern boundary of Kudhiraiyar reserved forest till it meets northern boundary of Oliyanuthu reserved forest; Thence, it runs along northern boundary of Oliyanuthu reserved forest till it meets northern boundary of Poombarai Vilpatti (PV) valley reserved forest; thence, it runs along northern boundary of Poombarai Vilpatti valley reserved forest till it meets western boundary of Velancombai reserved forest, thence it runs along western, northern and eastern boundary of Velancombai reserved forest, till it meets northern boundary of Poombarai Vilpatti valley reserved forest; thence, it runs along northern boundary of Poombarai Vilpatti valley reserved forest till it meets north east corner of Poombarai Vilpatti valley reserved forest (Southern side of road near Kannadipermal Koil at 9.2 km).

East.- Thence, the boundary runs generally towards south along the eastern boundary of the said Poombarai Vilpatti valley reserved forest till it meets the Gundar River and then cuts across and runs along eastern boundary of the said Poombarai Vilpatti valley reserved forest till it meets the south east corner of said Poombarai Vilpatti valley reserved forest.

South.- Thence, the boundary runs generally towards west along the southern and western boundary of the said Poombarai Vilpatti valley reserved forest till it meets southern boundary of Oliyanuthu reserved forest; thence, it runs towards west along the southern boundary of said Oliyanuthu reserved forest till it meets south east corner of Kudhiraiyar reserved forest; thence, it runs towards west along the southern and eastern boundary of said Kudhiraiyar reserved forest till it meets northern boundary of Samikanal reserved forest; thence, it runs towards south west along the northern boundary of Samikanal reserved forest till it meets southern boundary of said Kudhiraiyar reserved forest; thence it runs along southern boundary of Kudhiraiyar reserved forest till it meets the Kudhiraiyar River and then cuts across and runs along southern boundary of said Kudhiraiyar reserved forest till it meets the district boundary of Thiruppur and Dindigul districts.

west.- Thence, the boundary runs generally towards north along the district boundary of Thiruppur and Dindigul districts till it meets the southern boundary of said Andipatti reserved forest; thence the boundary runs towards west along the southern boundary of said Andipatti reserved forest till it meets south west corner of said Andipatti reserved forest; thence, the boundary runs towards north along the western boundary of said Andipatti reserved forest till it meets the starting points through Ellaigundu Rock (1250m).

MOHAN VERGHESE CHUNKATH
ADDITIONAL CHIEF SECRETARY TO GOVERNMENT

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ANNEXURE – II

Name of the district : Dindigul

Name of taluk : Kodaikanal.

Extent : 24051.084 Hectares

Serial Number (1)	Name of the reserved forest (2)	Extent in Hectares (3)	Area excluded for tourists site (Hectares) (4)	Area excluded for Roads (Hectares) (5)	Area excluded for Leased out (Hectares) (6)	Area after exclusion (Hectares) (7)
1	Gundar Valley	1809.04	0.76	1.5	0	1806.78
2	Gundar Valley Extension	2228.39	7.50	15.2	72.009	2133.681
3	Ampth Hill Down	12583.00	172.75	17.72	0.367	12392.163
4	Kookal	346.01	0	0	0	346.01
5	Poombarai	6.83	0	0	0	6.83
6	Shengalvara yar	1816.35	0	0	3.73	1812.62
7	Karungalthon imedu	1134.47	0	0	0	1134.47
8	Amburuvi	3543.86	0	5.76	0	3538.1
9	Kilanavayal	226.37	0	0	0	226.37
10	Samikanal	655.66	0	1.60	0	654.06
	Total	24349.98	181.01	41.78	76.106	24051.084

Boundary Description

North.- Starting from the north west corner of Kokkal reserved forest. Thence the boundary runs generally towards east along the northern boundary of Kokkal reserved forest and towards south along the eastern boundary of Kokkal reserved forest till it meets northern boundary of Ampthill Downs reserved forest; thence, it runs towards east along northern boundary of Ampthill Downs reserved forest till it meets south west corner of Samikanal reserved forest; thence, it runs towards north along the western boundary of Samikanal reserved forest and towards north east along the northern boundary of Samikanal reserved forest till it meets southern boundary of Kudthiraiyar reserved forest.

East.- Thence, the boundary runs generally towards south along the eastern boundary of Samikanal reserved forest till it meets the eastern boundary of Ampthilll Down reserved forest; thence it runs along the eastern and northern boundary of Ampthill Downs reserved forest till it meets north west corner of Poombarai reserved forest; thence it runs along the northern boundary of Poombarai reserved forest till it meets western boundary of (Umaiyar Block reserved forest) Gundar valley extension reserved forest; thence, it runs along the northern and eastern boundary of the said Gundar valley extension reserved forest till it meets northern boundary of Shengalvarayar reserved forest; thence, it runs along the northern and eastern boundary of said shengalvarayar reserved forest till it meets northern boundary of Karungal Dhonimedu reserved forest; thence, it runs along the northern and eastern boundary of said Karungal Dhonimedu reserved forest till it meets south east corner of said Karungal Dhonimedu reserved forest.

South.- Thence, boundary runs generally towards west along the southern boundary of said Karungal Dhonimedu reserved forest till it meets eastern boundary of Amburuvi reserved forest; thence, it runs along the southern boundary of said Amburuvi reserved forest till it meets southern boundary of Ampthill Downs reserved forest; thence, it runs along southern boundary of Ampthill Downs reserved forest till it meets south west corner of Ampthill Downs reserved forest (Pambadi Shola Malai (2425 M).

West.- Thence, boundary runs generally towards north along the western boundary of Ampthill Down reserved forest till it meets Kadavarai Kanavai; thence, it runs towards south east along eastern boundary of Ampthill Down reserved forest till it meets Uruman Kanavai; thence, it runs towards east along the northern boundary of Ampthill Down reserved forest till it meets Tuppiyan Kanavai; thence, it runs towards north along the western boundary of Ampthill Down reserved forest till it meets south east corner of Kilanavayal reserved forest; thence, it runs along southern, western and eastern boundary of Kilanavayal reserved forest till it meets western boundary of Ampthill Down reserved forest; thence, it runs towards north along the western boundary of Ampthill Down reserved forest till it meets south west corner of Kookal reserved forest; thence, it runs towards north along the western boundary of Kokkal reserved forest till it meets the starting point.

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ANNEXURE - III

Name of the districts : Dindigul and Theni

Name of taluks : Kodaikanal and Periyakulam.

Extent : 18380.958 Hectares

Serial Number (1)	Name of the reserved forest (2)	Extent in Hectares (3)	Area excluded for tourists site (Hectares) (4)	Area excluded for Roads (Hectares) (5)	Area excluded for Leased out (Hectares) (6)	Area after exclusion (Hectares) (7)
1	Unjalnachi	208.82	0	0.36	--	208.46
2	Palani Hills Southern Slope East	5042.69 + 264.43	0	50.65	0.56	5255.91
3	Mulaiyar	959.94	0	0	0	959.94
4	Pambar	1710.14	2.00	1.148	13.619	1693.373
5	Perumal-malai	2598.04	0	15.55	0.58	2581.91
6	Arunkanal	493.51	0	2.38	1.075	490.055
7	Adukkam	2277.29	0	3.50	4.00	2269.79
8	Marutha-nadiyar	1983.39	0	3.60	0	1979.79
9	Kaduguthadi	149.33	0	0.60	0	148.73
10	Murugamalai	2794.27	0.43	0.84	0	2793.00
	Total	18481.85	2.43	78.628	19.834	18380.958

Boundary Description

North.- Starting from the north west corner of Pambar reserved forest. Thence, the boundary runs generally towards east along the northern boundary of Pambar reserved forest till it meets western boundary of Adukkam reserved forest; thence, it runs along northern and eastern boundary of Adukkam reserved forest till it meets western boundary of Palani Hill Southern Slope reserved forests near Sanniyasi malai (1319 m); thence, it runs towards north along the western boundary of Palani Hill Southern Slope reserved forests till it meets southwest corner of Perumalmalai reserved forest; thence it runs along western boundary of Perumalmalai reserved forest till it meets Perumalmalail Peak (2234 m); thence, it runs towards south west along northern boundary of Perumalmalai reserved forest till it meets western boundary of Mulaiyar reserved forest; thence, it runs towards north east along northern boundary of Mulaiyar Reserved forest till it meets north east corner of Mulaiyar reserved forest.

East.- Thence, the boundary runs generally towards south along the eastern boundary of Mulaiyar reserved forest till it north east corner of Arankanal reserved forest; thence, it runs along eastern boundary of Arankanal reserved forest till it meets north west corner of kadugutadi reserved forest; thence, it runs along northern and eastern boundary of Kadugutadi reserved forest till it meets northern boundary of Marudanadiar reserved forest; thence, it runs along northern and eastern boundary of Marudanadiar reserved forest till it meets north east corner of Palani Hill Southern Slope reserved forests; thence, it runs along eastern boundary of Palani Hill Southern Slope reserved forests till it meets Manturai odai.

South.- Thence, the boundary runs generally towards west along the southern boundary of Palani Hill Southern Slope reserved forests till it meets Manjal Ar and then cuts across and then runs along southern boundary of Palani Hill Southern Slope reserved forests till it meets northern boundary of Murugamalai reserved forest; thence, it runs along the northern, eastern, southern and western boundary of Murugamalai reserved forest till it meets the trijunction of Palani Hill Southern Sloper reserved forests, Adukkam Reserved forest and Murugamalai reserved forest (near Kaludai kanavay); thence, it runs along southern boundary of Adukkam reserved forest till it meets eastern boundary of Pambar reserved forest; thence it runs along southern boundary of Pambar reserved forest till it meets Kumbakkarai falls.

West.- Thence, boundary runs generally towards north along the western boundary of Pambar reserved forest till it meets starting point.

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ANNEXURE - IV

DETAILS OF TOURIST AREAS EXCLUDED FROM WILD LIFE SANCTUARY

DIVISION - KODAIKANAL

Serial Number (1)	Tourism spots (2)	Name of reserved forests (3)	Area in Hectares (4)
KODAIKANAL DIVISION			
1	Caps valley	Gundar Valley	0.25
2	Moir Point	Gundar Valley	0.50
3	Silent Valley	Gundar Valley	0.01
	Total	**Gundar Valley**	**0.76**
4	Pillar Rock	Gundar Valley Extension	1.00
5	Pine Forest	Gundar Valley Extension	0.50
6	Guna Cave	Gundar Valley Extension	6.00
	Total	**Gundar Valley Extension**	**7.50**
7	Berijam Lake	Ampthill Down	86.30
8	Berijam Staff Quarters	Ampthill Down	3.45
9	Mannavanur Lake	Ampthill Down	83.00
	Total	**Ampthill Down**	**172.75**
10	Kumbakkarai Falls	**Pambar**	**2.00**
11	Paramasivan koil	**Murugamalai**	**0.43**
	Total		**183.44**

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ANNEXURE – V

DETAILS OF ROADS AND PATHS EXCLUDED FROM WILD LIFE SANCTUARY

Serial Number (1)	Name of Road (2)	Name of Reserved Forest (3)	Length of road (4)	Width of road (5)	Proposed width of road to be excluded for further expansion (6)	Area excluded for road (in Hectares) (7)	Remarks (8)
1	Palani – Perumalmalai Road	Poomparai - Vilpatti	13.0 Km	5.5 m	10.0 m	13.00	Bus Route
2.	Paniyaraparai to Berijam	Gundar valley	9.00 Km	5.00 M	--	1.5	Forest Road
3.	Poomparai to Krishnan Kovil	Gundar Valley Extension	6.00 Km	5.00 M	6m	3.6	Bus Route
4.	Moirpoint to Gundar	Gundar Valley Extension	4.00 Km	4.00 M	6 m	2.4	Bus Route
5.	Moirpoint to Paniyaraparai	Gundar Valley Extension	5.00 Km	4.00 M	--	2.0	Forest Road
6.	Observatory to Kosan Road	Gundar Valley Extension RF	5.00 Km	5.00 M	6 m	3.0	Bus Route
7.	Pambarpalam to Moirpoint	Gundar Valley Extension	7.00 Km	6.00 M	--	4.20	Bus Route
		Gundar Valley Extension			**Total**	**15.20**	
8	Krishnan Kovil to Vettuvarai	Ampthil down	2.00 Km	5.00 M	--	1.0	Bus Route
9	Kaikatti to Kookalpirivu	Ampthil down	7.40 Km	5.00 M	6m	4.44	Bus Route
10	Kookal pirivu to Thalvukad Asam	Ampthil down	5.00 Km	5.00 M	--	2.5	Bus Route
11	Kookal pirivu to Thanneerparai	Ampthil down	2.80K m	5.00 M	6m	1.68	Forest Road
12.	Grassland to Athupalam	Ampthil down	1.00K m	5.00 M	6m	0.60	Bus Route
13.	Mannavanur to Berijam	Ampthil down	9.00K m	5.00 M	--	4.50	Forest Road
14	Paniyaraparai to Berijam	Ampthil down	9.00 Km	5.00 M	--	3.00	Forest Road
		Ampthil down			**Total**	**17.72**	

15	Kumbakkarai to Agamalai	Amburuvi	2 Km	9 m	--	1.80	Foot path
16	Kumbakkarai to Chinnur	Amburuvi	2.4 Km	9 m	--	2.16	Foot path
17	Kumbakkarai to Periur	Amburuvi	4 Km	4.5 m	--	1.80	Foot Path
		Amburuvi			**Total**	**5.76**	
18	Kookal to Puthur - Poomparai	**Samikanal**	3.20 Km	5.00 M	--	**1.6**	Bus Route
19	Kumbarakadu to Pulathur	Unjalnatchi	0.80 Km	6 Feet (1.8 m)	3m	0.24 Ha	Bus Route
20	Kumbarakadu to Sethukanal	Unjalnatchi	0.40 Km	6 Feet (1.8 m)	3m	0.12 Ha	Bus Route
		Unjalnatchi			**Total**	**0.36**	
21	Ghat Road – Kodaikanal to Ganguvarpatti	Palani Hills Southern Slope	25.00 Km	40+6=46 Feet (13.8 m)	20 m	50	Bus Route
22	Mulaiyar to Vilangulam	Palani Hills Southern Slope	0.36 Km	6 Feet (1.8 m)	1.8m	0.65	Only foot path to enclosure
		Palani Hills Southern Slope East			**Total**	**50.65**	
23	Kumbakkarai to Vellagavi	Pambar	4.8 Km	1.8 m	--	0.86	Foot Path
24	Fairy Falls	Pambar	1.00 Mile (or) 1.60 Km	6 Feet or 1.8m	--	0.288	Foot Path
		Pambar			**Total**	**1.148**	
25	Pannaikadu to Kodaikanal	Perumalmalai	6 Mile (or) 9.60 Km	20 Feets or 6 m	15 m	14.4	Bus Route
26	Perumalmalai to Samaikattu Pallam	Perumalmalai	1.0 Mile (or) 1.60 Km	24 Feets or 7.2m	--	1.15	Forest Road
		Perumalmalai			**Total**	**15.55**	
27	Pannaikadu to Geronium	Arunganal	4.60 Km	10 Feet (3m)	3m	1.38 Ha	Forest Road
28	Pannaikadu to Ethiroli Parai	Arunganal	2.00 Km	15 Feet (4.5m)	5m	1.0 Ha	Bus Route
		Arunganal			**Total**	**2.38**	

29	Kumbakarai – Selumbu to Adukkam	**Adukkam**	5.00 Km	7.50 M	15 m	**3.50**	Bus Route
30	Kaduguthadi RF Boundary to Pannaikadu	**Maruthanadiyar**	6 Km	5.5 m	6 m	**3.60**	Bus Route
31	Kaduguthadi puthur to Perumparai	**Kaduguthadi**	1.0 Km	5.5 m	6 m	**0.60**	Bus Route
32	Kannimar Combai kanavai to Simmaraya Perumal koil	Muruga-malai	2.8 Km	1.0 m	--	0.28	Foot Path
33	Endapuli Route	Muruga-malai	2.0 Km	1.0 m	--	0.2	Foot Path
34	Devadanappatty to Paramasivam Koil	Muruga-malai	2.0 Km	1.8 m	--	0.36	Foot Path
		Muruga-malai			**Total**	**0.84**	
	Grand Total					**133.408**	

MOHAN VERGHESE CHUNKATH
ADDITIONAL CHIEF SECRETARY TO GOVERNMENT

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ANNEXURE - VI

DETAILS OF LEASED AREA EXCLUDED FROM WILDLIFE SANCTUARY

Serial Number (1)	Name of reserved forest (2)	Name of the project (3)	User Agency (4)	Area diverted (in Hectares) (5)
(1)	Andipatty	Kuthiraiar Reservoir Project	Public Works Department	17.80
(2)	Gundar Valley Extension	Golf Ground	Golf Club, Kodaikanal	53.57
(3)	Gundar valley extension	Laying pipe line	Tamil Nadu Water and Drainage Board	0.079
(4)	Gundar Valley Extension	Research Station	Tamil Nadu Agricultural University	18.36
	Gundar Valley Extension	Total		72.009
(5)	Ampthill Down	Laying Pipe Line	Tamil Nadu Water and Drainage Board	0.367
(6)	Shengalvarayar	Golf Ground	Golf Club, Kodaikanal	3.73
(7)	SSRF	Laying fibre cable	Bharat Sanchar Nigam Limited	0.56
(8)	Pambar	Electric line	Electricity Board	13.619
(9)	Perumalmalai	Laying fibre cable	Bharat Sanchar Nigam Limited	0.24
(10)	Perumalmalai	Laying pipe line	Tamil Nadu Water and Drainage Board	0.34
	Perumalmalai	Total		0.58
(11)	Arunkanal	Police Repeater station	Police Department, Government of Tamil Nadu	1.075
(12)	Adukkam	Adukkam Road	District Rural Development Agency, Dindigul	4.0
		Grand Total		113.74

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ADDITIONAL CHIEF SECRETARY TO GOVERNMENT

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SECTION OFFICER

18. Kodaikanal Wildlife Sanctuary Eco Sensitive Zone Notification dated 23.01.2020.

उपाबंध -V

की गई कार्रवाई की रिपोर्ट का प्रपत्र:

1. बैठकों की संख्या और तारीख ।
2. बैठकों का कार्यवृत: (कृपया मुख्य उल्लेखनीय बिंदुओं का उल्लेख करें । बैठक के कार्यवृत्त को एक पृथक उपाबंध में उपाबद्ध करें) ।
3. आंचलिक महायोजना की तैयारी की प्रास्थिति जिसके अंतर्गत पर्यटन महायोजना भी है।
4. भू-अभिलेख में सदृश्य त्रुटियों के सुधार के लिए व्यौहार किए गए मामलों का सार (पारिस्थितिकी संवेदी जोन वार)। ब्यौरे उपाबंध के रूप में संलग्न किए जाएं।
5. पर्यावरण समाघात निर्धारण अधिसूचना, 2006 के अधीन आने वाले क्रियाकलापों की संवीक्षा के मामलों का सार । (ब्यौरे एक पृथक् उपाबंध के रूप में संलग्न किए जाएं)।
6. पर्यावरण समाघात निर्धारण अधिसूचना, 2006 के अधीन न आने वाले क्रियाकलापों की संवीक्षा के मामलों का सार । (ब्यौरे एक पृथक् उपाबंध के रूप में संलग्न किए जाएं)।
7. पर्यावरण (संरक्षण) अधिनियम, 1986 की धारा 19 के अधीन दर्ज की गई शिकायतों का सार ।
8. कोई अन्य महत्वपूर्ण मामला ।

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 23rd January, 2020

S.O. 412(E).—WHEREAS, a draft notification was published in the Gazette of India, Extraordinary, *vide* notification of the Government of India in the Ministry of Environment, Forest and Climate Change number S.O. 5834 (E) dated the 22nd November, 2018, inviting objections and suggestions from all persons likely to be affected thereby within the period of sixty days from the date on which copies of the Gazette containing the said notification were made available to the public;

AND WHEREAS, copies of the Gazette containing the said draft notification were made available to the public on the 26nd November, 2018;

AND WHEREAS, no objections and suggestions were received from persons and stakeholders in response to the draft notification;

AND WHEREAS, Kodaikanal Wildlife Sanctuary is spread over an area of 608.95 square kilometres and located in Kodaikanal and Palani Taluks of Dindigul District and Periyakulam Taluk of Theni District in the State of Tamil Nadu;

AND WHEREAS, Kodaikanal Forest Division was formed after bifurcating erstwhile Madurai North Division with headquarters at Kodaikanal with effect from 19th April, 1982 as per G.O.Ms. No.468 and as ordered in G.O.Ms. No. 261 dated 21st March, 1977. On bifurcation of Madurai Revenue District into Madurai and Dindigul districts as per G.O. Ms. No. 640 Revenue dated 22nd April, 1985, the forest areas under the control of Theni Forest Division were transferred to Kodaikanal Forest division and the division forms contiguous and compact block, lying in Kodaikanal Taluk and part of Palani Taluk in Dindigul district and part of Periyakulam Taluk of Theni district and the Kodaikanal Forest Division have been declared as Kodaikanal Wildlife Sanctuary in G.O. No.143 Environment and Forest (FR-5) dated: 20th September, 2013;

AND WHEREAS, forests of Kodaikanal Forest Division falling between $77^0$16' and 77^0 45' of East longitude and 10^0 20' and $10^0$5' of North latitude, is surrounded by Kerala State in the West, Coimbatore Revenue district in the North-West, Dindigul Forest Division on the

North-East, Madurai Revenue district in the South – East and Theni Forest Division on the South;

AND WHEREAS, Kodaikanal Wildlife Sanctuary is an important and unique habitat for varied flora and fauna which provide an ecologically sustainable habitat for about 44 species of mammals including endangered species like tiger, elephant, nilgiri tahr etc. It supports more than 150 species of birds, 40 species of reptiles, 8 species of amphibians, 202 species of butterflies and wide variety of ecosystems such as grasslands, fresh water ecosystem, marsh ecosystem, dry deciduous forest, tropical evergreen forest and shola forests and it is necessary to conserve the physical and biological diversity around the protected area of Kodaikanal Wildlife Sanctuary;

AND WHEREAS, the Sanctuary's floral diversity is extraordinary. The biota of the region is highly diverse with over 2478 species of flowering plant in 201 families of which 1758 are indigenous species, 161 species are naturalized in the area, 344 are cultivated species and 215 are garden species and examples of the floras are Pachai savukku (*Acacia decurrens*), Sokkala (*Aglaia elaeagnoidea*), Asiatic pennywort (*Centella asiatica*), Arabian jasmine (*Jasminum sambac*), etc;

AND WHEREAS, the Sanctuary has variety of birds, butterflies, insects, reptiles, amphibians and mammals and the examples of mammals are Tiger (*Panthera tigris*), Indian gaur (*Bos gaurus*), Elephant (*Elephas mazimus*), Wildboar (*Sus scrofa*), common Langur (*Semnopithecus*) etc. and the examples of birds are Red-whiskered bulbul (*Phycnonotus jocous*), common Kingfisher (*Alcedo atthis*), Bebra Sparrow-hawk (*Virgatus besra*) etc. while amphibians of the Sanctuary are common Asian Toad *(Bufo melanostictus)*, Indian Skipper Frog *(Euphlyatis cyanophlyetis)*, etc;

AND WHEREAS, the Kodaikanal Wildlife Sanctuary has 32 species of rare, endangered and threatened species and 49 endemic species which includes birds (29 species), butterfly (12 species), amphibians (8 species) and some endemic floral species which has become endangered and endemic to shola forest of this Sanctuary;

AND WHEREAS, it is necessary to conserve and protect the area, the extent and boundaries of Kodaikanal Wildlife Sanctuary which are specified in paragraph 1 as Eco-Sensitive Zone from ecological, environmental and biodiversity point of view and to prohibit industries or class of industries and their operations and processes in the said Eco-Sensitive Zone;

NOW THEREFORE, in exercise of the powers conferred by sub-section (1) and clauses (v) and (xiv) of sub-section (2) and sub-section (3) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986) (hereafter in this notification referred to as the Environment Act) read with sub-rule (3) of rule 5 of the Environment (Protection) Rules, 1986, the Central Government hereby notifies an area to an extent varying from 0.0 (zero) kilometre to 1.0 kilometre around the boundary of Kodaikanal Wildlife Sanctuary, in Dindigul and Theni districts in the State of Tamil Nadu as the Eco-Sensitive Zone (hereafter in this notification referred to as the Eco-Sensitive Zone), details of which are as under, namely: -

1. **Extent and boundaries of Eco-Sensitive Zone. –** (1) The Eco-Sensitive Zone shall be to an extent of 0.0 (zero) to 1.0 kilometre around the boundary of Kodaikanal Wildlife Sanctuary and the area of the Eco-Sensitive Zone is 106.78 square kilometres. *(Zero extent of Eco-Sensitive Zone is due to inter-State border with Kerala and presence of a township)*.

2. The boundary description of Kodaikanal Wildlife Sanctuary and its Eco-Sensitive Zone is appended as **Annexure-I.**

3. The maps of the Eco-Sensitive Zone of Kodaikanal Wildlife Sanctuary along with boundary details and latitudes and longitudes are appended as **Annexure-IIA, Annexure-IIB, Annexure-IIC, Annexure-IID, Annexure-IIE** and **Annexure-IIF.**

4. List of geo-coordinates of the boundary of Eco-Sensitive Zone of Kodaikanal Wildlife Sanctuary and prominent locations of zero extent of Eco-Sensitive Zone are given in Table **A,** Table **B** and Table **C** of **Annexure-III.**

5. The list of villages falling in the proposed Eco-Sensitive Zone along with their geo co-ordinates at prominent points is appended as **Annexure-IV.**

2. Zonal Master Plan for Eco-Sensitive Zone.- (1) The State Government shall, for the purposes of effective management of the Eco-Sensitive Zone prepare a Zonal Master Plan within a period of two years from the date of publication of this notification in the Official Gazette, in consultation with local people and adhering to the stipulations given in this notification for approval of the competent authority of State.

(2) The Zonal Master Plan for the Eco-Sensitive Zone shall be prepared by the State Government in such manner as is specified in this notification and also in consonance with the relevant Central and State laws and the guidelines issued by the Central Government, if any.

(3) The Zonal Master Plan shall be prepared in consultation with the following Departments of the State Government, for integrating the ecological and environmental considerations into the said plan:-

(i) Environment;

(ii) Forest and Wildlife;

(iii) Agriculture;

(iv) Revenue;

(v) Urban Development;

(vi) Tourism;

(vii) Rural Development;

(viii) Irrigation and Flood Control;

(ix) Municipal;

(x) Panchayati Raj;

(xi) Public Works Department;

(xii) Highways; and

(xiii) Tamil Nadu State Pollution Control Board.

(4) The Zonal Master Plan shall not impose any restriction on the approved existing land use, infrastructure and activities, unless so specified in this notification and the Zonal Master Plan shall factor in improvement of all infrastructure and activities to be more efficient and eco-friendly.

(5) The Zonal Master Plan shall provide for restoration of denuded and degraded areas, conservation of existing water bodies, management of catchment areas, watershed management, groundwater management, soil and moisture conservation, needs of local community and such other aspects of the ecology and environment that need attention.

(6) The Zonal Master Plan shall demarcate all the existing worshipping places, villages and urban settlements, types and kinds of forests, agricultural areas, fertile lands, green area, such as, parks and like places, horticultural areas, orchards, lakes and other water bodies with supporting maps giving details of existing and proposed land use features.

(7) The Zonal Master Plan shall regulate development in Eco-Sensitive Zone and adhere to prohibited and regulated activities listed in the Table in paragraph 4 and also ensure and promote eco-friendly development for security of local communities' livelihood.

(8) The Zonal Master Plan shall be co-terminus with the Regional Development Plan.

(9) The Zonal Master Plan so approved shall be the reference document for the Monitoring Committee for carrying out its functions of monitoring in accordance with the provisions of this notification.

(10) The said Master Plan shall regulate development in Eco-Sensitive Zone so as to ensure eco-friendly development for security of local community development.

3. **Measures to be taken by the State Government**.- The State Government shall take the following measures for giving effect to the provisions of this notification, namely:-

(1) Land use.– (a) Forests, horticulture areas, agricultural areas, parks and open spaces earmarked for recreational purposes in the Eco-Sensitive Zone shall not be used or converted into areas for major commercial or residential or industrial activities:

Provided that the conversion of agricultural and other lands, for the purpose other than that specified at part (a) adove, within the Eco-Sensitive Zone may be permitted on the recommendation of the Monitoring Committee, and with the prior approval of the competent authority under Regional Town Planning Act and other rules and regulations of Central Government or State Government as applicable and *vide* provisions of this Notification, to meet the residential needs of the local residents and for activities such as:-

(i) widening and strengthening of existing roads and construction of new roads;

(ii) construction and renovation of infrastructure and civic amenities;

(iii) small scale industries not causing pollution;

(iv) cottage industries including village industries; convenience stores and local amenities supporting eco-tourism including home stay; and

(v) promoted activities given under paragraph 4:

Provided further that no use of tribal land shall be permitted for commercial and industrial development activities without the prior approval of the competent authority under Regional Town Planning Act and other rules and regulations of the State Government and without compliance of the provisions of article 244 of the Constitution or the law for the time being in force, including the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (2 of 2007):

Provided also that any error appearing in the land records within the Eco-Sensitive Zone shall be corrected by the State Government, after obtaining the views of Monitoring Committee, once in each case and the correction of said error shall be intimated to the Central Government in the Ministry of Environment, Forest and Climate Change:

Provided also that the correction of error shall not include change of land use in any case except as provided under this sub-paragraph.

(b) Efforts shall be made to reforest the unused or unproductive agricultural areas with afforestation and habitat restoration activities.

(2) Natural water bodies.-The catchment areas of all natural springs or rivers shall be identified and plans for their conservation and rejuvenation shall be incorporated in the Zonal Master Plan and the guidelines shall be drawn up by the State Government in such a manner as to prohibit development activities at or near these areas which are detrimental to such areas.

(3) Tourism or Eco-tourism.- (a) All new eco-tourism activities or expansion of existing tourism activities within the Eco-Sensitive Zone shall be as per the Tourism Master Plan for the Eco-Sensitive Zone.

(b) The Eco-Tourism Master Plan shall be prepared by the Department of Tourism in consultation with State Departments of Environment and Forests.

(c) The Tourism Master Plan shall form a component of the Zonal Master Plan.

(d) The Tourism Master Plan shall be drawn based on the study of carrying capacity of the Eco-Sensitive Zone.

(e) The activities of eco-tourism shall be regulated as under, namely:-

(i) new construction of hotels and resorts shall not be allowed within one kilometre from the boundary of the protected area or upto the extent of the Eco-Sensitive Zone whichever is nearer:

Provided that beyond the distance of one kilometre from the boundary of the Wildlife Sanctuary till the extent of the Eco-Sensitive Zone, the establishment of new hotels and resorts shall be allowed only in pre-defined and designated areas for eco-tourism facilities as per Tourism Master Plan;

(ii) all new tourism activities or expansion of existing tourism activities within the Eco-Sensitive Zone shall be in accordance with the guidelines issued by the Central Government in the Ministry of Environment, Forest and Climate Change and the eco-tourism guidelines issued by National Tiger Conservation Authority (as amended from time to time) with emphasis on eco-tourism, eco-education and eco-development;

(iii) until the Zonal Master Plan is approved, development for tourism and expansion of existing tourism activities shall be permitted by the concerned regulatory authorities based on the actual site specific scrutiny and recommendation of the Monitoring Committee and no new hotel, resort or commercial establishment construction shall be permitted within Eco-Sensitive Zone area.

(4) Natural heritage.- All sites of valuable natural heritage in the Eco-Sensitive Zone, such as the gene pool reserve areas, rock formations, waterfalls, springs, gorges, groves, caves, points, walks, rides, cliffs, etc. shall be identified and a heritage conservation plan shall be drawn up for their preservation and conservation as a part of the Zonal Master Plan.

(5) Man-made heritage sites.- Buildings, structures, artefacts, areas and precincts of historical, architectural, aesthetic, and cultural significance shall be identified in the Eco-Sensitive Zone and heritage conservation plan for their conservation shall be prepared as part of the Zonal Master Plan.

(6) Noise pollution. - Prevention and control of noise pollution in the Eco-Sensitive Zone shall be complied in accordance with the provisions of the Noise Pollution (Regulation and Control) Rules, 2000 under the Environment Act.

(7) Air pollution.- Prevention and control of air pollution in the Eco-Sensitive Zone shall be compiled in accordance with the provisions of the Air (Prevention and Control of Pollution) Act, 1981 (14 of 1981) and the rules made thereunder.

(8) Discharge of effluents.- Discharge of treated effluent in Eco-Sensitive Zone shall be in accordance with the provisions of the General Standards for Discharge of Environmental Pollutants covered under the Environment Act and the rules made thereunder or standards stipulated by State Government whichever is more stringent.

(9) Solid wastes.- Disposal and Management of solid wastes shall be as under:-

a) the solid waste disposal and management in the Eco-Sensitive Zone shall be carried out in accordance with the Solid Waste Management Rules, 2016, published by the Government of India in the Ministry of Environment, Forest and Climate Change *vide* notification number S.O. 1357 (E), dated the 8th April, 2016; the inorganic material may be disposed in an environmental acceptable manner at site identified outside the Eco-Sensitive Zone;

b) safe and Environmentally Sound Management (ESM) of Solid wastes in conformity with the existing rules and regulations using identified technologies may be allowed within Eco-Sensitive Zone.

(10) Bio-Medical Waste.– Bio Medical Waste Management shall be as under:-

a) the Bio-Medical Waste disposal in the Eco-Sensitive Zone shall be carried out in accordance with the Bio-Medical Waste Management, Rules, 2016 published by the Government of India in the Ministry of Environment, Forest and Climate Change *vide* notification number G.S.R 343 (E), dated the 28th March, 2016.

b) safe and Environmentally Sound Management of Bio-Medical Wastes in conformity with the existing rules and regulations using identified technologies may be allowed within the Eco-Sensitive Zone.

(11) Plastic waste management.- The plastic waste management in the Eco-Sensitive Zone shall be carried out as per the provisions of the Plastic Waste Management Rules, 2016, published by the Government of India in the Ministry of Environment, Forest and Climate Change *vide* notification number G.S.R. 340(E), dated the 18th March, 2016, as amended from time to time.

(12) Construction and demolition waste management.- The construction and demolition waste management in the Eco-Sensitive Zone shall be carried out as per the provisions of the Construction and Demolition Waste Management Rules, 2016 published by the Government of India in the Ministry of Environment, Forest and Climate Change *vide* notification number G.S.R. 317(E), dated the 29th March, 2016, as amended from time to time.

(13) E-waste.- The E-waste management in the Eco-Sensitive Zone shall be carried out as per the provisions of the E-Waste Management Rules, 2016, published by the Government of India in the Ministry of Environment, Forest and Climate Change, as amended from time to time.

(14) Vehicular traffic.– The vehicular movement of traffic shall be regulated in a habitat friendly manner and specific provisions in this regard shall be incorporated in the Zonal Master Plan and till such time as the Zonal Master plan is prepared and approved by the Competent Authority in the State Government, the Monitoring Committee shall monitor compliance of vehicular movement under the relevant Acts and the rules and regulations made thereunder.

(15) Vehicular pollution.- Prevention and control of vehicular pollution shall be incompliance with applicable laws and efforts shall be made for use of cleaner fuel like CNG, LPG etc.

(16) Industrial units.– (i) On or after the publication of this notification in the Official Gazette, no new polluting industries shall be permitted to be set up within the Eco-Sensitive Zone.

(ii) Only non-polluting industries shall be allowed within Eco-Sensitive Zone as per the classification of Industries in the guidelines issued by the Central Pollution Control Board in February, 2016, unless so specified in this notification, and in addition, the non-polluting cottage industries shall be promoted.

(17) Protection of hill slopes.- The protection of hill slopes shall be as under:-

(a) the Zonal Master Plan shall indicate areas on hill slopes where no construction shall be permitted;

(b) construction on existing steep hill slopes or slopes with a high degree of erosion shall not be permitted.

4. List of activities prohibited or to be regulated within Eco-Sensitive Zone.- All activities in the Eco sensitive Zone shall be governed by the provisions of the Environment Act and the rules made there under including the Coastal Regulation Zone, 2011 and the Environmental Impact Assessment Notification, 2006 and other applicable laws including the Forest (Conservation) Act, 1980 (69 of 1980), the Indian Forest Act, 1927 (16 of 1927), the Wildlife (Protection) Act 1972 (53 of 1972), and amendments made thereto and be regulated in the manner specified in the Table below, namely:-

TABLE

S. No. (1)	Activity (2)	Description (3)
	A. Prohibited Activities	
1.	Commercial mining, stone quarrying and crushing units.	(a) All new and existing mining (minor and major minerals), stone quarrying and crushing units are prohibited with immediate effect except for meeting the domestic needs of bona fide local residents including digging of earth for construction or repair of houses and for manufacture of country tiles or bricks for housing and for personal consumption; (b) The mining operations shall be carried out in accordance with the order of the Hon'ble Supreme Court dated the 4th August, 2006 in the matter of T.N. Godavarman Thirumulpad Vs. UOI in W.P.(C) No.202 of 1995 and dated the 21st April, 2014 in the matter of Goa Foundation Vs. UOI in W.P.(C) No.435 of 2012.
2.	Setting of industries causing pollution (Water, Air, Soil, Noise, etc.).	New industries and expansion of existing polluting industries in the Eco-Sensitive Zone shall not be permitted: Provided that non-polluting industries shall be allowed within Eco-Sensitive Zone as per classification of Industries in the guidelines issued by the Central Pollution Control Board in February, 2016, unless otherwise specified in this notification and in addition the non-polluting cottage industries shall be promoted.
3.	Establishment of major hydro-electric project.	Prohibited (except as otherwise provided) as per the applicable laws.
4.	Use or production or processing of any hazardous substances.	Prohibited (except as otherwise provided) as per the applicable laws.
5.	Discharge of untreated effluents in natural water bodies or land area.	Prohibited (except as otherwise provided) as per the applicable laws.
6.	Setting up of new saw mills.	New or expansion of existing saw mills shall not be permitted within the Eco-Sensitive Zone.
7.	Setting up of brick kilns.	Prohibited (except as otherwise provided) as per the applicable laws.
	B. Regulated Activities	
8.	Commercial establishment of hotels and resorts.	No new commercial hotels and resorts shall be permitted within one kilometer of the boundary of the protected area or upto the extent of Eco-Sensitive Zone, whichever is nearer, except for small temporary structures for eco-tourism activities:

S. No. (1)	Activity (2)	Description (3)
		Provided that, beyond one kilometer from the boundary of the protected area or upto the extent of Eco-Sensitive Zone whichever is nearer, all new tourist activities or expansion of existing activities shall be in conformity with the Tourism Master Plan and guidelines as applicable.
9.	Construction activities.	(a) New commercial construction of any kind shall not be permitted within one kilometer from the boundary of the protected area or upto extent of the Eco-Sensitive Zone, whichever is nearer: Provided that, local people shall be permitted to undertake construction in their land for their use including the activities mentioned in sub-paragraph (1) of paragraph 3 as per building bye-laws to meet the residential needs of the local residents. Provided further that the construction activity related to small scale industries not causing pollution shall be regulated and kept at the minimum, with the prior permission from the competent authority as per applicable rules and regulations, if any. (b) Beyond one kilometer it shall be regulated as per the Zonal Master Plan.
10.	Small scale non polluting industries.	Non polluting industries as per classification of industries issued by the Central Pollution Control Board in February, 2016 and non-hazardous, small-scale and service industry, agriculture, floriculture, horticulture or agro-based industry producing products from indigenous materials from the Eco-Sensitive Zone shall be permitted by the competent Authority.
11.	Felling of trees.	(a) There shall be no felling of trees in the forest or Government or revenue or private lands without prior permission of the Competent Authority in the State Government. (b) The felling of trees shall be regulated in accordance with the provisions of the concerned Central or State Act and the rules made thereunder.
12.	Collection of Forest produce or Non-Timber Forest produce.	Regulated as per the applicable laws.
13.	Establishment of large-scale commercial livestock and poultry farms by firms, corporate and	Regulated (except otherwise provided) as per the applicable laws except for meeting local needs.

S. No. (1)	Activity (2)	Description (3)
	companies.	
14.	Erection of electrical and communication towers and laying of cables and other infrastructures.	Regulated as per the applicable laws (underground cabling may be promoted).
15.	Infrastructure including civic amenities.	Taking measures of mitigation as per the applicable laws, rules and regulations available guidelines.
16.	Widening and strengthening of existing roads and construction of new roads.	Taking measures of mitigation as per the applicable laws, rules and regulation and available guidelines.
17.	Undertaking other activities related to tourism like flying over the Eco-Sensitive Zone area by hot air balloon, helicopter, drones, microlites, etc.	Regulated as per the applicable laws.
18.	Protection of hill slopes and river banks.	Regulated as per the applicable laws.
19.	Movement of vehicular traffic at night.	Regulated for commercial purpose as per the applicable laws.
20.	Ongoing agriculture and horticulture practices by local communities along with dairies, dairy farming, aquaculture and fisheries.	Permitted as per the applicable laws for use of locals.
21.	Discharge of treated waste water or effluents in natural water bodies or land area.	The discharge of treated waste water or effluents shall be avoided to enter into the water bodies and efforts shall be made for recycle and reuse of treated waste water. Otherwise the discharge of treated waste water or effluent shall be regulated as per the applicable laws.
22.	Commercial extraction of surface and ground water.	Regulated as per the applicable laws.
23.	Open well, bore well etc. for agriculture or other usage.	Regulated and the activity should be strictly monitored by the appropriate authority.
24.	Solid waste management.	Regulated as per the applicable laws.
25.	Introduction of exotic species.	Regulated as per the applicable laws.
26.	Eco-tourism.	Regulated as per the applicable laws.
27.	Use of polythene bags.	Regulated as per the applicable laws.
28.	Commercial sign boards and hoardings.	Regulated as per the applicable laws.

S. No. (1)	Activity (2)	Description (3)
	C. Promoted Activities	
29.	Rain water harvesting.	Shall be actively promoted.
30.	Organic farming.	Shall be actively promoted.
31.	Adoption of green technology for all activities.	Shall be actively promoted.
32.	Cottage industries including village artisans, etc.	Shall be actively promoted.
33.	Use of renewable energy and fuels.	Bio-gas, solar light etc. shall be actively promoted.
34.	Agro-Forestry.	Shall be actively promoted.
35.	Plantation of Horticulture and herbals.	Shall be actively promoted.
36.	Use of eco-friendly transport.	Shall be actively promoted.
37.	Skill development.	Shall be actively promoted.
38.	Restoration of degraded land/ forests/ habitat.	Shall be actively promoted.
39.	Environmental awareness.	Shall be actively promoted.

5. **Monitoring Committee for Monitoring the Eco-Sensitive Zone Notification.-** For effective monitoring of the provisions of this notification under sub-section (3) of section 3 of the Environment (Protection) Act, 1986, the Central Government hereby constitutes a Monitoring Committee, comprising of the following, namely:-

S N	Constituent of the Monitoring Committee	Designation
(i)	District Collector	Chairman, ex officio
(ii)	District Forest Officer, Dindigul Division	Member;
(iii)	Assistant Director, Mines and Minerals	Member;
(iv)	Executive Engineer, Public Work Department and Ground Water	Member;
(v)	A representative of Non-government Organization working in the field of wildlife conservation to be nominated by State Government	Member;
(vi)	An expert in Biodiversity nominated by the State Government	Member;
(vii)	An expert in Ecology and Environment to be nominated by the State Government	Member;
(viii)	A representative from State Public Works Department	Member;
(ix)	A representative from State Pollution Control Board	Member;
(x)	Deputy Director, Town Planning	Member;
(xi)	District Forest Officer, Kodaikanal	Member-Secretary.

6. Terms of reference. – (1) The Monitoring Committee shall monitor the compliance of the provisions of this notification.

(2) The tenure of the Monitoring Committee shall be for three years or till the re-constitution of the new Committee by the State Government and subsequently the Monitoring Committee shall be constituted by the State Government.

(3) The activities that are covered in the Schedule to the notification of the Government of India in the erstwhile Ministry of Environment and Forests number S.O. 1533 (E), dated the 14th September, 2006, and are falling in the Eco-Sensitive Zone, except for the prohibited activities as specified in the Table under paragraph 4 thereof, shall be scrutinised by the Monitoring Committee based on the actual site-specific conditions and referred to the Central Government in the Ministry of Environment, Forest and Climate Change for prior environmental clearances under the provisions of the said notification.

(4) The activities that are not covered in the Schedule to the notification of the Government of India in the erstwhile Ministry of Environment and Forest number S.O. 1533 (E), dated the 14th September, 2006 and are falling in the Eco-Sensitive Zone, except for the prohibited activities as specified in the Table under paragraph 4 thereof, shall be scrutinised by the Monitoring Committee based on the actual site-specific conditions and referred to the concerned regulatory authorities.

(5) The Member-Secretary of the Monitoring Committee or the concerned Deputy Commissioner(s) shall be competent to file complaints under section 19 of the Environment Act, against any person who contravenes the provisions of this notification.

(6) The Monitoring Committee may invite representatives or experts from concerned Departments, representatives from industry associations or concerned stakeholders to assist in its deliberations depending on the requirements on issue to issue basis.

(7) The Monitoring Committee shall submit the annual action taken report of its activities as on the 31st March of every year by the 30th June of that year to the Chief Wildlife Warden in the State as per proforma appended at **Annexure V**.

(8) The Central Government in the Ministry of Environment, Forest and Climate Change may give such directions, as it deems fit, to the Monitoring Committee for effective discharge of its functions.

7. The Central Government and State Government may specify additional measures, if any, for giving effect to provisions of this notification.

8. The provisions of this notification shall be subject to the orders, if any passed or to be passed by the Hon'ble Supreme Court of India or High Court or the National Green Tribunal.

[F. No. 25/31/2018-ESZ]

Dr. SATISH C. GARKOTI, Scientist 'G'

ANNEXURE- I

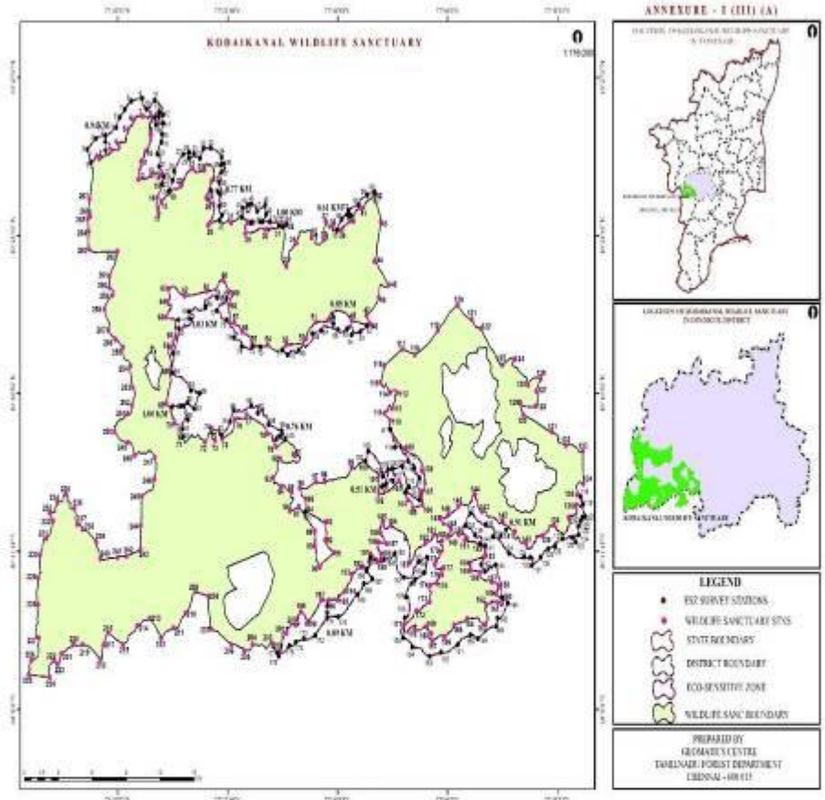
BOUNDARY DESCRIPTION OF KODAIKANAL WILDLIFE SANCTUARY AND ITS ECOSENSITIVE ZONE IN THE STATE TAMIL NADU

North	The Northern boundary of the Eco-Sensitive Zone commences from the Palani – Perumalmalai Road to Anna Junction (Palani – Perumalmalai) at Id – F14 to F15 runs crossing the prominent places as mentioned in the map from North to North East in Palani Range. In North Eco sensitive Zone runs from in North East Id-G1 to id-G3 runs towards west crossing from the prominent places. (Anchuran mandai to Nagamarathalai) in Palani Range.

North East	The North East boundary of the Sanctuary from North east to East corner is surrounded by the Boundary of Dindigul Forest Division in Dindigul District. No proposal is being made for the Eco-Sensitive Zone on that front in Perumpallam Range. Because they are cliffs.
East	The eastern boundary of the Eco-Sensitive Zone commences from the Perumalmalai Addukkam Road (Id-G13), Palamalai (Id-G12), Kurudikadumalai (Id-G11) and extend to Periyavarai (Id-B11) and runs towards South East crossing the prominent places as mentioned in the map and key location in Kodaikanal Range. And the other part of Eco sensitive zone commences from the Krishnan kovail and staring point of Dindingul – Theni Districts boundary at id – H1 and runs towars south east crossing the prominent places as mentioned in the map with Global Positioning System (GPS) readings in order of Id – H2 to Id – H7 and finally reach Batalagundu – Periyakulam Road at Id - H8 in Perumpallam and Devathanapatty Ranges.
South East	The South east boundary of the Eco-Sensitive Zone commences from the Batalagundu – Periyakulam Road at Id - H8 towards south crossing the prominent places as mentioned in the map with Global Positioning System (GPS) readings in order of Id – H9 to Id – H18 and finally reach the Sothuparai Reservoir at Id – H19.
South	The South boundary of the sanctuary from South corner to South West corner is surrounded by the Boundary of Theni Forest Division in Theni District. No proposal is being made for the Eco-Sensitive Zone on that front in Devathanapatty, Berijam and Vandaravu Ranges.
South West	The South West boundary of the Eco-Sensitive Zone commences from the id-11(Gurusamy medu) extend towards west up to 10 (Zero Eco-Sensitive Zone) and from 9 (Zero Eco-Sensitive Zone) runs towards at id- G9 (Kulatta kanavay Falls) crossing the prominent places as mentioned in the map. And, also interstate boundary of Kerala Buffer and core area of Anamalai Tiger Reserve located from Northwest towards west. Therefore, no proposal is being made for the Eco-Sensitive Zone on that front in Vandaravu, Mannavanur and Poombarai Ranges.
West	The West boundary of the Eco Sensitive Zone commences from the Kulatta kanavay Falls to Ulrapulran Kanavai at id – G9 to id- G4 towards Northwest crossing the prominent places as mentioned in the map in Palani Range. And, also Anamalai Tiger Reserve located from West corner to Northwest corner. No proposal is being made for the Eco-Sensitive Zone on that front in Poombarai and Palani Ranges.
North West	The northern west boundary of the Eco-Sensitive Zone commences from the Bi-junction of Anamalai Tiger Reserve and Kodaikanal Wildlife Sanctuary boundary at Id – F1 and runs towards north crossing the prominent places along the natural boundaries such as Streams, roads, path way and nullahsetc with Global Positioning System (GPS) reading in order of id's viz F2 (Naval Odai DGL – Thiruppur District Boundary) to F11 (Vannatti odai).And also from Mottaiparai to Palar-Porandalar Reservoir-zero point at id-F12 to id-F13 in Palani Range.

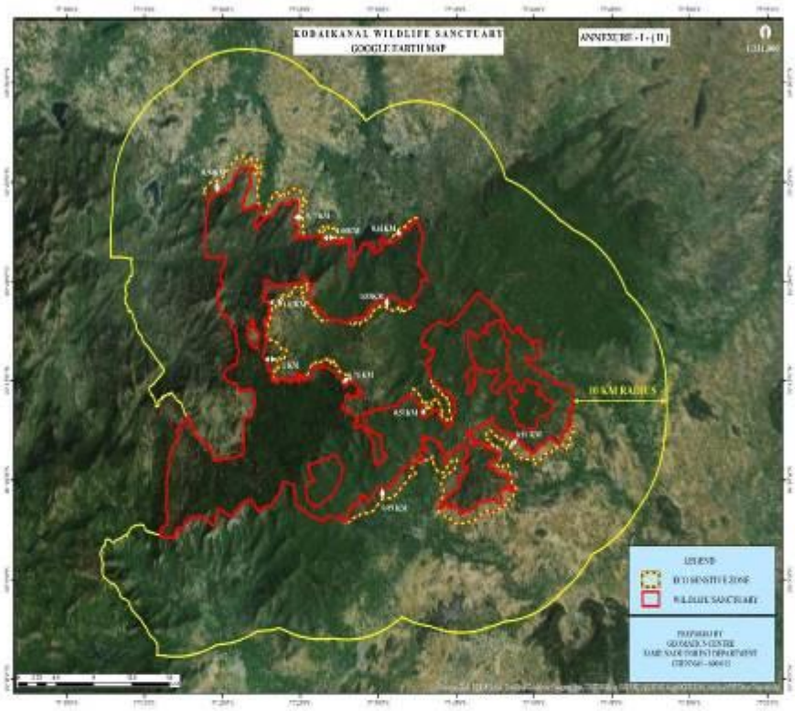
ANNEXURE- IIA

LOCATION MAP OF KODAIKANAL WILDLIFE SANCTUARY AND ITS ECO-SENSITIVE ZONE ALONG WITH LATITUDE AND LONGITUDE OF PROMINENT LOCATIONS



ANNEXURE- IIB

GOOGLE MAP OF ECO-SENSITIVE ZONE OF KODAIKANAL WILDLIFE SANCTUARY ALONG WITH LATITUDE AND LONGITUDE OF PROMINENT LOCATIONS

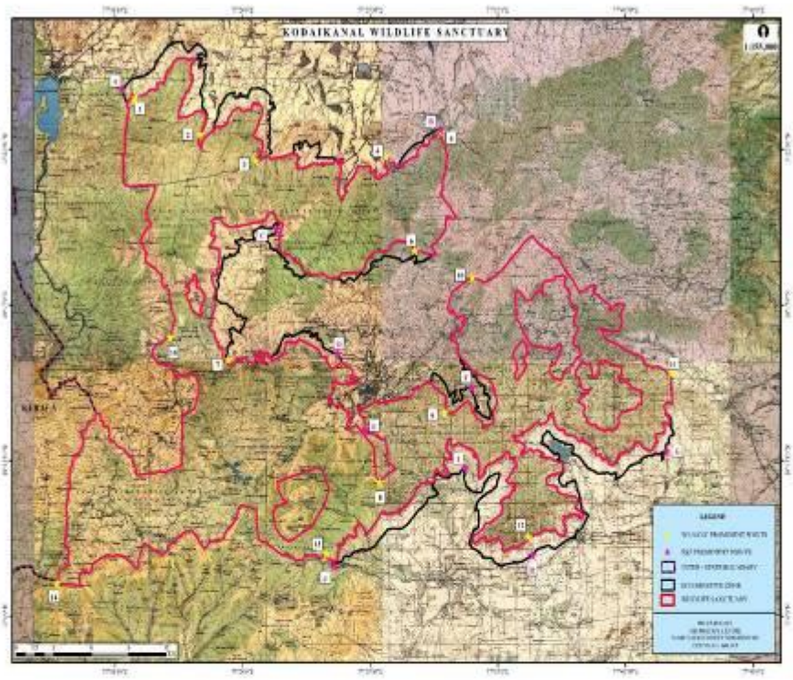


ANNEXURE- IIC

GOOGLE MAP OF ECO-SENSITIVE ZONE OF KODAIKANAL WILDLIFE SANCTUARY SHOWING 10 KM BUFFER ALONG WITH LATITUDE AND LONGITUDE OF PROMINENT LOCATIONS

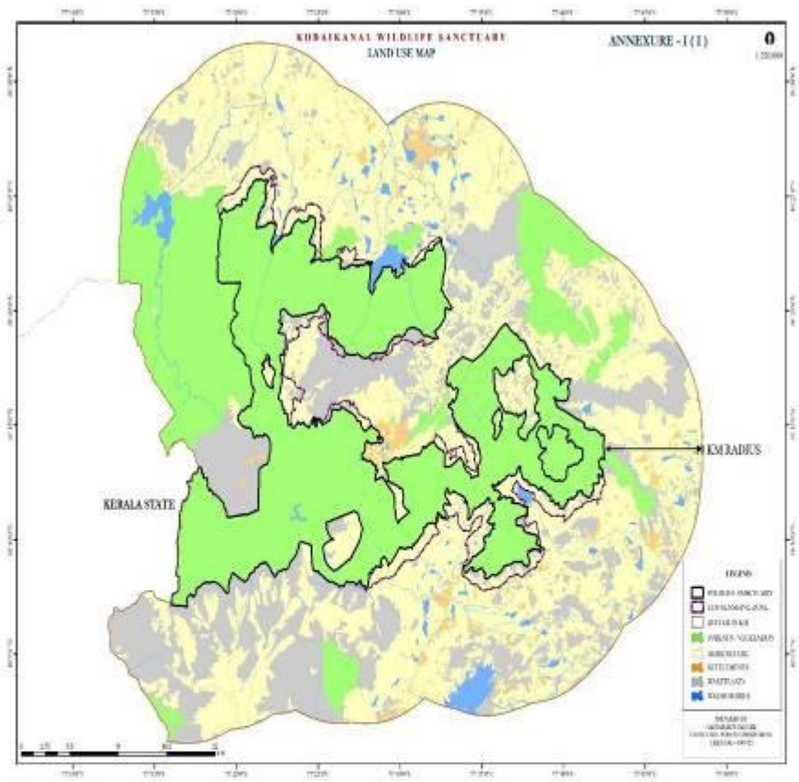
ANNEXURE- IID

MAP OF ECO-SENSITIVE ZONE OF KODAIKANAL WILDLIFE SANCTUARY ALONG WITH LATITUDE AND LONGITUDE OF PROMINENT LOCATIONS ON SURVEY OF INDIA (SOI) TOPOSHEET



ANNEXURE- IIE

MAP SHOWING LANDUSE PATTERN OF ECO-SENSITIVE ZONE OF KODAIKANAL WILDLIFE SANCTUARY AND 10 KM BUFFER ALONG WITH LATITUDE AND LONGITUDE OF PROMINENT LOCATIONS



ANNEXURE- IIF

MAP SHOWING FOREST LAND OF ECO-SENSITIVE ZONE OF KODAIKANAL WILDLIFE SANCTUARY

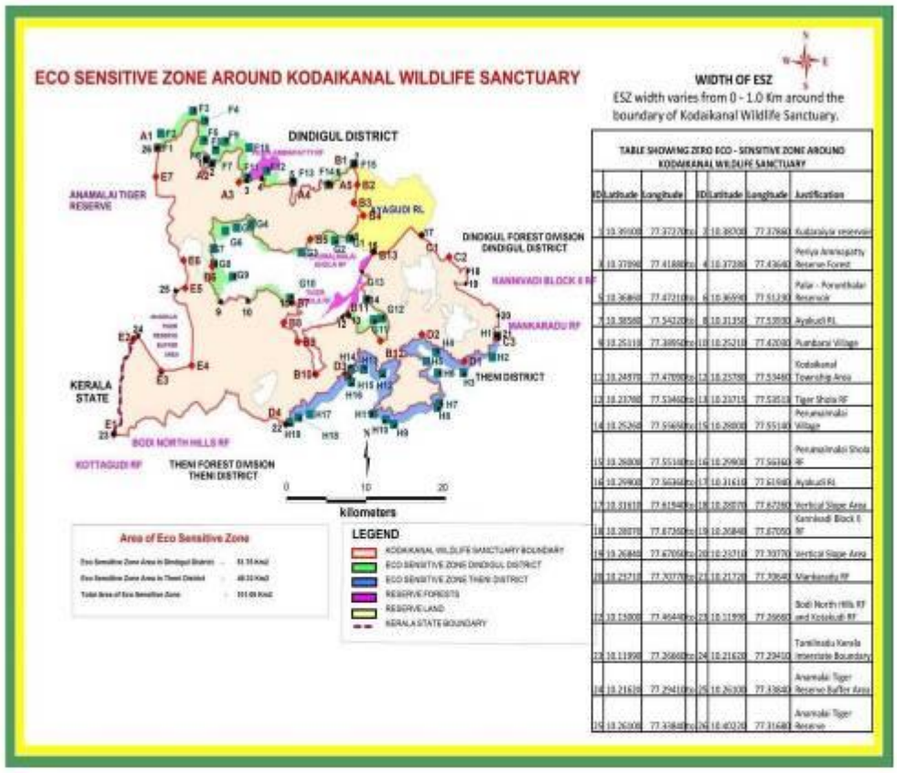


TABLE SHOWING ZERO ECO - SENSITIVE ZONE AROUND KODAIKANAL WILDLIFE SANCTUARY

ID	Latitude	Longitude	ID	Latitude	Longitude	Justification
1	10.35900	77.37270	2	10.36700	77.37990	Kudiraiyar reservoir
3	10.37890	77.41480	4	10.37280	77.43640	Periya Annaiyapatty Reserve Forest
5	10.36860	77.47210	6	10.36590	77.51230	Palar - Perumthalai Reserve
7	10.38560	77.54220	8	10.31350	77.53930	Ayakudi RL
9	10.25110	77.38950	10	10.25210	77.42030	Pumparai Village
11	10.24570	77.47090	12	10.23780	77.53480	Kodaikanal Township Area
13	10.23780	77.53460	14	10.23710	77.53510	Tiger Shola RF
15	10.25260	77.59690	16	10.26900	77.55180	Perumalmalai Village
17	10.26800	77.55180	18	10.29800	77.56160	Perumalmalai Shola RF
19	10.29900	77.56360	20	10.31610	77.61940	Ayakudi RL
21	10.31610	77.61940	22	10.29570	77.62780	Vertical Slope Area
23	10.28070	77.67360	24	10.26840	77.67090	Kannivadi Block II RF
25	10.26840	77.67060	26	10.23710	77.70770	Vertical Slope Area
27	10.23710	77.70770	28	10.21720	77.70540	Manjanoothu RF
29	10.13800	77.46540	30	10.11990	77.39680	Bodi North Hills RF and Kottagudi RF
31	10.11990	77.39680	32	10.21620	77.29410	Tamilnadu Kerala Interstate Boundary
33	10.21620	77.29410	34	10.26300	77.43640	Anamalai Tiger Reserve Buffer Area
35	10.26300	77.43640	36	10.40220	77.31680	Anamalai Tiger Reserve

ANNEXURE-III

TABLE A: GEO- COORDINATES OF PROMINENT LOCATIONS OF KODAIKANAL WILDLIFE SANCTUARY

Key Points along Kodaikanal Wildlife Sanctuary Boundary			
ID	**Location**	**Latitude (N)**	**Longitude (E)**
A1	North West corner of Andipatti	10.40220	77.31670
A2	Kudaraiyar Reservoir ZeroPoint	10.39100	77.37260
A3	Pachaiyar River enters Revenue land	10.36820	77.40970
A4	PalarPoranthalar Reservoir Zero point	10.36830	77.47190
A5	Palani - PerumalMalai Road	10.36570	77.51470
B1	North East Corner of PV Valley	10.38530	77.54230
B2	Savarikadu	10.36580	77.54590
B3	AttukalluMalai	10.34830	77.54180
B4	PallangiMalai	10.33540	77.55310
B5	VaikundaMalai	10.31200	77.49190
B6	Kukal - Pazhmputhur Road	10.28540	77.37920
B7	Pig Valley	10.24970	77.47100
B8	Kodai - Poomparai Road Near Oothu	10.23000	77.46150
B9	Suicide Point	10.21100	77.47770
B10	KodiMudi	10.17890	77.49840
B11	PeriyaVarai	10.23790	77.53460
B12	SanniyasiMalai	10.21170	77.57230
B13	PerumalMalai Peak	10.29970	77.56410
C1	ArunkanalMalai	10.31610	77.61930
C2	Pannaikadu - Thandikudi Road	10.29490	77.65130
C3	Dindigul - Theni District Junction	10.21480	77.70650
D1	Ghat Road Near Kamakkapatti	10.19200	77.66860
D2	Manjalar River enters in Revenue land	10.21840	77.61990
D3	Periyakulam - Kumbakarai Road	10.17890	77.53240
D4	Sothuparai Dam	10.12960	77.46400
E1	PambadiSolaiMalai	10.11930	77.26660
E2	Kilavarai - Kadavarai Path	10.21370	77.28920
E3	UrumbanKanavai	10.18200	77.32030
E4	ThuppianKanavai	10.18750	77.35570
E5	VellariMalai	10.26380	77.34810
E6	PappalammanMalai	10.29130	77.34600
E7	EllaiKunduParai	10.37380	77.31460

TABLE B: GEO-COORDINATES OF PROMINENT LOCATIONS OF ECO-SENSITIVE ZONE

ID	Location	Latitude (N)	Longitude (E)
F1	Bi-junction of Anamalai TR and KKL WLS	10.40220	77.31670
F2	Naval Odai (DGL - Tirupur District Boundary)	10.41640	77.32020
F3	PerandaiKaradu	10.43860	77.35720
F4	KottanKaradu	10.42880	77.37060
F5	GajattuOdai	10.40950	77.36960
F6	Kudiraiyar Reservoir Zero Point (Western)	10.39100	77.37260
F7	Kudiraiyar Reservoir Zero Point (Eastern)	10.38690	77.37870
F8	Kudiraiyar Reservoir Road	10.39990	77.38330
F9	ChinnaKaradu Hillock	10.40860	77.39440
F10	Pachaiyar River	10.40250	77.42180
F11	VannattiOdai	10.37280	77.41990
F12	MottaiParai	10.37960	77.44130
F13	Palar - Porandalar Reservoir - Zero Point	10.36850	77.47210
F14	Palani- Perumalmalai Road	10.36580	77.51230
F15	Annanagar Junction (Palani - PerumalMalai)	10.38670	77.54210
G1	AnchuraMandai	10.31300	77.53710
G2	GenguvarOdai	10.31110	77.52030
G3	Nagamaratalai	10.29910	77.48160
G4	UlrapuIranKanavai	10.32740	77.42420
G5	Attivayal	10.32350	77.40730
G6	VadugamannadiVarai	10.32040	77.39450
G7	Kundupatti Metal Road	10.30280	77.38050
G8	Kukal - Pazhamputhur Road	10.28800	77.38120
G9	KulattaKanavay Falls	10.27520	77.40280
G10	GuruswamiMettu	10.25400	77.46860
G11	KurudikaduMalai	10.23280	77.56470
G12	Palamalai	10.23400	77.57380
G13	Perumalmalai - Adukkam Road	10.25260	77.55650
H1	Krishnan Koil-Starting point of DGL-Then	10.21720	77.70630
H2	ManthuraiOdai	10.19600	77.70110
H3	Forest CheckpostKamakkapatti (KKL- Ghat Road)	10.18060	77.66770

H4	Manjalar Zero point- Northern Side	10.20070	77.63630
H5	Rasimalai Nagar	10.19190	77.62520
H6	Devadanapatti - Manjalar Road	10.18030	77.63840
H7	Siphon Near Devadanapatti	10.15030	77.63980
H8	Batlagundu - Periyakulam Road	10.14650	77.63770
H9	Entrance of Horticultural College	10.12970	77.58760
H10	Endapuli - Murugamalai Metal Road	10.13430	77.57840
H11	Murugamalai Main Road	10.13990	77.56480
H12	PuliOdai	10.17970	77.57500
H13	Pulikuttar River	10.18380	77.55310
H14	Kumbakarai - Adukkam Road	10.18410	77.53870
H15	Kumbakari -Periyakulam Road	10.17700	77.53560
H16	Pambar River	10.17100	77.53890
H17	VarahaNadi	10.13950	77.49150
H18	Periyar River	10.13610	77.47820
H19	Sotuparai Reservoir	10.13140	77.46830

TABLE C: GEO-COORDINATES OF PROMINENT LOCATIONS OF KODAIKANAL WILDLIFE SANCTUARY HAVING ZERO EXTENT OF ECO-SENSITIVE ZONE

ID	Latitude	Longitude		ID	Latitude	Longitude	Justification
1	10.39100	77.37270	to	2	10.38700	77.37860	Kudaraiyar reservoir
3	10.37090	77.41880	to	4	10.37280	77.43640	PeriyaAmmapatty Reserve Forest
5	10.36860	77.47210	to	6	10.36590	77.51230	Palar - Porunthalar Reservoir
7	10.38580	77.54220	to	8	10.31350	77.53930	Ayakudi RL
9	10.25110	77.38950	to	10	10.25210	77.42030	Poombarai village
11	10.24970	77.47090	to	12	10.23780	77.53460	Kodaikanal Township Area
12	10.23780	77.53460	to	13	10.23715	77.53513	Tiger Shola RF
14	10.25260	77.55650	to	15	10.28000	77.55140	Perumalmalai Village
15	10.28000	77.55140	to	16	10.29900	77.56360	Perumalmalai Shola RF
16	10.29900	77.56360	to	17	10.31610	77.61940	Ayakudi RL
17	10.31610	77.61940	to	18	10.28070	77.67260	Vertical Slope Area
18	10.28070	77.67260	to	19	10.26840	77.67050	Kannivadi Block II RF
19	10.26840	77.67050	to	20	10.23710	77.70770	Vertical Slope Area
20	10.23710	77.70770	to	21	10.21720	77.70640	Mankaradu RF
22	10.13000	77.46440	to	23	10.11990	77.26660	Bodi North Hills RF and Kotakudi RF

23	10.11990	77.26660	to	24	10.21620	77.29410	Tamilnadu Kerala Interstate Boundary
24	10.21620	77.29410	to	25	10.26100	77.33840	Anamalai Tiger Reserve Buffer Area
25	10.26100	77.33840	to	26	10.40220	77.31680	Anamalai Tiger Reserve

ANNEXURE-IV

LIST OF VILLAGES COMING UNDER ECO-SENSITIVE ZONE OF KODAIKANAL WILDLIFE SANCTUARY ALONG WITH GEO-COORDINATES

S. No	Division	Name of the Villages	Geo – Coordinates	
			Latitude	Longitude
1	Kodaikanal	Andipatty	10°26' 13.2"	77°22' 42.96"
2		Velayudampalayampudur	10° 15' 44.78"	77° 15' 11.88"
3		Pappampatty	10° 15' 44.12"	77° 14' 33.39"
4		Kavalpatty	10° 15' 43.63"	77° 15' 14.99"
5		Annanagar	10°23' 9.97"	77° 32' 28.12"
6		Adukkam	10° 14' 16.98"	77° 33' 08.21"
7		Kodaikanal	10° 14' 16.07"	77° 29' 20.85"
8		Kookal	10° 17' 09.23"	77°21' 48.04"
9		Poomparai	10° 15' 23.10"	77°24' 28.13"
10		Thandikudi	10° 18' 35.32"	77° 38' 35.11"
11		Pannaikadu	10° 16' 43.47"	77° 37' 42.81"
12		Poolathur	10° 13' 27.03"	77° 39' 56.51"
13		Vellagavi – Periyar	10° 9' 26.54"	77°26' 26.95"
		Vellagavi - Chinnur	10° 11' 50.49"	77° 29' 59.70"
14		Devathanapatty	10° 08' 47.86"	77° 38' 36.90"
15		Ganguvarpatty	10° 10' 14.58"	77° 41' 52.86"
16		Vadakarai	10° 08' 53.50"	77° 31' 02.62"

ANNEXURE –V

Performa of Action Taken Report:

1. Number and date of meetings.
2. Minutes of the meetings: (mention noteworthy points. Attach minutes of the meeting as separate Annexure).
3. Status of preparation of Zonal Master Plan including Tourism Master Plan.
4. Summary of cases dealt with rectification of error apparent on face of land record (Eco-Sensitive Zone wise). Details may be attached as Annexure.
5. Summary of cases scrutinised for activities covered under the Environment Impact Assessment Notification, 2006 (Details may be attached as separate Annexure).
6. Summary of cases scrutinised for activities not covered under the Environment Impact Assessment Notification, 2006 (Details may be attached as separate Annexure).
7. Summary of complaints lodged under section 19 of the Environment (Protection) Act, 1986.
8. Any other matter of importance.

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