BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL,
SOUTHERN ZONE, CHENNAI

Original Application No. 35/2025

BETWEEN:

E. Ashok Kumar

.....Applicant

AND

The Ministry of Environment, Forest and Climate Change,
Government of India,
Rep.by its Secretary (EF&CC),
and 8 others

...Respondents

TYPEDSET OF DOCUMENTS

S. No	Date	Document	Pg. No
1.	28.03.2025	**ANNEXURE R1 Colly** – Consent Order extended by the 3rd Respondent under the Air Act and Water Act till 31st March 2030.	1 - 16
2.	23.05.2023	**ANNEXURE R2** – Notice issued by the 3rd Respondent calling the 9th Respondent for a personal hearing on 26.05.2023.	17 – 18
3.	27.04.2023	**ANNEXURE R3** – Letter/Report issued by the 5th Respondent.	19 – 25
4.	09.06.2023	**ANNEXURE R4** – Oral and Written submissions issued by the 9th Respondent in the TNPCB Personal Hearing	26 – 63
5.	29.12.2023	**ANNEXURE R5** – Letter containing directions issued by the 3rd Respondent to the 9th Respondent regarding the TNPCB Proceeding (Personal Hearing)	64 – 69

6.	25.01.2024	**ANNEXURE R6 Colly** – Response Letter issued by the 9th Respondent Unit.	70 - 181
13.	12.06.2024	**ANNEXURE R7** - Letter issued by the 9th Respondent to the 5th Respondent.	182 - 183
14.	30.12.2024	**ANNEXURE R8** – Report of analysis issued by TNPCB dated 30.12.2024	184
15.	11.11.2024	**ANNEXURE R9** – Reports issued by TNPCB dated 11.11.2024	185 - 194
16.	February 2025	**ANNEXURE R10 Colly** – Monthly monitoring report of February, 2025 issued by Enviro Solutions & Labs.	195 - 209
17.	-	**ANNEXURE R11** – Annual report of TNAU for the period July, 2023 to June, 2024.	210 - 271
18.	10.02.2025	**ANNEXURE R12** – Letter on behalf of the 6th Respondent requesting TNAU to examine the water and soil samples from the field of the applicant.	272 - 273
19.	18.03.2025	**ANNEXURE R13** – TNAU Report dated 18.03.2025.	274 - 276
20.	18.12.2024	**ANNEXURE R14** – Letter issued by the 5th Respondent to the 9th Respondent.	277 - 279

Dated at Chennai on this the 8th day of July, 2025.

COUNSEL FOR 9th RESPONDENT

ANNEXURE R1

TAMILNADU POLLUTION CONTROL BOARD

Category of the Industry :

RED

CONSENT ORDER NO. 2508264250928 DATED: 28/03/2025.

PROCEEDINGS NO.F.0038CBN/RL/JCEE-M/TNPCB/CBN/A/2025 DATED: 28/03/2025

SUB: Tamil Nadu Pollution Control Board - RENEWAL OF CONSENT –M/s. ITC LIMITED - PSPD, UNIT : KOVAI , S.F.No. 241/1,409/1,409/2A,409/2B,409/2C,409/2D,409/2E,409/2F,409/2G,409/2H,409/2I, 410/2B,410/3A,410/3B, 411/1B,411/1C,411/1D, 412/1E,412/1F,412/2,412/3C,412/3D1,412/3D2,412/3D3, 414/2A,414/2C,414/2D,414/2E, 415/2,415/3A ,415/3B,415/4, 416/2A,418,421/1,421/2, 422/1A,422/1B,422/1C,422/2, 423/1,423/3, 424/1,424/2,424/3,424/4, 427/1,427/2,427/5A,97/3 of Thekkampatty village and 133/2E2, 132/2C, 141/1A, 141/2A, 141/2B, 141/2C, 877/2A2,877/2B,877/2C, 878/2, 879/2,914,921/1A, 921/1B, 922/2,922/1, 923/1A,923/2A,923/2B,923/2C, 924/1,924/2,925/1,925/2, 926/1,927/1A, 930, 932/1, 936, 938/1,938/2,938/3, 939/1A1,939/1A2, 940, 941/1,941/2, 942/1,942/2, 943/1A,943/1B, 848,849,850,851,885, 889/2A,889/2B, 891/2B2,890/2A,890/2B, 892,893,894,895,899,891/2B1,891/2A2,884/1,775/5,775/6, 776/1,776/2,776/3,776/4A,776/5A,777/1,777/2,778/2A,778/2B,778/2C,778/2D2,778/2E2, 778/2F2,779,844/1,844/2,962,921/2,1011,1012,900/1,901/2,902/1,904/1B, 900/2C,901/1A, 900/2A, 901/1C,900/2B,901/1B of Kemmarampalayam village, KEMMAARAMPALAYAM village, Mettupalayam Taluk and Coimbatore District - Renewal of Consent for the operation of the plant and discharge of emissions under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 (Central Act 14 of 1981) –Issued- Reg. (Industry User ID-R15CBN229745)

REF: 1. CTO-direct Proc. No.T3/TNPCB/F.0038CBN/RL/CBN/A/2022 DATED: 18/07/2022
2. Unit's application No. 64250628 for CTO-renew through OCMMS dated 11.02.2025 and 26.03.2025
3. IR.No : F.0038CBN/RL/AE/CBN/2025 dated 26/03/2025

RENEWAL OF CONSENT is hereby granted under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 (Central Act 14 of 1981) (hereinafter referred to as "The Act") and the rules and orders made there under to

Unit Head

M/s. ITC LIMITED - PSPD, UNIT : KOVAI

S.F No. 241/1,409/1,409/2A,409/2B,409/2C,409/2D,409/2E,409/2F,409/2G,409/2H,409/2I, 410/2B,410/3A,410/3B, 411/1B,411/1C,411/1D, 412/1E,412/1F,412/2,412/3C,412/3D1,412/3D2,412/3D3, 414/2A,414/2C,414/2D,414/2E, 415/2,415/3A ,415/3B,415/4, 416/2A,418,421/1,421/2, 422/1A,422/1B,422/1C,422/2, 423/1,423/3, 424/1,424/2,424/3,424/4, 427/1,427/2,427/5A,97/3 of Thekkampatty village and 133/2E2, 132/2C, 141/1A, 141/2A, 141/2B, 141/2C, 877/2A2,877/2B,877/2C, 878/2, 879/2,914,921/1A, 921/1B, 922/2,922/1, 923/1A,923/2A,923/2B,923/2C, 924/1,924/2,925/1,925/2, 926/1,927/1A, 930, 932/1, 936, 938/1,938/2,938/3, 939/1A1,939/1A2, 940, 941/1,941/2, 942/1,942/2, 943/1A,943/1B, 848,849,850,851,885, 889/2A,889/2B, 891/2B2,890/2A,890/2B, 892,893,894,895,899,891/2B1,891/2A2,884/1,775/5,775/6, 776/1,776/2,776/3,776/4A,776/5A,777/1,777/2,778/2A,778/2B,778/2C,778/2D2,778/2E2, 778/2F2,779,844/1,844/2,962,921/2,1011,1012,900/1,901/2,902/1,904/1B, 900/2C,901/1A, 900/2A, 901/1C,900/2B,901/1B of Kemmarampalayam village

KEMMAARAMPALAYAM Village

Mettupalayam Taluk

Coimbatore District.

TAMILNADU POLLUTION CONTROL BOARD

Authorizing the occupier to operate the industrial plant in the Air Pollution Control Area as notified by the Government and to make discharge of emission from the stacks/chimneys.

This is subject to the provisions of the Act, the rules and the orders made there under and the terms and conditions incorporated under the Special and General conditions stipulated in the Consent Order issued earlier and subject to the special conditions annexed.

This RENEWAL OF CONSENT is valid for the period ending **March 31, 2030**

Joint Chief Environmental Engineer-Monitoring,
Tamil Nadu Pollution Control Board,
Coimbatore

TAMILNADU POLLUTION CONTROL BOARD

SPECIAL CONDITIONS

1. This renewal of consent is valid for operating the facility for the manufacture of products (Col. 2) at the rate (Col. 3) mentioned below. Any change in the products and its quantity has to be brought to the notice of the Board and fresh consent has to be obtained.

Sl. No.	Description	Quantity	Unit
	Product Details		
1.	DUPLEX BOARD, ART BOARD, CROMO BOARD	120000	Tons/Annum

2. This renewal of consent is valid for operating the facility with the below mentioned emission/noise sources along with the control measures and/or stack. Any change in the emission source/control measures/change in stack height has to be brought to the notice of the Board and fresh consent/Amendment has to be obtained.

I	**Point source emission with stack :**			
Stack No.	**Point Emission Source**	**Air pollution Control measures**	**Stack height from Ground Level in m**	**Gaseous Discharge in Nm3/hr**
1	DG SET 250 KVA (NEAR BOARD MACHINE)	Acoustic enclosures with stack	24	1645
2	Boiler 44 TPH (Stand by)	ESP with stack	67	90500
II	**Fugitive/Noise emission :**			
Sl. No.	**Fugitive or Noise Emission sources**	**Type of emission**	**Control measures**	
1.	DG Set-1 250 KVA	Noise	Acoustic Enclosure	

Special Additional Conditions:

The unit shall obtain No Objection Certificate (NOC) from the Tamil Nadu Bio Diversity Board /National Bio Diversity Authority if the unit is using any Biological resources or knowledge associated thereto as per the provisions of Biological Diversity Act 2002.

The industries shall take all efforts to use and popularize "Mission LiFE" logo and mascot which is available in TNPCB & MoEFCC website. They shall also request their employees to adopt "Mission LiFE" action points and document the same and furnish half yearly report to Board.

Additional Conditions:

1. No process emission shall be let out from the premises. The unit shall adhere to Ambient Air Quality emission standards prescribed by the Board.
2. The unit shall adhere to ambient noise level standards prescribed by the board time to time.
3. The unit shall continue to develop and maintain the green belt within the premises and furnish exact green belt area ear marked/developed in the unit premises and furnish photographs along with latitude and longitude co-ordinates.
4. The unit shall submit Environmental Statement for every financial year ending the 31st March in Form -V as per the Rule 14 of the Environment (Protection) Rules, 1986.
5. As and when the unit operates 44 TPH (Stand by) boiler, it shall ensure that the emission from the boiler shall meet the standards prescribed by the Board. The unit shall also ensure that the online monitor shall continually transmit the data to the TNPCB server uninterruptedly.
6. The unit shall comply with the Notification No. TNPCB/Labs/DD(L)/02151/2019 Dated: 30.07.2024 on retrofitting of Emission Control Devices/Equipment in DG sets with capacity of 61kW – less than 800 kW and 800 kW & above in the state of Tamil Nadu.
7. In case of revision of consent fee by the Government, the unit shall remit the difference in amount within one month from the date of notification. Failing to remit the consent fee, this consent order will be withdrawn without any notice and further action will be initiated against the unit as per law.
8. The unit shall comply with the conditions imposed in the Hazardous Waste Authorisation issued to the unit.

TAMILNADU POLLUTION CONTROL BOARD

Joint Chief Environmental Engineer-
Monitoring,
Tamil Nadu Pollution Control Board,
Coimbatore

To
Unit Head,
M/s.ITC LIMITED - PSPD, UNIT : KOVAI,
Thekkampatty Village,
Vivekanandapuram.P.O.,
Mettupalayam Taluk,
Coimbatore District
Pin: 641113

Copy to:

1.The Commissioner, KARAMADAI-Panchayat Union, Mettupalayam Taluk, Coimbatore District .
2. Copy submitted to the Member Secretary, Tamil Nadu Pollution Control Board, Chennai for favour of kind information.
3. The District Environmental Engineer, Tamil Nadu Pollution Control Board, COIMBATORE NORTH for favour of kind information.
4. File

TAMILNADU POLLUTION CONTROL BOARD

Category of the Industry :

RED

CONSENT ORDER NO. 2508164250928 DATED: 28/03/2025.

PROCEEDINGS NO.F.0038CBN/RL/JCEE-M/TNPCB/CBN/W/2025 DATED: 28/03/2025

SUB: Tamil Nadu Pollution Control Board - RENEWAL OF CONSENT – M/s. ITC LIMITED - PSPD, UNIT : KOVAI , S.F.No. 241/1,409/1,409/2A,409/2B,409/2C,409/2D,409/2E,409/2F,409/2G,409/2H,409/2I, 410/2B,410/3A,410/3B, 411/1B,411/1C,411/1D, 412/1E,412/1F,412/2,412/3C,412/3D1,412/3D2,412/3D3, 414/2A,414/2C,414/2D,414/2E, 415/2,415/3A ,415/3B,415/4, 416/2A,418,421/1,421/2, 422/1A,422/1B,422/1C,422/2, 423/1,423/3, 424/1,424/2,424/3,424/4, 427/1,427/2,427/5A,97/3 of Thekkampatty village and 133/2E2, 132/2C, 141/1A, 141/2A, 141/2B, 141/2C, 877/2A2,877/2B,877/2C, 878/2, 879/2,914,921/1A, 921/1B, 922/2,922/1, 923/1A,923/2A,923/2B,923/2C, 924/1,924/2,925/1,925/2, 926/1,927/1A, 930, 932/1, 936, 938/1,938/2,938/3, 939/1A1,939/1A2, 940, 941/1,941/2, 942/1,942/2, 943/1A,943/1B, 848,849,850,851,885, 889/2A,889/2B, 891/2B2,890/2A,890/2B, 892,893,894,895,899,891/2B1,891/2A2,884/1,775/5,775/6, 776/1,776/2,776/3,776/4A,776/5A,777/1,777/2,778/2A,778/2B,778/2C,778/2D2,778/2E2, 778/2F2,779,844/1,844/2,962,921/2,1011,1012,900/1,901/2,902/1,904/1B, 900/2C,901/1A, 900/2A, 901/1C,900/2B,901/1B of Kemmarampalayam village, KEMMAARAMPALAYAM village, Mettupalayam Taluk and Coimbatore District - Renewal of Consent for the operation of the plant and discharge of sewage and/or trade effluent under Section 25 of the Water (Prevention and Control of Pollution) Act, 1974 as amended in 1988 (Central Act 6 of 1974) – Issued- Reg. (Industry User ID- R15CBN229745)

REF: 1. CTO-direct Proc. No.T3/TNPCB/F.0038CBN/RL/CBN/A/2022 DATED: 18/07/2022
2. Unit's application No. 64250628 for CTO-renew through OCMMS dated 11.02.2025 and 26.03.2025
3. IR.No : F.0038CBN/RL/AE/CBN/2025 dated 26/03/2025

RENEWAL OF CONSENT is hereby granted under Section 25 of the Water (Prevention and Control of Pollution) Act, 1974 as amended in 1988 (Central Act, 6 of 1974) (hereinafter referred to as "The Act") and the rules and orders made there under to

Unit Head
M/s . ITC LIMITED - PSPD, UNIT : KOVAI
S.F No. 241/1,409/1,409/2A,409/2B,409/2C,409/2D,409/2E,409/2F,409/2G,409/2H,409/2I, 410/2B,410/3A,410/3B, 411/1B,411/1C,411/1D, 412/1E,412/1F,412/2,412/3C,412/3D1,412/3D2,412/3D3, 414/2A,414/2C,414/2D,414/2E, 415/2,415/3A ,415/3B,415/4, 416/2A,418,421/1,421/2, 422/1A,422/1B,422/1C,422/2, 423/1,423/3, 424/1,424/2,424/3,424/4, 427/1,427/2,427/5A,97/3 of Thekkampatty village and 133/2E2, 132/2C, 141/1A, 141/2A, 141/2B, 141/2C, 877/2A2,877/2B,877/2C, 878/2, 879/2,914,921/1A, 921/1B, 922/2,922/1, 923/1A,923/2A,923/2B,923/2C, 924/1,924/2,925/1,925/2, 926/1,927/1A, 930, 932/1, 936, 938/1,938/2,938/3, 939/1A1,939/1A2, 940, 941/1,941/2, 942/1,942/2, 943/1A,943/1B, 848,849,850,851,885, 889/2A,889/2B, 891/2B2,890/2A,890/2B, 892,893,894,895,899,891/2B1,891/2A2,884/1,775/5,775/6, 776/1,776/2,776/3,776/4A,776/5A,777/1,777/2,778/2A,778/2B,778/2C,778/2D2,778/2E2, 778/2F2,779,844/1,844/2,962,921/2,1011,1012,900/1,901/2,902/1,904/1B, 900/2C,901/1A, 900/2A, 901/1C,900/2B,901/1B of Kemmarampalayam village
KEMMAARAMPALAYAM Village
Mettupalayam Taluk
Coimbatore District.

TAMILNADU POLLUTION CONTROL BOARD

Authorising the occupier to make discharge of sewage and /or trade effluent.

This is subject to the provisions of the Act, the rules and the orders made there under and the terms and conditions incorporated under the Special and General conditions stipulated in the Consent Order issued earlier and subject to the special conditions annexed.

This RENEWAL OF CONSENT is valid for the period ending **March 31, 2030**

Joint Chief Environmental Engineer-Monitoring,
Tamil Nadu Pollution Control Board,
Coimbatore

TAMILNADU POLLUTION CONTROL BOARD

SPECIAL CONDITIONS

1. This renewal of consent is valid for operating the facility for the manufacture of products/byproducts (Col. 2) at the rate (Col 3) mentioned below. Any change in the product/byproduct and its quantity has to be brought to the notice of the Board and fresh consent has to be obtained.

Sl. No.	Description	Quantity	Unit
	Product Details		
1.	DUPLEX BOARD, ART BOARD, CROMO BOARD	120000	Tons/Annum

2. This renewal of consent is valid for operating the facility with the below mentioned outlets for the discharge of sewage/trade effluent. Any change in the outlets and the quantity has to be brought to the notice of the Board and fresh consent has to be obtained.

Outlet No.	Description of Outlet	Maximum daily discharge in KLD	Point of disposal
Effluent Type : Sewage			
1.	Sewage	50.0	In the Existing ETP
Effluent Type : Trade Effluent			
1.	Trade Effluent	2600.0	On land for irrigation

Special Additional Conditions:

The unit shall obtain No Objection Certificate (NOC) from the Tamil Nadu Bio Diversity Board /National Bio Diversity Authority if the unit is using any Biological resources or knowledge associated thereto as per the provisions of Biological Diversity Act 2002.

The industries shall take all efforts to use and popularize "Mission LiFE" logo and mascot which is available in TNPCB & MoEFCC website. They shall also request their employees to adopt "Mission LiFE" action points and document the same and furnish half yearly report to Board.

Additional Conditions:

1. The unit shall restrict the production and effluent generation within the consented quantity.
2. The unit shall operate and maintain all the components of STP for the treatment of sewage efficiently and continuously and the treated sewage shall be utilized for gardening and plantation after satisfying the standards prescribed by the Board.
3. The unit shall regularly analyse the treated sewage and furnish the ROA of the same to the Board.
4. The unit shall operate and maintain the ETP efficiently and continuously for the treatment of trade effluent generated from this unit and power plant unit and the treated trade effluent shall be utilized for irrigation (after maximum recycling of trade effluent before treatment in the process) after satisfying the standards prescribed by the Board.
5. The unit shall ensure that under any circumstances does not discharge either treated or untreated trade effluent into nearby water bodies / lands / outside the premises of the unit either directly or indirectly.
6. The unit shall regularly analyze the treated trade effluent and furnish the ROA of the same to the Board.
7. The unit shall collect the water samples from 10 Nos. of piezo metric wells provided at the land areas earmarked for utilizing treated trade effluent and analyze the same so as to monitor ground water quality and furnish report to Board.
8. The unit shall comply with the Guidelines for Utilization of Treated Effluent in Irrigation issued by CPCB during September 2019.
9. The unit shall continue to study regarding the effect of treated effluent continuously used on land for irrigation on soil and crops/plants/trees through TNAU, Coimbatore and furnish report to Board on yearly basis.
10. The unit shall comply with the recommendations of study report of TNAU, Coimbatore from time to time.
11. The unit shall ensure that utilization of treated trade effluent for green belt development shall not pollute the soil and ground water in and around the project area either directly or indirectly under any circumstances.
12. The unit shall explore the possibilities to recycle maximum extent of treated trade effluent in its process itself, so as to avoid land and ground water pollution.
13. The unit shall operate and maintain the EMFM with computer recorder arrangements provided at the inlet of ETP (source of waste water generation) and outlet of ETP (disposal point for reuse in paper board plant and for green belt development) and maintain the data at all times.
14. The unit shall continue to connect the flow meters provided at the inlet and out let of ETP to the online servers of CPCB.
15. The unit shall operate and maintain the online continuous monitor for effluent parameters flow, pH, BOD COD and TSS and ensure the connectivity with Water Quality Watch of TNPCB at all times.
16. The Unit shall comply with the provisions of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016, as amended.
17. The unit shall furnish the Annual returns in form -4 (Part C) as per Rule 6(5), 13(8),16(6) and20(2) of Hazardous and other wastes (M&TM)Rules 2016 for handling of other wastes mentioned in part D of schedule III (Description of waste B 3020).
18. The unit shall continue to dispose the plastic waste generated from the unit then and there as per the Plastic Waste Management Rules, 2016, as amended.
19. The unit shall dispose the non-hazardous solid wastes then and there without accumulating inside the premises.
20. The unit shall provide suitable arrangements for surface runoff, if any, will be collected through storm water drains and diverted to a collection sump for further recycling in the water treatment system.
21. The unit shall maintain log book with proper entries for receipt of raw materials, chemicals used for process, quantity of water usage, quantity of effluent from all sources separately, solid waste generation/storage/disposal and quantity of product manufactured.
22. All pipes, valves, sewers and drains shall be leak proof. Floor washings shall be admitted in to the effluent collection system only and shall not be allowed to find their way to storm water drains or open areas.
23. The unit shall maintain good housekeeping both within the factory and in the premises
24. The unit shall provide water meters at the inlet of the water supply connection for each of the purposes separately for assessing the quantity of water used and ensuring that such meters are easily accessible for inspection and maintenance and for other purposes of the Act.
25. The unit shall explore the possibilities for further source reduction of waste minimization.
26. The unit shall continue to take all possible measures (like process / equipment modification, improved internal recycling practices, good housekeeping) to conserve the fresh water requirement and work towards the Bench Mark target as per CPCB guidelines, 2006 set by National Productivity Council.
27. No municipal solid wastes or bio medical wastes or any other type of contaminants shall be allowed to be imported along with the paper wastes. Mixed waste paper is not permitted. In case of

TAMILNADU POLLUTION CONTROL BOARD

any illegal imports, the consignment will be sent back to the exporting country and the importer / exporter shall bear the cost for the same.
28. The unit shall not use" use and throwaway plastics" such as plastic sheets used for food wrapping, spreading on dining table etc, plastic plates, plastic coated tea cups , plastic tumbler, water pouches and packets, plastic straw, plastic carry bags and plastic flags irrespective of thickness, etc as per the GO(Ms) No.84, Environment & Forest Department of Tamilnadu Government (EC.2) notification dated 25.06.2018. Instead unit shall encourage use of eco-friendly alternative such as banana leaf, areca nut palm plate, stainless steel, glass, porcelain plates/cups, cloth bag, jute bag etc.
29. The unit shall continue to develop and maintain the green belt within the premises and furnish exact green belt area ear marked/developed in the unit premises and furnish photographs along with latitude and longitude co-ordinates.
30. The unit shall submit Environmental Statement for every financial year ending the 31st March in Form -V as per the Rule 14 of the Environment (Protection) Rules, 1986.
31. The unit shall not carryout bleaching, deinking and colouring activities and shall maintain good housekeeping.
32. The unit shall utilize only waste paper and purchased pulp as raw material.
33. The unit shall ensure that E-Waste generated by them shall be handed over only to the registered producer, refurbisher or recycler/Dismantler as per the E-Waste (Management) Rules, 2022.
34. In case of revision of consent fee by the Government, the unit shall remit the difference in amount within one month from the date of notification. Failing to remit the consent fee, this consent order will be withdrawn without any notice and further action will be initiated against the unit as per law.
35. The unit shall comply with the conditions imposed in the Hazardous Waste Authorisation issued to the unit.

23/3/15

Joint Chief Environmental Engineer-Monitoring,
Tamil Nadu Pollution Control Board,
Coimbatore

To
Unit Head,
M/s.ITC LIMITED - PSPD, UNIT : KOVAI,
Thekkampatty Village,
Vivekanandapuram.P.O.,
Mettupalayam Taluk,
Coimbatore District
Pin: 641113

Copy to:

1.The Commissioner, KARAMADAI-Panchayat Union, Mettupalayam Taluk, Coimbatore District .

2. Copy submitted to the Member Secretary, Tamil Nadu Pollution Control Board, Chennai for favour of kind information.

3. The District Environmental Engineer, Tamil Nadu Pollution Control Board, COIMBATORE NORTH for favour of kind information.

4. File

Category of the Industry :

RED

CONSENT ORDER NO. 2205241846701 DATED: 29/08/2022.

PROCEEDINGS NO.T3/TNPCB/F.2158CBN/RL/CBN/A/2022 DATED: 29/08/2022

SUB: Tamil Nadu Pollution Control Board –CONSENT TO OPERATE –DIRECT -M/s. ITC LIMITED PSPD UNIT KOVAI - POWER PLANT , S.F.No. 423/2,423/5, 423/4, 426/1A, 426/1B, 426/1C, 426/1D, 426/2, 426/3A, 426/3B, 426/3C located in Thekkampatty village, THEKKAMPATTY villageMettupalayam Taluk and Coimbatore District - Consent for operation of the plant and discharge of emissions under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 (Central Act 14 of 1981) –Issued- Reg.

Ref: 1. Unit's application no. 41846701 dated: 26.11.2021.
2. IR.No : F.2158CBN/RL/JCEE-M/CBN/2022 dated 11/08/2022
3. Minutes of the 203rd TSC meeting vide item No. 203-09 dated:24.08.2022.

CONSENT TO OPERATE is hereby granted under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 (Central Act 14 of 1981) (hereinafter referred to as "The Act") and the rules and orders made there under to

The Unit Head,
M/s , ITC LIMITED PSPD UNIT KOVAI - POWER PLANT
S.F No.423/2,423/5, 423/4, 426/1A, 426/1B, 426/1C, 426/1D, 426/2, 426/3A, 426/3B, 426/3C located in Thekkampatty village,
THEKKAMPATTY Village,
Mettupalayam Taluk,
Coimbatore District.

Authorizing the occupier to operate the industrial plant in the Air Pollution Control Area as notified by the Government and to make discharge of emission from the stacks/chimneys.

This is subject to the provisions of the Act, the rules and the orders made there under and the terms and conditions incorporated under the Special and General conditions stipulated in the Consent Order issued earlier and subject to the special conditions annexed.

This CONSENT is valid for the period ending March 31, 2027

RAMASAMY RAJAMANICKAM
Digitally signed by RAMASAMY RAJAMANICKAM
Date: 2022.08.31 08:08:18 +05'30'

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

To
The Unit Head,
M/s.ITC LIMITED PSPD UNIT KOVAI - POWER PLANT,
ITC LIMITED, PSPD, UNIT : KOVAI Thekkampatty Village, Vivekanandapuram.P.O., Mettupalayam Taluk, Coimbatore District, Pin: 641113

Copy to:

1.The Commissioner, KARAMADAI-Panchayat Union, Mettupalayam Taluk, Coimbatore District .

2. The District Environmental Engineer, Tamil Nadu Pollution Control Board, COIMBATORE NORTH.

3. The JCEE-Monitoring, Tamil Nadu Pollution Control Board, Coimbatore.

4. File

SPECIAL CONDITIONS

1. This consent to operate is valid for operating the facility for the manufacture of products (Col. 2) at the rate (Col. 3) mentioned below. Any change in the products and its quantity has to be brought to the notice of the Board and fresh consent has to be obtained.

Sl. No.	Description	Quantity	Unit
	Product Details		
1.	Power Plant	8.0	MWHR

2. This consent to operate is valid for operating the facility with the below mentioned emission/noise sources along with the control measures and/or stack. Any change in the emission source/control measures/change in stack height has to be brought to the notice of the Board and fresh consent/Amendment has to be obtained.

I	**Point source emission with stack :**			
Stack No.	**Point Emission Source**	**Air pollution Control measures**	**Stack height from Ground Level in m**	**Gaseous Discharge in Nm3/hr**
1	Captive Power Point Boiler 60T/Hr	ESP with stack	84	175000
2	DG set 250 KVA(Near Power Plant)	Acoustic enclosures with stack	8.2	1100
3	Coal/Bio Fuel Bunker	Bag Filters with stack	9.9	20000
4	Coal/Bio Fuel Transfer Point	Bag Filters with stack	9.9	15000
II	**Fugitive/Noise emission :**			
Sl. No.	**Fugitive or Noise Emission sources**	**Type of emission**	**Control measures**	
1.	Coal/Bio fuel Bunker	Fugitive	Bag Filter	
2.	Coal/Bio Fuel Transfer Point	Fugitive	Bag Filter	
3.	DG set -250 KVA	Noise	acoustic enclosures	

3(a). The emission shall not contain constituents in excess of the tolerance limits as laid down hereunder :

Sl.	Parameter	Unit	Tolerance limits	Stacks

Annexure enclosed if applicable. :-

3.(b) The Ambient Air in the industrial plant area shall not contain constituents in excess of the tolerance limits prescribed below.

Sl. No.	Pollutant	Time Weighted Average	Unit	Tolerance Limits	
				Industrial, Residential, Rural and other area	Ecologically Sensitive Area (notified by Central Govt.)
1.	Sulphur Dioxide (SO2)	Annual 24 hours	microgram/m3 microgram/m3	50 80	20 80
2.	Nitrogen Dioxide (NO2)	Annual 24 hours	microgram/m3 microgram/m3	40 80	30 80
3.	Particulate Matter (Size Less than 10 micro M) or PM10	Annual 24 hours	microgram/m3 microgram/m3	60 100	60 100
4.	Particulate Matter (Size Less than 2.5 micro M) or PM2.5	Annual 24 hours	microgram/m3 microgram/m3	40 60	40 60
5.	Ozone (O3)	Annual 24 hours	8 Hours 1 Hour	100 180	100 180
Sl. No.	**Pollutant**	**Time Weighted Average**	**Unit**	**Tolerance Limits**	
				Industrial, Residential, Rural and other area	**Ecologically Sensitive Area (notified by Central Govt.)**
6.	Lead (Pb)	Annual 24 hours	microgram/m3 microgram/m3	0.5 1.0	0.5 1.0
7.	Carbon Monoxide (CO)	8 Hours 1 Hour	miligram/m3 miligram/m3	02 04	02 04
8.	Ammonia (NH3)	Annual 24 hours	microgram/m3 microgram/m3	100 400	100 400
9.	Benzene (C6H6)	Annual	microgram/m3	5	5
10.	Benzo(O) Pyrene (BaP) –particulate phase only	Annual	nanogram/m3	01	01
11.	Arsenic (As)	Annual	nanogram/m3	06	06
12.	Nickel (Ni)	Annual	nanogram/m3	20	20

3(c) The Ambient Noise Level in the industrial plant area shall not exceed the limits prescribed below:

Limits in L.eq.-dB(A)	Day Time	Night Time
ResidentialArea	**55**	**45**

4. All units of the Air pollution control measures shall be operated efficiently and continuously so as to achieve the standards prescribed in Sl. No.3 above.
5. The occupier shall not change or alter quality or quantity or the rate of emission or replace or alter the air pollution control equipment or change the raw material or manufacturing process resulting in change in quality and/or quantity of emissions without the previous written permission of the Board.
6. The occupier shall maintain log book regarding the stack monitoring system or operation of the plant or any other particulars for each of the unit operations of air pollution control systems to reflect the working condition which shall be furnished for verification of the Board officials during inspection.
7. The occupier shall at his own cost get the samples of emission/air/noise levels collected and analyzed by the TNPC Board Laboratory once in every 6 months/once in a year/periodically for the parameters as prescribed.

8. Any upset condition in any of the plants of the factory which is likely to result in increased emissions and result in violation of the standards mentioned in Sl.No.3 shall be reported to the Member Secretary / Joint Chief Environmental Engineer-Monitoring and the concerned District/Assistant Environmental Engineer of the Board by e-mail immediately and subsequently by Post with full details of such upset condition.

9. The occupier shall always comply and carryout the order/directions issued by the Board in this Consent Order and from time to time without any negligence. The occupier shall be liable for action as per provisions of the Act in case of non compliance of any order/directions issued.

Special Additional Conditions:

i. The unit shall install the approved retrofit emission control device/equipment with at least 70% Particulate matter reduction efficiency on all DG sets with capacity of 125 KVA and above or otherwise the unit shall be shift to gas based generators within the time frame prescribed in the notification No. TNPCB/Labs/DD(L)02151/2019 dated 10.06.2020 issued by TNPCB.

ii. The unit shall obtain No Objection Certificate (NOC) from the Tamil Nadu Bio Diversity Board /National Bio Diversity Authority if the unit is using any Biological resources or knowledge associated thereto as per the provisions of Biological Diversity Act 2002.

Additional Conditions:

1. The unit shall operate and maintain the air pollution control measures provided to emission sources efficiently and continuously so as to satisfy the NAAQ / Emission / ANL standards prescribed by the Board.
2. The unit shall satisfy the Ambient Noise Level standards prescribed by the Board.
3. The unit shall not include/install any process or carry out any alteration/deviation in the process which result in gaseous emission from the industry without the prior consent of the TNPCB.
4. The unit shall operate and maintain the Online continuous stack monitors attached to the APC measures continuously so as to get quality data and continuous connectivity to CAC, Chennai.
5. The unit shall conduct AAQ/ANL/SM survey through TNPC Board Lab once a year as assured.
6. The unit shall continue to develop more green belt in and around the unit premises.
7. In case of revision of consent fee by the Government, the unit shall remit the difference in amount within one month from the date of notification. Failing to remit the consent fee, this consent order will be withdrawn without any notice and further action will be initiated against the unit as per law.
8. The unit shall comply with the Board's direction issued vide Proc. T1/TNPCB/F0038/CBN/RL/W&A/2020dated:17.03.2020 at all times.
9. The unit shall comply the directions mentioned in the minutes of personal hearing conducted on 07.08.2020
10. The unit shall comply with the conditions mentioned in the T.O. letter No.T3/TNPCB/F0038/CBN/2020, dated: 23.11.2021.
11. The unit shall comply with the outcome of W.P.No.10495/2020 filed before the Hon'ble High Court of Madras in respect of Environmental compensation.
12. The unit shall explore some scientific methods for disposing the plastic wastes dumped in the said premises.
13. This consent order does not absolve from obtaining necessary permission / Clearance from other Authority or under other statutes as applicable.

RAMASAMY RAJAMANICKAM

Digitally signed by RAMASAMY RAJAMANICKAM
Date: 2022.08.31 08:08:52 +05'30'

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

GENERAL CONDITIONS

1. The occupier shall make an application along with the prescribed consent fee for grant of renewal of consent at least 60 days before the date of expiry of this Consent Order along with all the required particulars ensuring that there is no change in production quantity and emission.
2. This Consent is given by the Board in consideration of the particulars given in the application. Any change or alteration or deviation made in actual practice from the particulars furnished, in the application will also be ground for review/variation/revocation of the Consent Order under Section 21 of the Act.
3. The conditions imposed shall continue in force until revoked under Section 21 of the Act.
4. After the issue of this order, all the 'Consent to Operate' orders issued previously under Air (Prevention and Control of Pollution) Act, 1981 as amended stands defunct.
5. The occupier shall maintain an Inspection Register in the factory so that the inspecting officer shall record the details of the observations and instructions issued to the unit at the time of inspection for adherence.
6. The occupier shall provide and maintain an alternate power supply along with separate energy meter for the Air Pollution Control measures sufficient to ensure continuous operation of all pollution control equipments to ensure compliance.
7. The occupier shall provide all facilities to the Board officials for collection of samples in and around the factory at any time.
8. The applicant shall display the flow diagram of the sources of emission and pollution control systems provided at the site.
9. The liquid effluent arising out of the operation of the air pollution control equipment shall also be treated in a manner and to the satisfaction of standards prescribed by the Board in accordance with the provisions of Water (Prevention and Control of Pollution) Act, 1974 as amended.
10. The air pollution control equipments, location of inspection chambers and sampling port holes shall be made easily accessible at all time.
11. In case of any episodal discharge of emission, the industry shall take immediate action to bring down the emission within the limits prescribed by the Board.
12. If applicable, the occupier has to comply with the provisions of Public Liability Insurance Act, 1991 to provide immediate relief in the event of any hazard to human beings, other living creatures/plants and properties while handling and storage of hazardous substances.
13. The issuance of this consent does not authorize or approve the construction of any physical structures or facilities or the undertaking of any work in any natural watercourse or in Government Poromboke lands.
14. The issuance of this Consent does not convey any property right in either real personal property or any exclusive privileges, nor does it authorize any injury to private property or Government property or any invasion of personal rights nor any infringement of Central, State laws or regulation.
15. The occupier shall forth with keep the Board informed of any accident of unforeseen act or event of any poisonous, noxious or polluting matter or emissions are being discharged into stream or well or air as a result of such discharge, water or air is being polluted.
16. If due to any technological improvements or otherwise the Board is of opinion that all or any of the conditions referred to above requires variation (including the change of any treatment system, either in whole or in part) the Board shall, after giving the applicant an opportunity of being heard, vary all or any of such conditions and thereupon the applicant shall be bound to comply with the conditions as so varied.
17. In case there is any change in the constitution of the management, the occupier of the new management shall file fresh application under Air (Prevention and Control of Pollution) Act, 1981, as amended in Form-I alongwith relevant documents of change of management immediately and get the necessary amendment with renewal of consent order.
18. In case there is any change in the name of the company alone, the occupier shall inform the same with relevant documents immediately and get the necessary amendments for the change of name from the Board.

19. The occupier shall display this consent order granted to him in a prominent place for perusal of the inspecting Officers of this Board.

RAMASAMY RAJAMANICKAM

Digitally signed by RAMASAMY RAJAMANICKAM
Date: 2022.08.31 08:09:19 +05'30'

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

ANNEXURE R2

By Speed Post

TAMIL NADU POLLUTION CONTROL BOARD

From

Dr. Jayanthi M. I.F.S.
Chairperson,
Tamil Nadu Pollution Control Board,
76, Mount Salai, Guindy,
Chennai – 600 032.

To

The Unit Head,
M/s. ITC Limited,
PSPD Unit Kovai,
Door no. 328 GSt Road,
Thekkampatty Village,
Vivekanandapuram P.O.,
Mettuplayam Taluk,
Coimbatore District- 641 113.

Lr. No: T2/ TNPCB / F.0038/RL/CBN/2021 Dated: 23.05.2023

Sub: TNPCB – Industries – M/s. ITC Limited PSPD unit, Kovai, S.F.No:24/1 etc, Thekkampatty Village, Mettupalayam Taluk, Coimbatore District- Personal hearing on **26.05.2023(Friday) at 3.00 PM** in the Corporate Office, TNPCB, Guindy, Chennai - Regarding.

Ref:
1. Hon'ble High Court of Madras order in the matter of Writ Petition No. 10495 of 2020 dated 12.04.2023.
2. DEE's letter No.:DEE/TNPCB/ F.1371/Tech/CBE(N)/2023/dated 27/04/2023

I invite your kind attention to the reference 1st cited, wherein the unit M/s. ITC Limited PSPD unit, Kovai, S.F.No:24/1 etc, Thekkampatty Village, Mettupalayam Taluk, Coimbatore District has been issued with direction vide Proc. No. T1/TNPCB/F.0038/ CBN/ RL/ W&A/ 2020 dated 17.03.2020 to comply certain instructions including the interim environmental compensation of an amount of Rs. 331.80 Lakhs and an additional amount of Rs.30,000/- per day until the until compliance of the conditions mentioned therein. However, it was reported by the DEE, Coimbatore North vide reference 2nd cited, that the unit is yet to complete the Bio-mining of dumped plastic waste.

Further, the Hon'ble High Court of Madras has passed the order in the matter of Writ Petition No. 10495 of 2020 on 12.04.2023 as follows:

"(1)The order dated 17.03.2020 is set aside. The matter is remanded to the 2nd respondent. The 2nd respondent shall issue notice to the petitioner and fix the date of hearing on which day the petitioner shall appear and give its explanation.

(2).If the petitioner does not avail this opportunity the respondents can proceed and pass orders.

(3).The 2nd respondent shall pass a detailed speaking order taking into consideration all aspects including the Joint Inspection Report but the order shall not be predicated only on the basis of the Joint Inspection Report done presently

(4).This exercise shall be completed within a period of three months from the date of receipt of a copy of this order."

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In this regard, in order to comply with the above order, Board has decided to conduct a personal hearing on 26.05.2023 at 3.00 PM in the Corporate Office, TNPCB, Guindy, Chennai. Hence, you are requested to attend the personal hearing with all the relevant particulars without fail.

The receipt of this letter may be acknowledged.

For Chairperson

23/5/2023

Copy to

1. The District Environmental Engineer,
   Tamil Nadu Pollution Control Board,
   Coimbatore North–(for information and follow up action)

2. PRO

ANNEXURE R3

TAMILNADU POLLUTION CONTROL BOARD

From	To
Dr. K.Ravichandran, M.Tech.,Ph.D., District Environmental Engineer Tamilnadu Pollution Control Board Coimbatore North, No. 5, Ramasamy Nagar Kavundampalayam, Coimbatore – 641 030	The Member Secretary, Tamilnadu Pollution Control Board, 72, Mount Salai, Guindy, Chennai-641032.

Letter No.DEE/TNPCB/F.1371/Tech//CBE(N)/2023 dated:27/04/2023

Sir,

Sub : TNPC Board – O/o. DEE, Coimbatore North - M/s. ITC Limited, PSPD Unit, Kovai, S.F No:241/1,etc., Thekkampatty Village, Mettupalayam Taluk, Coimbatore District - Hon'ble High Court of Madras passed Orders in the matter of Writ Petition No.10495 of 2020 – Compliance - Reg.

Ref : 1. Proc No. F.CBS0038/DEE/TNPCB/CBN/RL/W&A/2020/ dated.09.01.2020
2. The Board's Proc.No.T1/TNPCB/F.0038/CBN/RL/W&A/2020 dated 17.03.2020.
3. Order passed by the Hon'ble High Court of Madras in the matter of Writ Petition No.10495 of 2020 on 12.04.2023.
4. The Board's Memo.No.TNPCB/LAW/LAI/016248/2020 dated. 22.04.2023

* * * * *

With reference to the above the following are submitted,

1. The Hon'ble National Green Tribunal, Southern Zone, Chennai in the matter of original application No. 26 of 2019 filed by Thiru. E. Rajendran and Thiru. E Ashok Raj Kumar against the unit of M/s ITC Limited, directed on 13.12.2019 as;

"...we feel that it is appropriate to constitute a Joint Committee, consisting of a Senior Scientist from Central Pollution Control Board and Tamil Nadu Pollution Control Board to inspect the unit in question and consider whether the "land fill" has been properly maintained and they are complying all the norms and assess soil, water and air quality in that area and If there is any violation, they are directed to take appropriate action in accordance with law and submit a factual and action taken report within a period of one month to this tribunal...."

2. Accordingly, the joint committee was constituted and inspection was carried out during January 06 to 08, 2020. Meanwhile, the TNPCB has issued show cause notice vide Proc. No. F.CBS0038/DEE/TNPCB/CBN/RL/W&A/2020/dated 09.01.2020 under Water (P&CP) Act 1974 as amended and Air (P&CP) Act 1981 as amended to the industry for the violations observed.

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3. And also, Based on the recommendations of the Joint Committee the Tamilnadu Pollution Control Board has issued directions to the unit of M/s. ITC Limited, Paper Boards and Specialty Boards Division, Unit: Kovai vide Proc. No.T1/TNPCB/F.0038/CBN/RL/W&A/2020 dated 17.03.2020 to comply certain instructions including interim environmental compensation of an amount of Rs. 331.80 Lakhs and an additional amount of Rs.30,000/- per day until the compliance of the instructions. (The present status of the directions issued vide proc. Dated 17.03.2020 is enclosed herewith).

4. Further, the TNPC Board had conducted personal hearing meeting with the unit of M/s. ITC Limited, Paper Boards and Specialty Boards Division, Unit: Kovai on 07.08.2020 @ 10.00 AM at Corporate Office, TNPCB, Guindy, Chennai. During personal hearing meeting, the unit has requested to waive the Environmental Compensation. (The present status of the minutes of the personal hearing held on 07.08.2020 is also enclosed herewith)

5. Moreover, a Writ Petition No.10495 of 2020 has been filed seeking for a Writ of Certiorari to call for the records on the file of the TNPC Board in Proceedings No.T1/TNPCB/F.0038/CBN/RL/W&A/2020, dated 17.03.2020, quash the same and for consequential orders by M/s. ITC Limited, Paper Boards and Specialty Boards Division, Unit: Kovai against the respondents 1. The District Environmental Engineer, Tamil Nadu Pollution Control Board, Coimbatore North and 2. The Chairman, Tamil Nadu Pollution Control Board, Chennai.

6. The Hon'ble High Court of Madras has passed the order in the matter of Writ Petition No.10495 of 2020 on 12.04.2023 as follows,

1) ***The order dated 17.03.2020 is set aside. The matter is remanded to the 2nd respondent. The 2nd respondent shall issue notice to the petitioner and fix the date of hearing on which day the petitioner shall appear and give its explanation.***
2) ***If the petitioner does not avail this opportunity the respondents can proceed and pass orders.***
3) ***The 2nd respondent shall pass a detailed speaking order taking into consideration all aspects including the Joint Inspection Report but the order shall not be predicated only on the basis of the Joint Inspection Report done presently.***
4) ***This exercise shall be completed within a period of three months from the date of receipt of a copy of this order.***

In view of the above, the Board shall take suitable action as per the order passed by the Hon'ble High Court of Madras by giving fresh notice to the petitioner as the unit is yet to complete the Bio-mining of dumped plastic waste.

Submitted for taking further necessary action please.

Encl: As above.

District Environmental Engineer
Tamilnadu Pollution Control Board,
Coimbatore North.

Copy submitted to:

The Joint Chief Environmental Engineer (M), Tamilnadu Pollution Control Board, Coimbatore for favour of kind information please.

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Annexure-I

Compliance status on the minutes of the personal hearing held on 07.08.2020 at Corporate Office

S.No.	Conditions	Compliances
1.	The unit shall submit separate applications and obtain consents for paper production (Duplex Board, Art Board, Cromo Board) and power generation (8MW Hr).	The unit has obtained separate consents as M/s. ITC LIMITED, PSPD UNIT KOVAI vide board Proc. No. T3/TNPCB/F.0038CBN/RL/CBN/W&A/2022 dt. 18.07.2022 valid up to 31.03.2025 and M/s ITC LIMITED PSPD UNIT KOVAI - POWER PLANT vide board Proc No. T3/TNPCB/F.2158CBN/RL/CBN/W&A/2022 dt 29.08.2022valid up to 31.03.2027
2.	The industry shall provide calibration facility in the OCEMS installed in 60 TPH boiler for the parameters PM, SO_2 and NO_2. SO_2 and NO_2 analyzer and same be connected to CPCB and TNPCB server.	The unit has installed Online Continuous Emission Monitoring System (OCEMS) for 60 TPH Boiler for the parameters PM, SO_2 and NO_2 and connected to CPCB and Care Air Centre, TNPCB server
3	The industry shall provide OCEMS in 44 TPH boiler for the parameters PM, SO_2 and NO_2. SO_2 and NO_2 and same be connected to CPCB and TNPCB server by 30.09.2020.	The unit has installed Online Continuous Emission Monitoring System (OCEMS) for 44 TPH standby Boiler for the parameters PM, SO_2 and NO_2 and connected to CPCB and Care Air Centre, TNPCB server.
4	The unit shall furnish the records of 44 TPH boiler operations as claimed by the unit.	The unit has maintained the records of 44 TPH boiler operations.
5	The industry shall quantify the plastic waste and process waste sludge (binding chemicals) which was dumped and furnish the details along with disposal details.	The unit has started manual cleaning of dumped plastic wastes inside the unit premises since October 2021. The unit has disposed 863.85 Tons of segregated dumped plastic wastes to the Cement industries so far. The unit has not complied as assured by the unit to dispose the dumped plastic wastes inside the unit premises to the cement industries for co-processing before December 2021. However, the unit has engaged the third party (M/s Zigma) for segregation and disposal of plastic waste through mechanized and the works is in progress.
6	The unit shall utilize imported coal having 0.5%Sulphur instead of Lignite obtained from NLC having 1.5% Sulphur.	The unit is utilizing 35 % of imported coal, 20 % of bio mass and remaining 45 % of lignite purchased from the NLC as fuel for the boiler and reported that they are already achieving the SO_2 norms. They also informed that they will reduce the quantity of lignite gradually.
7	The unit shall analyse the heavy metals in the raw material and also furnish report to Board, since Ni was found to be present in the ground water sample report.	The unit has analyzed the raw material samples through TNAU, Coimbatore. From the report of analysis dated 02.11.2020, it is ascertained that the heavy metal Nickel is lesser as compared with tolerance limits for trade effluent on land for irrigation standards prescribed by the Board.

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8.	The unit shall provide X-Ray type scan to screen the barrels / container with paper raw materials at the port, so as to reduce time of inspection for TNPCB officials.	**Not complied.** The unit has informed that they are exploring the possibilities of providing X-Ray type scanner to screen the barrels / container.
9.	The unit shall form 30 m x 30 m grid and install piezometric bore well for analysis of ground water.	The unit has already provided 10 Nos. of piezometric bore well for analysis of ground water in the irrigation land and assured to provide more piezometric bore wells as instructed.
10.	The unit shall provide sprinkler arrangements to avoid fugitive emissions	The unit has provided water sprinklers in coal and biomass storage area.
11.	The unit shall check proximity & Ultimate analysis to find the Heavy metals in the Lignite.	The unit has analyzed the Lignite sample through TNAU, Coimbatore. From the report of analysis dated 02.11.2020, it is ascertained that the heavy metal Nickel is lesser as compared with tolerance limits for trade effluent on land for irrigation standards prescribed by the Board. Attached in Annexure II)
12.	The unit shall furnish the list of proprietary chemicals used in the industry.	The unit has furnished list of proprietary chemicals used in the industry.

Compliance status of direction issued vide Proc. dated:17.03.2020

S.No.	Directions issued vide Proc. dated:17.03.2020	Present status of compliance
1	Non-installation of Online Continuous Emission Monitoring System (OCEMS) for 44 TPH standby Boiler.	The unit has installed Online Continuous Emission Monitoring System (OCEMS) for 44 TPH standby Boiler for the parameters PM, SO_2 and $NO_2$and connected to CPCB and Care Air Centre, TNPCB server since September 2020.
2	Dumping of plastic waste inside the unit premises.	The unit has started manual cleaning of dumped plastic wastes inside the unit premises since October 2021. The unit has disposed 863.85 Tons of segregated dumped plastic wastes to the Cement industries so far. The unit has not complied as assured by the unit to dispose the dumped plastic wastes inside the unit premises to the cement industries for co-processing before December 2021. However, the unit has engaged the third party (M/s Zigma) for segregation and disposal of plastic waste through mechanized and the works is in progress.
3	Exceedance of source emissions parameters (NO_2& SO_2).	The unit is utilizing 70 % of imported coal&30 % of bio mass as fuel for the boiler and reported that they are already achieving the SO_2 norms. They also informed that they stopped utilizing of lignite from NLC and assured to comply the MoEF&CC notification dated:31/03/2021 before 31/12/2024.
4	Traces of heavy metals in soil due to past discharge of partial/untreated effluent	The unit has provided Effluent Treatment Plant for the treatment of effluent generation from the manufacturing process and treated effluent is being utilized for irrigation. The unit has engaged Tamil Nadu Agricultural

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		University (TNAU) monitor the impact of application of treated effluent on soil and ground water quality since year 2000. Further the unit was advised to comply the suggestions given by TNAU
1	The unit shall remit the interim environmental compensation of an amount of Rs. 331.80 Lakhs calculated till 11.03.2020 for violations made by the unit.	The Hon'ble High Court of Madras has passed the order in the matter of Writ Petition No 10495 of 2020 on 12.04.2023 as follows, *1) The order dated 17.03.2020 is set aside. The matter is remanded to the 2nd respondent. The 2nd respondent shall issue notice to the petitioner and fix the date of hearing on which day the petitioner shall appear and give its explanation.* *2) If the petitioner does not avail this opportunity the respondents can proceed and pass orders.* *3) The 2nd respondent shall pass a detailed speaking order taking into consideration all aspects including the Joint Inspection Report but the order shall not be predicated only on the basis of the Joint Inspection Report done presently.* *4) This exercise shall be completed within a period of three months from the date of receipt of a copy of this order.*
2		
i	The industry shall ensure no discharge of partially/untreated effluent in to the soil.	The unit has provided Effluent Treatment Plant for the treatment of effluent generation from the manufacturing process and treated effluent is being utilized for irrigation.
ii	The industry shall provide flow meter at inlet of ETP in order to quantify total effluent generation and treated and its shall be connected to the online servers of CPCB and TNPCB	The unit has provided flow meter at the inlet of ETP and connected to Water Quality Watch Centre, TNPCB to monitoring the actual flow of effluent. Yet to be connected with CPCB.
iii	The industry shall provide calibration facility in the OCEMS installed in 60 TPH boiler for the parameters PM, NO_2& SO_2. Data from NO_2& SO_2 analyzers to be connected to CPCB and TNPCB server.	The unit has provided calibration software to online NO_2& SO_2 analyzer of 60 TPH boiler and data from NO_2& SO_2 analyzers are connected to CPCB and TNPCB server.
iv	The OCEMS attached in the 60 TPH Boiler shall be placed in appropriate location as per emission regulations part-III	The unit has relocated the OCEMS of 60TPH boiler as per the directions.

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v	The industry shall install OCEMS in 44 TPH boiler for the parameters PM, SO2& NO2 with gaseous calibration facility and connected to CPCB & TNPCB server.	The unit has installed Online Continuous Emission Monitoring System (OCEMS) for 44 TPH standby Boiler for the parameters PM, SO_2 and $NO_2$and connected to CPCB and Care Air Centre, TNPCB server.
vi	The industry shall provide proper processing and storage facilities for vermicomposting of bio sludge.	The unit has provided additional vermi-composting pits with shed.
vii	The industry shall provide proper processing and storage facilities for the boiler fuel (Lignite & biomass) and avoid open storage. This facility shall be provided with proper drainage system.	The unit has stored the lignite in closed shed. There is no open storage of lignite and biomass inside the unit premise.
viii	The industry shall provide adequate control measures and maintain regularly to avoid fugitive emission from storage yard of boiler fuel and bottom ash.	The unit has completed construction of extension of existing fuel shed. The unit has provided water sprinklers in fuel, biomass and fly ash storage area.
ix	The industry shall remove the open dumping of plastic waste and process waste sludge (Binding chemicals) found during committee visit and dispose it properly. The industry shall ensure no open dumping of waste at any time.	The unit has disposed the plastic waste and process waste sludge was removed from solar plant area to the cement industries for co-processing.
x	The industry shall provide garland drain system around the premises and connected to concerted rain water harvesting pond to avoid seepage or can adopt any appropriate methods to avoid seepage or can adopt any appropriate methods to avoid seepage water flowing to agriculture land.	The unit has created pits for storage of rain water runoff in low lying area and the unit has designed the scheme for collection of roof water from waste paper yard and fuel yard to divert rain water to storage pond.

District Environmental Engineer
Tamilnadu Pollution Control Board,
Coimbatore North.

09.06.2023

Tamil Nadu Pollution Control Board,
76 Mount Salai, Guindy,
Chennai- 600 032,

Sub: Written Submissions by ITC Limited- PSPD, Unit: Kovai at Thekkampatty Village, Mettupalayam Taluk, Coimbatore.

Ref: (1) Letter bearing Lr. No: T2/TNPCB/F.0038/RL/CBN/2021 dated 23.05.2023 of the Tamil Nadu Pollution Control Board ("TNPCB")

(2) Letter No. DEE/TNPCB/F.1371/Tech//CBE(N)/2023 dated 27.04.2023 of the District Environmental Engineer, Coimbatore North ("DEE")

(3) Minutes of the meeting of personal hearing on 26.05.2023 before the TNPCB dated 01.06.2023.

Dear Sir/Madam,

1. At the outset it is submitted that we had challenged the earlier order/proceedings dated 17.03.2020 of the TNPCB in the Hon'ble Madras High Court by filing WP No. 10495 of 2020 and, the Hon'ble High Court by an order dt 12.04.2023 was pleased to set aside the TNPCB's order dated 17.03.2020 holding that the said order merely paraphrases the report of the Joint Inspection Committee of the NGT and has been passed in utter violation of the principles of natural justice. It may be noted that the said order dated 17.03.2020 comprised certain directions which were over and above the consent-conditions, and demands to pay environmental compensation of more than about 331 Lacs. While setting aside the order dated 17.03.2020, the Hon'ble High Court also noted that the TNPCB had merely implemented the liability as fixed by the Joint Inspection Committee even though such Committee was appointed by NGT to satisfy if there are any deviation from the consent conditions and applicable norms. Further, the Hon'ble High Court held that the conclusions of the Joint Inspection Committee are merely recommendatory and not final or binding on NGT or the TNPCB. The relevant parts of the said Order of the Hon'ble High Court are extracted below.

> *"18. … In the present case, the impugned order merely paraphrases the order of the Joint Inspection Committee of the NGT and has been passed in utter violation of the principles of natural justice.*
>
> *17. He took us to the order of the NGT and pointed out that as the Joint Inspection Committee had fixed the liability, the Tamil Nadu Pollution Control Board merely implemented the same. The Joint Inspection Committee was appointed by the NGT to satisfy itself if there are any*

ITC Limited PSPD Unit: Kovai Thekkampatty

deviation from the conditions imposed by the respondents in the consent to operate and if there are any deficiencies in the manner of implementing the consent.

...

The conclusions of the Joint Inspection Committee are merely recommendatory and it is not final or binding, even on the NGT let alone the respondents.

....

(1) The Order dated 17.03.2020 is set aside."

2. The above Order of the Hon'ble High Court has directed the TNPCB to conduct proper enquiry by giving proper notice and opportunity of hearing to the Unit and then pass necessary order within 3 months. The Hon'ble High Court has neither directed TNPCB to issue the same proceedings/order dated 17.03.2020, nor has it directed TNPCB to pass any order demanding compensation. Needless to reiterate, the Hon'ble High Court has categorically set aside the proceedings/order dated 17.03.2020 of TNPCB which *inter alia* had directed payment of environmental compensation.

3. Now, in the above factual background, we have received the letter 1st referred above on 23.05.2023 from your goodselves directing us to appear before TNPCB Head Office at Guindy for a personal hearing on 26.05.2023. The said letter of the TNPCB has been issued in pursuance of the Order dated 12.04.2023 of the Hon'ble Madras High Court in WP no. 10495 of 2020. The said letter of the TNPCB only cited the letter 2nd referred above of the District Environmental Engineer and stated that our Unit is yet to complete the bio-mining of dumped plastic waste and merely directed us to appear for the personal hearing on 26.05.2023. The letter 1st cited above does not have any material detail as to what was the violation on part of the Unit which the Unit needs to address in its reply and in the personal hearing. In absence of material details in the letter 1st cited above, we assume that there is no violation on the part of the Unit which makes the Unit liable for any civil consequences. Copies of the letters 1st and 2nd referred above are enclosed herewith as **Annexure A** and **B** for ready reference.

4. We appeared before the TNPCB on 26.05.2023 through our counsel and sought some time as the time given was very short. The Board was pleased to grant us time and fixed the hearing on 09.06.2023. Although in the hearing we had merely sought sometime in the matter, the Additional Chief Environment Engineer ("ACEE") present in the hearing on 26.05.2023 mentioned the following points requiring our answers for your consideration: -

(i) completion of disposal of plastic waste,



(ii) providing of X- ray type scanner to screen the containers with paper raw material at the port; and

(iii) connectivity of OCEMS with TNPCB server.

5. Thereafter, we received a minute of meeting ("MoM") dated 01.06.2023 for the hearing on 26.05.2023 from the Member Secretary of TNPCB in which the same aforesaid points of ACEE were reiterated. Further, the said MoM merely directed submission of a detailed report with action plan within two weeks on the updated status of compliance of the earlier MoM of hearing on 07.08.2020 and directions issued vide proceedings dated 17.03.2020. Copy of the said MoM dated 01.06.2023 is enclosed herewith as **Annexure C** for ready reference.

6. It may please be noted that Para 1 of the letter 1st referred above reiterates the direction made in earlier order of TNPCB dt 17.03.2020 and draws analogy as if there is no compliance of earlier order dt 17.03.2020. It is our humble submission that Hon'ble High Court has set aside the said order dt 17.3.2020, in entirety including the so-called environmental compensation of Rs 331.80 Lakhs. Hence, no reference of earlier order dt 17.03.2020 much less the compensation of Rs 331.80 lakhs allegedly levied earlier can be made in the hearing notice. Such references to the earlier compensation, which has been set aside by the Hon'ble High Court, in the hearing notice would not only be highly improper but also be arbitrary and without any basis.

7. Hence, in the light of the above it is our preliminary submission that the letter 1st cited above and the MoM 3rd cited above, is not only improper but also arbitrary and without any basis and simultaneously lacking all material particulars of a show cause notice, pursuant to which no order or adjudication can be made.

8. Without prejudice to the above said preliminary submission, we wish to submit the following in response to those three points mentioned in MoM 3rd cited above, for your kind consideration:-

(i) <u>Disposal of plastic waste:</u>

a) TNPCB is well aware, as also evidenced by the counter of TNPCB in the Hon'ble High Court in WP 10495 of 2020 that the Unit was taken over by ITC Limited from BILT Industrial Packaging Company Limited only in the year 2004 and plastics have been left by the said erstwhile owner of the Unit which were found embedded in the soil and over which vegetation have grown. The said plastic waste has neither been generated nor left by us. To put it differently, we never generated such plastic waste. Further, we also

hasten to add that the plastic waste that was found in the Unit has not caused any loss or damage to the soil, considering the thick vegetation existing in our Unit, and notwithstanding the same and as directed by TNPCB we have been taking steps to dispose of such plastic as detailed in later paragraphs hereinafter.

b) Even though the Joint Committee report of March 2020 was made unilaterally without hearing us and which the High Court has held to be not binding on NGT or TNPCB, it is pointed out that such report after analyzing the samples of water, soil, air (source& ambient) at all relevant locations at the Unit had concluded that:

(i) the treated effluent parameters are within the limits prescribed by the Board;
(ii) ground and surface water parameters are within the permissible limits for irrigation and livestock;
(iii) no contamination of ground /surface water due to industrial activity;
(iv) presence of slightly higher nickel may be due to natural resources;
(v) traces of heavy metals may be due to past discharge of partial/untreated effluent however, the presence of heavy metals is lesser when compared with compost standards for agricultural purpose, indicating that there is no damage to the soil;
(vi) ambient air quality is within the notified ambient air quality standards and;
(vii) only SO2 and NO2 from the stack attached to 60 TPH boiler are exceeding the prescribed standards. We may point out here that the norm that the Joint Committee applied at the relevant time for NO2 and SO2 was not even applicable to co-generation captive power plants like that of the Unit.

c) As would be clear that even the Joint Committee clearly concluded that the ground/surface water and soil were not found to be contaminated or damaged. There is no finding as to the plastic waste left by the previous owner/operator to have contaminated the water or soil. There is, therefore no damage caused to the environment by the said plastic waste, which anyway was not left by the Unit and on the contrary the Unit is taking efforts and spending money for disposal of such plastic waste as detailed in later paragraphs below. So, there cannot be any adjudication on imposition of any compensation on this ground.

d) There is absolutely no proof that such plastic waste, which is being removed has caused any damage to the environment.



e) However, having great regard to the environment, and in deference to the observation of TNPCB, the Unit had already started excavating and disposal of the said plastic since July 2021 at its own cost and expense. The Unit has already disposed about 863 MT of such plastic to M/s Dalmia Cements at Kadapa, Andhra Pradesh. This fact has also been acknowledged and confirmed in the letter of the DEE 2nd cited above.

f) TNPCB is also already aware that the Unit has engaged one Zigma Global Environ Solutions Pvt Ltd ("Zigma") for mechanized segregation & disposal of plastic waste in Oct'22 by processing the soil/earth within the Unit where the plastic has been found underneath earth.

g) Zigma has already started the operations in the end of Feb'23 and until the end of May 2023, Zigma has processed 39,000 MT of soil and disposed 3891 MT of plastic to Cement Plants for Co-Processing. Details of such disposal are enclosed herewith as **Annexure- D**.

h) We may point out that it is wrongly mentioned in the letter 2nd referred above of the DEE that the Unit had assured that it will dispose the dumped plastic waste inside the unit premises to the cement industries before December 2021. No such assurance was given by the Unit and so the Unit cannot be held responsible in this regard. It may be noted as narrated above, the plastic waste has been left by the previous owner of the Unit and we cannot accurately estimate the volume and the time which would be taken for excavation, processing and disposal of the same. However, based on our reasonable estimate, the quantity to be excavated and segregated is about 1,80,000 MT. Based on our discussions with the contractor, we reasonably estimate that it will take about 12-15 months from now to complete the work and the work is going on at a very fast pace.

(ii) <u>X-ray type scanner to screen the barrels/containers with paper raw materials at the port:</u>

This purported direction for the first time was made in the MoM dated 07.08.2020 so as to reduce time of inspection for TNPCB officials. This purported direction for installation of scanner by the Unit is not a requirement of any law or pollution control norms. Notwithstanding that the Unit is not obligated to comply with the said purported direction of TNPCB, the Unit approached V.O. Chidambaranar Port Authority seeking their permission to install an exclusive X-ray scanner. The Port Authority rejected the proposal to install such exclusive scanner and rather suggested to use the existing scanning facility at the said Port by the TNPCB officials. We had already

communicated the response of the Port Authority to TNPCB earlier. Copy of our letter to the said Port Authority and the latter's response are enclosed herewith as **Annexures- E and F,** respectively.

Thus, this purported direction cannot be even alleged as violation of any pollution control norms warranting any action by TNPCB much less warranting any determination of environmental compensation.

(iii) Connectivity of OCEMS with TNPCB Server:

The Unit has already installed OCEMS instruments and the relevant data transmission has also been established with TNPCB and CPCB servers for the 44 TPH standby boiler and the same was reported earlier to TNPCB. Further for the 60 TPH boiler also the calibration software for SO2 and NO2 were installed and connected to TNPCB and CPCB servers. The connectivity with TNPCB and CPCB server has also been confirmed by the DEE in the letter 2nd referred above. Hence, we are fully in compliance of the same as evidenced by DEE's letter 2nd cited above.

It may be noted that the said 44 TPH standby boiler is a process boiler and not a typical boiler used in thermal power generating plant for generating power, and at the relevant time OCEMS installation was meant for boiler in thermal/captive power plant and not for the process boiler like the one used in the Unit. So, the non-installation of OCEMS for 44 TPH stand by boiler, at the relevant time, was not any violation of any provision of law or any direction of TNPCB. This stipulation was not even part of the consent-conditions at the relevant time. 44TPH Boiler, admittedly, is used only intermittently when the main boiler is under repair or maintenance. Even in one of the consent renewal order issued by TNPCB dt 03.05.2017 under the Air Act it has been clearly mentioned under "Additional Condition" that 44 TPH boiler shall be used as standby only. The said boiler is not the main boiler used in the plant and was used as stand by and it was sparingly used and certainly not on all days as computed/considered by the Joint Committee in its Report, based on which huge compensation was arrived at and which compensation has been set aside now by the Hon'ble High Court. However, in any event the said stipulation of OCEMS for the said standby boiler has been met with, as narrated above.

It may also be noted that even the Joint Committee Report of March 2020 had concluded that that PM, S02 & NO2 are within the notified ambient air quality standards. So, assuming without conceding that there was any violation regarding non-installation/connection of OCEMS of 44TPH boiler with TNPCB and CPCB server, the same does not amount to any damage to environment for which any compensation can be demanded, more so, when the emissions were found to be within the consented/stipulated norms even in the report of



TNPCB as well as reports of independent lab. Report of TNPCB on the ambient and stack air quality for January 2020 is enclosed herewith as **Annexure G**.

9. Without prejudice to all other contentions made herein, we submit that the alleged violations in the proceedings/order dated 17.03.2020 were not at all any violation of any law or pollution control norms and the TNPCB therein had not even alleged how such alleged violation caused any damage to the environment warranting any determination of compensation. Further, the directions in the said order dated 17.03.2020 were not part of the consent-conditions and at best could be considered as additional conditions imposed on the Unit. Nonetheless, the Unit complied with the same as also confirmed by the DEE in his letter 2nd referred to above in the Annexure thereto. In any event it is equally important to submit at this juncture that the said order dated 17.03.2020 stands as set aside by the Hon'ble High Court.

10. As to the status on direction no. 2(ii) in the order of TNPCB dated 17.03.2020, we would like to clarify that Unit had already installed Flowmeters at inlet of ETP, and thereafter also connected to TNPCB & CPCB servers and the data transmission to such servers has been established since 26/06/2020. However, in the letter of the DEE 2nd referred above, it is said that it is yet to be connected to CPCB which statement is not correct and the same can be verified at any time.

11. The directions in the MoM dated 07.08.2020 were mostly identical to the ones in the Order of TNPCB dated 17.03.2020 save some additional directions in the former, all of which have also been complied with as also confirmed by the DEE in the Annexure I to his letter 2nd referred above except the direction on providing X-ray type scanner at the port. With respect to the said X-ray scanner, our submissions made supra may please be noted.

12. In view of the above submissions, the only direction that remains to be completely fulfilled is the excavation and disposal of plastic waste, which activity is ongoing and is being carried out to the knowledge of TNPCB and we will continue with the said activity and update the TNPCB from time to time on the progress. As stated supra, based on our discussions with aforesaid Zigma, we reasonably estimate to complete such activity within 12-15 months from now. In any event, as submitted supra we have not caused the said plastic waste to be buried in soil and we are taking serious measures to excavate and dispose of the same as early as possible. Needless to mention, since the plastic waste was left over by the erstwhile owner of the Unit, no damage or loss to the environment, if any at all, can be said to have been caused by the Unit. For the plastic waste left by the erstwhile owner, Unit is rather spending money in excavating and processing the soil and disposing of the plastic waste. The total cost incurred/ spent by the unit so far towards removing such plastic waste is about 4(four) crores as tabulated in **Annexure – H** as enclosed herewith.

13. Environmental compensation will not ordinarily be imposed, unless one has acted deliberately in defiance of a law /rule or was guilty of any conduct/misconduct. Further if there is a technical or venial breach of the provisions of law or where the breach flows from a *bona fide* belief that the person is not liable to act in the manner prescribed by the statue, no penalty or compensation can be imposed.

14. In the light of the submissions made above, we wish to state that we have complied with all applicable laws and regulations and there is no defiance of any law or regulation as such. Further, as evident from the letter 2nd cited above, we have also complied with all the directions issued by TNPCB from time to time, except the removal of plastic waste which is also being done now though for no fault on our side and though there was no time limit prescribed for such removal. Hence, in the absence of any material particulars as aforesaid in the hearing notice, as well as there being no defiance of law on our side, we wish to submit that no action, much less levy of any compensation be taken or made against us.

15. Accordingly, in view of all of the above, it is clearly established that there is no violation of the prescribed pollution control norms or directions and there is no damage caused to the environment warranting any action or determination against the Unit. It is therefore prayed that the above proceedings may be dropped in the interest of justice and thereby render justice.

We reserve our rights to make further submissions or modify the above at the time or after the personal hearing.

Yours faithfully,

ITC Limited PSPD Unit: Kovai Enduring Value

For ITC Limited – Unit Kovai

Encl: Annexures A to H

SECRETARY, TAMILNADU POLLUTION CONTROL BOARD CHENNAI-600 032

09 JUN 2023

PA to MS

2253145

By Speed Post

TAMIL NADU POLLUTION CONTROL BOARD

From

Dr. Jayanthi M. I.F.S.
Chairperson,
Tamil Nadu Pollution Control Board,
76, Mount Salai, Guindy,
Chennai – 600 032.

To

The Unit Head,
M/s. ITC Limited,
PSPD Unit Kovai,
Door no. 328 GSt Road,
Thekkampatty Village,
Vivekanandapuram P.O.,
Mettuplayam Taluk,
Coimbatore District- 641 113.

Lr. No: T2/ TNPCB / F.0038/RL/CBN/2021 Dated: 23.05.2023

Sub: TNPCB – Industries – M/s. ITC Limited PSPD unit, Kovai, S.F.No:24/1 etc, Thekkampatty Village, Mettupalayam Taluk, Coimbatore District- Personal hearing on **26.05.2023(Friday) at 3.00 PM** in the Corporate Office, TNPCB, Guindy, Chennai - Regarding.

Ref:
1. Hon'ble High Court of Madras order in the matter of Writ Petition No. 10495 of 2020 dated 12.04.2023.
2. DEE's letter No.:DEE/TNPCB/ F.1371/Tech/CBE(N)/2023/dated 27/04/2023

I invite your kind attention to the reference 1st cited, wherein the unit M/s. ITC Limited PSPD unit, Kovai, S.F.No:24/1 etc, Thekkampatty Village, Mettupalayam Taluk, Coimbatore District has been issued with direction vide Proc. No. T1/TNPCB/F.0038/ CBN/ RL/ W&A/ 2020 dated 17.03.2020 to comply certain instructions including the interim environmental compensation of an amount of Rs. 331.80 Lakhs and an additional amount of Rs.30,000/- per day until the until compliance of the conditions mentioned therein. However, it was reported by the DEE, Coimbatore North vide reference 2nd cited, that the unit is yet to complete the Bio-mining of dumped plastic waste.

Further, the Hon'ble High Court of Madras has passed the order in the matter of Writ Petition No. 10495 of 2020 on 12.04.2023 as follows:

"(1)The order dated 17.03.2020 is set aside. The matter is remanded to the 2nd respondent. The 2nd respondent shall issue notice to the petitioner and fix the date of hearing on which day the petitioner shall appear and give its explanation.

(2).If the petitioner does not avail this opportunity the respondents can proceed and pass orders.

(3).The 2nd respondent shall pass a detailed speaking order taking into consideration all aspects including the Joint Inspection Report but the order shall not be predicated only on the basis of the Joint Inspection Report done presently

(4).This exercise shall be completed within a period of three months from the date of receipt of a copy of this order."

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In this regard, in order to comply with the above order, Board has decided to conduct a personal hearing on 26.05.2023 at 3.00 PM in the Corporate Office, TNPCB, Guindy, Chennai. Hence, you are requested to attend the personal hearing with all the relevant particulars without fail.

The receipt of this letter may be acknowledged.

For Chairperson

23/5/2023

Copy to

1. The District Environmental Engineer,
   Tamil Nadu Pollution Control Board,
   Coimbatore North–(for information and follow up action)

2. PRO

TAMILNADU POLLUTION CONTROL BOARD

From	To
Dr. K.Ravichandran, M.Tech.,Ph.D., District Environmental Engineer Tamilnadu Pollution Control Board Coimbatore North, No. 5, Ramasamy Nagar Kavundampalayam, Coimbatore – 641 030	The Member Secretary, Tamilnadu Pollution Control Board, 72, Mount Salai, Guindy, Chennai-641032.

Letter No.DEE/TNPCB/F.1371/Tech//CBE(N)/2023 dated:27/04/2023

Sir,

Sub : TNPC Board – O/o. DEE, Coimbatore North - M/s. ITC Limited, PSPD Unit, Kovai, S.F No:241/1,etc., Thekkampatty Village, Mettupalayam Taluk, Coimbatore District - Hon'ble High Court of Madras passed Orders in the matter of Writ Petition No.10495 of 2020 – Compliance - Reg.

Ref : 1. Proc No. F.CBS0038/DEE/TNPCB/CBN/RL/W&A/2020/ dated.09.01.2020
2. The Board's Proc.No.T1/TNPCB/F.0038/CBN/RL/W&A/2020 dated 17.03.2020.
3. Order passed by the Hon'ble High Court of Madras in the matter of Writ Petition No.10495 of 2020 on 12.04.2023.
4. The Board's Memo.No.TNPCB/LAW/LAI/016248/2020 dated. 22.04.2023

* * * * *

With reference to the above the following are submitted,

1. The Hon'ble National Green Tribunal, Southern Zone, Chennai in the matter of original application No. 26 of 2019 filed by Thiru. E. Rajendran and Thiru. E Ashok Raj Kumar against the unit of M/s ITC Limited, directed on 13.12.2019 as;

"...we feel that it is appropriate to constitute a Joint Committee, consisting of a Senior Scientist from Central Pollution Control Board and Tamil Nadu Pollution Control Board to inspect the unit in question and consider whether the "land fill" has been properly maintained and they are complying all the norms and assess soil, water and air quality in that area and If there is any violation, they are directed to take appropriate action in accordance with law and submit a factual and action taken report within a period of one month to this tribunal...."

2. Accordingly, the joint committee was constituted and inspection was carried out during January 06 to 08, 2020. Meanwhile, the TNPCB has issued show cause notice vide Proc No. F.CBS0038/DEE/TNPCB/CBN/RL/W&A/2020/dated 09.01.2020 under Water (P&CP) Act 1974 as amended and Air (P&CP) Act 1981 as amended to the industry for the violations observed.

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3. And also, Based on the recommendations of the Joint Committee the Tamilnadu Pollution Control Board has issued directions to the unit of M/s. ITC Limited, Paper Boards and Specialty Boards Division, Unit: Kovai vide Proc. No.T1/TNPCB/F.0038/CBN/RL/W&A/2020 dated 17.03.2020 to comply certain instructions including interim environmental compensation of an amount of Rs. 331.80 Lakhs and an additional amount of Rs.30,000/- per day until the compliance of the instructions. (The present status of the directions issued vide proc. Dated 17.03.2020 is enclosed herewith).

4. Further, the TNPC Board had conducted personal hearing meeting with the unit of M/s. ITC Limited, Paper Boards and Specialty Boards Division, Unit: Kovai on 07.08.2020 @ 10.00 AM at Corporate Office, TNPCB, Guindy, Chennai. During personal hearing meeting, the unit has requested to waive the Environmental Compensation. (The present status of the minutes of the personal hearing held on 07.08.2020 is also enclosed herewith)

5. Moreover, a Writ Petition No.10495 of 2020 has been filed seeking for a Writ of Certiorari to call for the records on the file of the TNPC Board in Proceedings No.T1/TNPCB/F.0038/CBN/RL/W&A/2020, dated 17.03.2020, quash the same and for consequential orders by M/s. ITC Limited, Paper Boards and Specialty Boards Division, Unit: Kovai against the respondents 1. The District Environmental Engineer, Tamil Nadu Pollution Control Board, Coimbatore North and 2. The Chairman, Tamil Nadu Pollution Control Board, Chennai.

6. The Hon'ble High Court of Madras has passed the order in the matter of Writ Petition No.10495 of 2020 on 12.04.2023 as follows,

1) ***The order dated 17.03.2020 is set aside. The matter is remanded to the 2nd respondent. The 2nd respondent shall issue notice to the petitioner and fix the date of hearing on which day the petitioner shall appear and give its explanation.***
2) ***If the petitioner does not avail this opportunity the respondents can proceed and pass orders.***
3) ***The 2nd respondent shall pass a detailed speaking order taking into consideration all aspects including the Joint Inspection Report but the order shall not be predicated only on the basis of the Joint Inspection Report done presently.***
4) ***This exercise shall be completed within a period of three months from the date of receipt of a copy of this order.***

13

In view of the above, the Board shall take suitable action as per the order passed by the Hon'ble High Court of Madras by giving fresh notice to the petitioner as the unit is yet to complete the Bio-mining of dumped plastic waste.

Submitted for taking further necessary action please.

Encl: As above.

District Environmental Engineer
Tamilnadu Pollution Control Board,
Coimbatore North.

Copy submitted to:

The Joint Chief Environmental Engineer (M), Tamilnadu Pollution Control Board, Coimbatore for favour of kind information please.

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Annexure-I

Compliance status on the minutes of the personal hearing held on 07.08.2020 at Corporate Office

S.No.	Conditions	Compliances
1.	The unit shall submit separate applications and obtain consents for paper production (Duplex Board, Art Board, Cromo Board) and power generation (8MW Hr).	The unit has obtained separate consents as M/s. ITC LIMITED, PSPD UNIT KOVAI vide board Proc. No. T3/TNPCB/F.0038CBN/RL/CBN/W&A/2022 dt. 18.07.2022 valid up to 31.03.2025 and M/s. ITC LIMITED PSPD UNIT KOVAI - POWER PLANT vide board Proc No. T3/TNPCB/F.2158CBN/RL/CBN/W&A/2022 dt. 29.08.2022valid up to 31.03.2027.
2.	The industry shall provide calibration facility in the OCEMS installed in 60 TPH boiler for the parameters PM, SO_2 and NO_2. SO_2 and NO_2 analyzer and same be connected to CPCB and TNPCB server.	The unit has installed Online Continuous Emission Monitoring System (OCEMS) for 60 TPH Boiler for the parameters PM, SO_2 and NO_2 and connected to CPCB and Care Air Centre, TNPCB server
3	The industry shall provide OCEMS in 44 TPH boiler for the parameters PM, SO_2 and NO_2. SO_2 and NO_2 and same be connected to CPCB and TNPCB server by 30.09.2020.	The unit has installed Online Continuous Emission Monitoring System (OCEMS) for 44 TPH standby Boiler for the parameters PM, SO_2 and $NO_2$and connected to CPCB and Care Air Centre, TNPCB server.
4	The unit shall furnish the records of 44 TPH boiler operations as claimed by the unit.	The unit has maintained the records of 44 TPH boiler operations.
5.	The industry shall quantify the plastic waste and process waste sludge (binding chemicals) which was dumped and furnish the details along with disposal details.	The unit has started manual cleaning of dumped plastic wastes inside the unit premises since October 2021. The unit has disposed 863.85 Tons of segregated dumped plastic wastes to the Cement industries so far. The unit has not complied as assured by the unit to dispose the dumped plastic wastes inside the unit premises to the cement industries for co-processing before December 2021. However, the unit has engaged the third party (M/s Zigma) for segregation and disposal of plastic waste through mechanized and the works is in progress.
6	The unit shall utilize imported coal having 0.5%Sulphur instead of Lignite obtained from NLC having 1.5% Sulphur.	The unit is utilizing 35 % of imported coal, 20 % of bio mass and remaining 45 % of lignite purchased from the NLC as fuel for the boiler and reported that they are already achieving the SO_2 norms. They also informed that they will reduce the quantity of lignite gradually.
7	The unit shall analyse the heavy metals in the raw material and also furnish report to Board, since Ni was found to be present in the ground water sample report.	The unit has analyzed the raw material samples through TNAU, Coimbatore. From the report of analysis dated 02.11.2020, it is ascertained that the heavy metal Nickel is lesser as compared with tolerance limits for trade effluent on land for irrigation standards prescribed by the Board.

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8.	The unit shall provide X-Ray type scan to screen the barrels / container with paper raw materials at the port, so as to reduce time of inspection for TNPCB officials.	**Not complied.** The unit has informed that they are exploring the possibilities of providing X-Ray type scanner to screen the barrels / container.
9.	The unit shall form 30 m x 30 m grid and install piezometric bore well for analysis of ground water.	The unit has already provided 10 Nos. of piezometric bore well for analysis of ground water in the irrigation land and assured to provide more piezometric bore wells as instructed.
10.	The unit shall provide sprinkler arrangements to avoid fugitive emissions	The unit has provided water sprinklers in coal and biomass storage area.
11.	The unit shall check proximity & Ultimate analysis to find the Heavy metals in the Lignite.	The unit has analyzed the Lignite sample through TNAU, Coimbatore. From the report of analysis dated 02.11.2020, it is ascertained that the heavy metal Nickel is lesser as compared with tolerance limits for trade effluent on land for irrigation standards prescribed by the Board. Attached in Annexure II)
12.	The unit shall furnish the list of proprietary chemicals used in the industry.	The unit has furnished list of proprietary chemicals used in the industry.

Compliance status of direction issued vide Proc. dated:17.03.2020

S.No.	Directions issued vide Proc. dated:17.03.2020	Present status of compliance
1	Non-installation of Online Continuous Emission Monitoring System (OCEMS) for 44 TPH standby Boiler.	The unit has installed Online Continuous Emission Monitoring System (OCEMS) for 44 TPH standby Boiler for the parameters PM, SO_2 and $NO_2$and connected to CPCB and Care Air Centre, TNPCB server since September 2020.
2	Dumping of plastic waste inside the unit premises.	The unit has started manual cleaning of dumped plastic wastes inside the unit premises since October 2021. The unit has disposed 863.85 Tons of segregated dumped plastic wastes to the Cement industries so far. The unit has not complied as assured by the unit to dispose the dumped plastic wastes inside the unit premises to the cement industries for co-processing before December 2021. However, the unit has engaged the third party (M/s Zigma) for segregation and disposal of plastic waste through mechanized and the works is in progress.
3	Exceedance of source emissions parameters (NO_2& SO_2).	The unit is utilizing 70 % of imported coal&30 % of bio mass as fuel for the boiler and reported that they are already achieving the SO_2 norms. They also informed that they stopped utilizing of lignite from NLC and assured to comply the MoEF&CC notification dated;31/03/2021 before 31/12/2024.
4	Traces of heavy metals in soil due to past discharge of partial/untreated effluent	The unit has provided Effluent Treatment Plant for the treatment of effluent generation from the manufacturing process and treated effluent is being utilized for irrigation. The unit has engaged Tamil Nadu Agricultural

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		University (TNAU) monitor the impact of application of treated effluent on soil and ground water quality since year 2000. Further the unit was advised to comply the suggestions given by TNAU
1	The unit shall remit the interim environmental compensation of an amount of Rs. 331.80 Lakhs calculated till 11.03.2020 for violations made by the unit.	The Hon'ble High Court of Madras has passed the order in the matter of Writ Petition No 10495 of 2020 on 12.04.2023 as follows. *1) The order dated 17.03.2020 is set aside. The matter is remanded to the 2nd respondent. The 2nd respondent shall issue notice to the petitioner and fix the date of hearing on which day the petitioner shall appear and give its explanation.* *2) If the petitioner does not avail this opportunity the respondents can proceed and pass orders.* *3) The 2nd respondent shall pass a detailed speaking order taking into consideration all aspects including the Joint Inspection Report but the order shall not be predicated only on the basis of the Joint Inspection Report done presently.* *4) This exercise shall be completed within a period of three months from the date of receipt of a copy of this order.*
2		
i	The industry shall ensure no discharge of partially/untreated effluent in to the soil.	The unit has provided Effluent Treatment Plant for the treatment of effluent generation from the manufacturing process and treated effluent is being utilized for irrigation.
ii	The industry shall provide flow meter at inlet of ETP in order to quantify total effluent generation and treated and its shall be connected to the online servers of CPCB and TNPCB.	The unit has provided flow meter at the inlet of ETP and connected to Water Quality Watch Centre, TNPCB to monitoring the actual flow of effluent. Yet to be connected with CPCB.
iii	The industry shall provide calibration facility in the OCEMS installed in 60 TPH boiler for the parameters PM, NO_2& SO_2. Data from NO_2& SO_2 analyzers to be connected to CPCB and TNPCB server.	The unit has provided calibration software to online NO_2& SO_2 analyzer of 60 TPH boiler and data from NO_2& SO_2 analyzers are connected to CPCB and TNPCB server.
iv	The OCEMS attached in the 60 TPH Boiler shall be placed in appropriate location as per emission regulations part-III	The unit has relocated the OCEMS of 60TPH boiler as per the directions.

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v	The industry shall install OCEMS in 44 TPH boiler for the parameters PM, SO2& NO2 with gaseous calibration facility and connected to CPCB & TNPCB server.	The unit has installed Online Continuous Emission Monitoring System (OCEMS) for 44 TPH standby Boiler for the parameters PM, SO_2 and $NO_2$and connected to CPCB and Care Air Centre, TNPCB server.
vi	The industry shall provide proper processing and storage facilities for vermicomposting of bio sludge.	The unit has provided additional vermi-composting pits with shed.
vii	The industry shall provide proper processing and storage facilities for the boiler fuel (Lignite & biomass) and avoid open storage. This facility shall be provided with proper drainage system.	The unit has stored the lignite in closed shed. There is no open storage of lignite and biomass inside the unit premise.
viii	The industry shall provide adequate control measures and maintain regularly to avoid fugitive emission from storage yard of boiler fuel and bottom ash.	The unit has completed construction of extension of existing fuel shed. The unit has provided water sprinklers in fuel, biomass and fly ash storage area
ix	The industry shall remove the open dumping of plastic waste and process waste sludge (Binding chemicals) found during committee visit and dispose it properly. The industry shall ensure no open dumping of waste at any time.	The unit has disposed the plastic waste and process waste sludge was removed from solar plant area to the cement industries for co-processing.
x	The industry shall provide garland drain system around the premises and connected to concerted rain water harvesting pond to avoid seepage or can adopt any appropriate methods to avoid seepage or can adopt any appropriate methods to avoid seepage water flowing to agriculture land.	The unit has created pits for storage of rain water runoff in low lying area and the unit has designed the scheme for collection of roof water from waste paper yard and fuel yard to divert rain water to storage pond

District Environmental Engineer
Tamilnadu Pollution Control Board,
Coimbatore North.

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TAMIL NADU POLLUTION CONTROL BOARD

MINUTES OF THE PERSONAL HEARING FOR THE UNIT M/S. ITC LIMITED, PAPER BOARDS AND SPECIALTY BOARDS DIVISION, UNIT: KOVAI, S.F NO. 241/1, 409/1, ETC THEKKAMPATTY VILLAGE, METTUPALAYAM TALUK, COIMBATORE DISTRICT AT THE ORPORATE OFFICE, TNPCB, GUINDY, CHENNAI ON 26.05.2023 AT 3.00 PM.

Present:

I.TNPCB Officials:

1. Er. R. Kannan, Member Secretary
2. Er. S. Rajan, Additional Chief Environmental Engineer
3. Er. Fathima Jalal, Assistant Engineer

II. Unit Authorities

1. Mr. AR. Ramanathan, Advocate, Counsel for ITC Limited
2. Mr.Amit Kumar.Legal Department, ITC PSPD,Secunderabad

****

At the outset, the Member Secretary briefed about the essence of calling the unit for personal hearing, in order to comply with the Hon'ble High Court of Madras, order dated:12.04.2023, in the matter of Writ Petition No. 10495 of 2020.

In this regard, the Advocate on behalf of the unit (M/s. ITC Limited, PSPD Unit) furnishing a Vakalat to the Board, informed that letter cum notice fixing the hearing on 26th May 2023 has been received by the unit on 23.05.2023 late evening via email. Further, the unit needs some more time to prepare explanation and make effective submissions in the personal hearing. Hence, it is requested to grant two week's time and fix a hearing date after 2 weeks, so as to enable to prepare and file a detailed reply with documents.

The ACEE pointed out that the unit is yet to complete the Bio-mining of dumped plastic waste, yet to provide X- ray type scan to screen the barrels/containers with paper raw materials at the port, connectivity of OCEMS with TNPCB Server. Hence, it is requested to submit a detailed report along with action plan within two weeks, on the updated status of compliance of the minutes of the personal hearing held on 07.08.2020 and directions issued vide proc. Dated. 17.03.2020.

Based on the request of the unit, the Board has decided to conduct the personal hearing on 9th June, 2023(Friday) at 11.00 AM.

With this the meeting came to an end.

For Member Secretary

No. 76, MOUNT SALAI, GUINDY, CHENNAI - 600 032.
Tel : 044-22353134 - 139 Fax : 044-22353068
Email : tnpcb-chn@gov.in Web : tnpcb.gov.in

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To

The Unit Head,
M/s. ITC Limited,PSPD Unit Kovai,
Mettuplayam Taluk,
Coimbatore District.-641113.

Copy to

1. The Joint Chief Environmental Engineer (M),
   Tamil Nadu Pollution Control Board,
   Coimbatore
2. The District Environmental Engineer,
   Tamil Nadu Pollution Control Board,
   Coimbatore (North)

S.No	Date	Customer Name	Item Name	Plant Name	Vehicle No	Destination	Qty in Tons
1	08/03/2023	Ultratech Cement Limited (Unit: Reddipalayam)	Double Shredded Plastic Waste	ITC Limited	TN36BV3805	REDDIPALAYAM	14.39
2	11/03/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB1395	NANDYAL	14.23
3	11/03/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J5593	NANDYAL	14.82
4	24/03/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J7641	NANDYAL	24.9
5	24/03/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52L7930	NANDYAL	18.02
6	24/03/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J1391	NANDYAL	20.85
7	28/03/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	AP39UF3003	NANDYAL	28.23
8	31/03/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52Q4773	NANDYAL	27.66
9	31/03/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB6606	NANDYAL	23.70
10	03/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB1064	NANDYAL	26.49
11	04/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J5593	NANDYAL	29.37
12	05/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J5518	NANDYAL	28.81
13	05/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB7248	NANDYAL	30.08
14	06/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J7641	NANDYAL	29.43
15	06/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J1365	NANDYAL	28.25
16	06/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN77L5890	NANDYAL	31.05
17	06/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52Q4312	NANDYAL	26.61
18	06/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J7691	NANDYAL	26.16
19	07/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB7224	NANDYAL	28.67
20	07/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	KA51AH3324	NANDYAL	26.65
21	07/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	KA51AG1599	NANDYAL	26.11
22	08/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52P8460	NANDYAL	26.06
23	08/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52L7956	NANDYAL	21.04
24	08/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52P8638	NANDYAL	24.57
25	09/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	AP39UE3838	NANDYAL	24.77
26	09/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52P8741	NANDYAL	24.03
27	12/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52Q4380	NANDYAL	27.45
28	12/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J7641	NANDYAL	25.84
29	13/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN77L5890	NANDYAL	25.14
30	13/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J7691	NANDYAL	28.69
31	13/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB1064	NANDYAL	27.78
32	13/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	KA51AH3323	NANDYAL	24.34
33	13/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52K9277	NANDYAL	24.14
34	14/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	AP39UF3030	NANDYAL	24.34
35	14/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	AP39UE3636	NANDYAL	24.55
36	14/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB7224	NANDYAL	24.72
37	16/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52P8638	NANDYAL	27
38	16/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB1045	NANDYAL	25.07
39	16/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52P8460	NANDYAL	23.3

40	17/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52L7956	NANDYAL	23.79
41	17/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J0547	NANDYAL	23.24
42	17/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52M1488	NANDYAL	22.27
43	18/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AA6888	NANDYAL	22.59
44	18/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52P8741	NANDYAL	21.85
45	23/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52L8146	NANDYAL	26.56
46	23/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52Q4312	NANDYAL	34.25
47	23/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52P8460	NANDYAL	26.99
48	23/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB7248	NANDYAL	26.62
49	23/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52L7956	NANDYAL	27.33
52	24/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52L7930	NANDYAL	28.15
53	24/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52P8638	NANDYAL	21.04
54	25/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN28BA4348	NANDYAL	23.44
55	25/04/2023	Dalmia Cement (B) Ltd (Unit: Dalmiapuram)	Unshredded Plastic Waste	ITC Limited	TN28BA0406	Dalmiapuram	24.08
56	26/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52R5199	NANDYAL	22.98
57	26/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB1278	NANDYAL	24.41
58	26/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AA4568	NANDYAL	25.52
59	27/04/2023	Dalmia Cement (B) Ltd (Unit: Dalmiapuram)	Unshredded Plastic Waste	ITC Limited	KA01AM1182	Dalmiapuram	21.13
60	27/04/2023	Dalmia Cement (B) Ltd (Unit: Dalmiapuram)	Unshredded Plastic Waste	ITC Limited	TN36BV3836	Dalmiapuram	24.14
61	27/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AA6888	NANDYAL	24.32
62	27/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	KA51AH3323	NANDYAL	24.44
63	27/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN77L5890	NANDYAL	27.94
64	27/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52Q4773	NANDYAL	26.6
65	28/04/2023	Dalmia Cement (B) Ltd (Unit: Dalmiapuram)	Unshredded Plastic Waste	ITC Limited	TN36BV3836	Dalmiapuram	18.36
66	28/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52Q4773	NANDYAL	52.98
67	29/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52M3558	NANDYAL	30.07
68	29/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J5518	NANDYAL	29.54
69	29/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52Q4380	NANDYAL	27.02
70	29/04/2023	Dalmia Cement (B) Ltd (Unit: Dalmiapuram)	Unshredded Plastic Waste	ITC Limited	TN36BV4178	Dalmiapuram	23.48
71	30/04/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN28BA3358	NANDYAL	26.57
72	08/05/2023	Dalmia Cement (B) Ltd (Unit: Dalmiapuram)	Unshredded Plastic Waste	ITC Limited	TN85M9090	Dalmiapuram	13.39
73	09/05/2023	Dalmia Cement (B) Ltd (Unit: Dalmiapuram)	Unshredded Plastic Waste	ITC Limited	TN24AD7810	Dalmiapuram	28.41
74	09/05/2023	Dalmia Cement (B) Ltd (Unit: Dalmiapuram)	Unshredded Plastic Waste	ITC Limited	TN36BV3892	Dalmiapuram	30.69
75	10/05/2023	Dalmia Cement (B) Ltd (Unit: Dalmiapuram)	Unshredded Plastic Waste	ITC Limited	TN24AD7810	Dalmiapuram	28.41
76	10/05/2023	Dalmia Cement (B) Ltd (Unit: Dalmiapuram)	Unshredded Plastic Waste	ITC Limited	TN36BV3892	Dalmiapuram	30.69
77	13/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J7641	NANDYAL	33.85
78	13/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	AP39UF3300	NANDYAL	34.34
79	13/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB4974	NANDYAL	34.66
80	14/05/2023	Dalmia Cement (B) Ltd (Unit: Dalmiapuram)	Unshredded Plastic Waste	ITC Limited	TN28AR1990	Dalmiapuram	17.69
81	14/05/2023	Dalmia Cement (B) Ltd (Unit: Dalmiapuram)	Unshredded Plastic Waste	ITC Limited	TN28AR7789	Dalmiapuram	16.32

82	14/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN77L5890	NANDYAL	30.66
83	14/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52Q1558	NANDYAL	25.67
84	15/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J5518	NANDYAL	31.45
85	15/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52L7956	NANDYAL	32.28
86	15/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52Q4312	NANDYAL	34.41
87	15/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN28BA3358	NANDYAL	26.44
88	15/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB0688	NANDYAL	25.9
89	15/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52Q4380	NANDYAL	30.05
90	16/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J1365	NANDYAL	29.58
91	16/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52K3117	NANDYAL	29.61
92	17/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52L8146	NANDYAL	26.32
93	18/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52P8460	NANDYAL	30.83
94	18/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52H5216	NANDYAL	28.49
95	18/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J0547	NANDYAL	31.88
96	19/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52M1488	NANDYAL	28.11
97	19/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52Q4773	NANDYAL	28.89
98	19/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52K9277	NANDYAL	29.72
99	19/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN34AA9194	NANDYAL	29.23
100	20/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB9571	NANDYAL	30.4
101	20/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB9561	NANDYAL	31.04
102	20/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52P8638	NANDYAL	29.34
103	21/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	AP39UE3663	NANDYAL	28.64
104	21/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J7691	NANDYAL	26.01
105	21/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB7248	NANDYAL	31.7
106	21/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	AP39UF3030	NANDYAL	35.39
107	22/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52M3558	NANDYAL	32.24
108	23/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AA5191	NANDYAL	33.59
109	23/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB7224	NANDYAL	34.41
110	23/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52P3536	NANDYAL	31.94
111	23/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN86F1152	NANDYAL	25.37
112	23/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB1045	NANDYAL	32.15
113	25/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J5593	NANDYAL	30.5
114	25/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52Q4380	NANDYAL	32.47
115	25/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52Q4312	NANDYAL	39.63
116	25/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J1365	NANDYAL	29.83
117	25/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52M1488	NANDYAL	31
118	25/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J0547	NANDYAL	31.49
119	26/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52L8146	NANDYAL	32.55
120	27/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB9561	NANDYAL	33.33
121	27/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52K9277	NANDYAL	27.41

122	27/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52Q4773	NANDYAL	30.68
123	27/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52P8460	NANDYAL	29.88
124	28/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN34AA9194	NANDYAL	25.65
125	28/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52L7956	NANDYAL	31.31
126	28/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J5518	NANDYAL	29.37
127	28/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J7691	NANDYAL	31.04
128	28/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB7248	NANDYAL	37.82
129	28/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52J1391	NANDYAL	28.82
130	30/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52P8638	NANDYAL	28.74
131	30/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52M3558	NANDYAL	30.87
132	30/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	KA51AH3324	NANDYAL	35.06
133	30/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52L8146	NANDYAL	23.67
134	30/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN28BA8678	NANDYAL	24.83
135	31/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB6421	NANDYAL	28.64
136	31/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB3485	NANDYAL	25.32
137	31/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB4926	NANDYAL	30.6
138	31/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AB9561	NANDYAL	38.55
139	31/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52M1488	NANDYAL	30.96
140	31/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	AP39UE3388	NANDYAL	34.01
141	31/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AA5191	NANDYAL	32.89
142	31/05/2023	JSW Cement Limited	Shredded Alternate Fuel	ITC Limited	TN52AA5106	NANDYAL	35.34
							3891.46

ITC Limited
PAPERBOARDS & SPECIALTY PAPERS DIVISION
Divisional Headquarters : ITC Bhadrachalam House
106, Sardar Patel Road,
Secunderabad - 500 003, Telangana, India
Telephone : 91- 40 - 27846566 -73
Fax : 91 - 40 27842997, Expts : 27810034
27849509, 27896048

Enduring Value

07/09/2022

To

The Chairman

V.O Chidambaranar Port Authority

Thoothukudi

Tamil Nadu

Dear Sir,

Subject: Inspection of the containers with imported waste paper by the officials from Tamil Nadu Pollution Control Board (TNPCB).

We at ITC Limited, Paperboards & Specialty Papers Division (PSPD), Unit Kovai at Thekkampatty village, Mettupalayam taluk, Coimbatore District has annual capacity to manufacture 1,20,000 MT of Coated Paperboards. The main raw material for this plant is waste paper. Unit sources domestic waste paper and also imports waste paper from various countries at Tuticorin port.

At present, Unit imports 1500 to 4000 MT of waste paper per month (100 to 200 containers).

As per direction of the Hon'ble Madras High Court, the TNPCB officials are carrying out physical inspection of all the imported waste paper consignments on regular basis along with Customs & ITC Ltd.'s officials before the consignment gets cleared for dispatch to plant.

Now, TNPCB has directed ITC Ltd., PSPD to provide X-Ray type scanning machine to screen the waste paper containers at the port so as to reduce the time of inspection for TNPCB officials.

In this regard, we seek your approval for

- Installing a X ray scanning machine inside "Tuticorin port" premises.
- Allocating designated place for installation of machine, control room.

Thanking you

Yours faithfully,

B Makarand

Divisional Head - Manufacturing

வ.உ.சிதம்பரனார் துறைமுக ஆணையம்
वी.ओ. चिदम्बरनार पत्तन प्राधिकरण
V.O.CHIDAMBARANAR PORT AUTHORITY
MINISTRY OF PORTS, SHIPPING AND WATERWAYS
GOVERNMENT OF INDIA
ADMINISTRATIVE OFFICE, HARBOUR ESTATE, TUTICORIN 628 004, TAMIL NADU

ISO 9001:2015, EMS ISO 14001:2015B, OHSMS 45001:2018 COMPLIANT PORT

SAGARMALA

F.No.TRA-OFTMK-MIS-BUISN-A1-18(44700)D. Date: 14.09.2022

To
Shri. B Markarand
Divisional Head – Manufacturing
Paperboards and speciality Papers Division,
ITC Limited,
ITC Bhardachalam House,
106, Sardar Patel Road,Secundrabad,
Telangana - 500 003.

Sub: Inspection of M/s. ITC containers with imported waste paper by the officials from Tamilnadu Pollution Control Board (TNPCB) - Request for installation of X-Ray scanning machine inside the Port premises by M/s. ITC – reg

Ref: Your letter dated 07.09.2022

****

Sir,

With reference to the letter cited on the above mentioned subject, it is informed that VOC Port has following three number of container scanners in the Port area in order to reduce the time taken for container scanning process, facilitate hassle-free movement of cargo and enhance ease of doing business at the Port:

- Fixed container scanner with the capacity of 12 containers/hour.
- Mobile container scanner with the capacity of 25 containers/hour.
- Drive Through Container Scanner (DTCS) with the capacity 100 containers/hour.

2 Containers selected under the Risk Management System (RMS) of the Customs Department are scanned through the above said facility. Hence, TNPCB officials may utilize the existing facility of the VOC Port for scanning said containers, subject to customs permission and payment of all necessary charges by M/s ITC, in order to avoid the installation of exclusive scanner.

14/09/2022

TRAFFIC MANAGER

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

From

K.Selvaraj, M.Sc.,
Assistant Director (Lab)
Advanced Environmental Laboratory
Tamilnadu Pollution Control **Board**
No.5, Ramasamy Nagar, Kavundampalayam
Coimbatore – 641 030.
Email – aeltnpcbcbe@gmail.com

To

M/s.ITC Limited.,
Paper Boards & Specialty Papers Division,
Unit : Kovai,
Vivekanandapuram (Post),
Thekkampatty (Village),
Coimbatore – 641 113.

Lr.No.TNPC Bd/AD (L)/AEL – CBE/AAQS & SM/F.No.M.1/19 – 20, Dated 21.01.2020.

Sir,

Sub: Furnishing of Report of Analysis of Ambient Air Quality / Stack Monitoring / **Ambient Noise Level Survey – Reg.**

Ref: **1. JCEE's Memo No.JCEE (M)/TNPCB/CBE/F**.200/Tech/2020 **Dated 02.01.2020.**
2. This office Lr.No.TNPC Bd/AD (L)/AEL-CBE/Air survey/F.No.M.1/19 – 20 **dated 16.05.2019 & 07.01.2020.**
3. Your mail **dated 23.01.2020.**
4. This office Bill No.12/2018-19 Dated 14.06.2018 for Excess Payment **Rs.12,2**00/-
5. Cash Receipt No.55640 dated 11.06.2019 for Rs.20,100/-.

*****

I am sending herewith the Report of Analysis of Ambient Air Quality /Stack Monitoring **/ Ambient Noise Level Survey conducted in the vicinity of your industry M/s.**ITC **Limited., Paper Boards & Specialty Papers Division on 06.01.2020 & 07.01.2020 with invoice for a sum of** Rs.58,300/- (Rupees fifty eight thousand and three hundred only) towards the above survey / analysis charges, and the amount Rs.32,300/- has been adjusted with the advance fees received vide reference (4) & (5) cited. The balance amount Rs.26,000/- may be remitted by means of DD Drawn in favour of DEE, TNPC Bd, Coimbatore and the copy may be send to this office without **fail.**

Kindly acknowledge the receipt of the report without **fail.**

23.01.2020

[K.SELVARAJ]
Authorised Signatory,
[Assistant Director (Lab)]

Encl: As above.

Copy submitted to:

1. The Deputy Director (Labs), TNPCB, Chennai for favour of kind information Please.
2. The JCEE (M), TNPCB, Coimbatore for favour of kind information Please.

Copy to:-

1. The DEE, TNPCB, Coimbatore (North) for favour of kind information please.
2. Copy to file.

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TAMILNADU POLLUTION CONTROL BOARD,
ADVANCED ENVIRONMENTAL LABORATORY,
COIMBATORE – 641 030.

Accredited Laboratory – (ISO/IEC 17025:2005) **NABL – TC-7025**

TEST REPORT **24hrs Average**

ULR-TC702519000000025P

Report No.68/AEL – CBE/ AAQS/2019 – 2020, Dated 21.01.2020.

1. Name of the Industry	:	M/s.ITC Limited., Paper Boards & Specialty Papers Division, Unit : Kovai,
2. Address of the Industry	:	Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
3. Date of Survey	:	06.01.2020 & 07.01.2020.
4. Duration of Survey	:	24 Hours
5. Category	:	Red / Large
6. Test Started on	:	14.01.2020.
7. Test Completed on	:	14.01.2020.
8. Matrix	:	Ambient Air Quality

Meteorological Conditions

Ambient Temperature (^{0}C)	Min	Max	Relative Humidity (%)	Min	Max
	25.4	33.1		51	92
Weather Condition	Clear Sky		Rain Fall (mm)	Nil	
Predominant Wind Direction	South East → North West & South → North		Mean Wind Speed (km/hr)	1.3 Km/hr	

Ambient Air Quality Survey Results

Sl. No	Location	Direction *	Distance (m) *	Height Form GL(m)	Pollutants Concentration (microgram / m^3)		
					PM_{10}	SO_2	NO_2
1	On top of Scaffolding in the Agriculture Land of Thiru.E.Ashok raj kumar, S.F.No.407/2A-1&2A-2, Thekkampatty Village.	East	360	3.0	37.0	<4.0	14.0
2	On top of scaffolding near R & D Lab of ITC Ltd.,	South West	350	3.0	37.0	4.0	16.0
3	On top of scaffolding near Secondary clarifier tank of ETP.	North West	350	3.0	49.0	6.0	16.0

Note:- * With respect to major emission sources.
The analytical results are restricted to the sampling period of 24 hrs.

Test Performed	Test Method
PM_{10}	IS 5182: (Part 23) – 2006
SO_2	Modified West – Gaeke / IS 5182: (Part 2) – 2001 RA: 2012
NO_2	Jacobs – Hochheiser / IS 5182: (Part 6) – 2006 RA: 2012

– End of Report –

J.E.S

D.C.S.O

[K.SELVARAJ]
Authorised Signatory
[Assistant Director (Lab)]

28

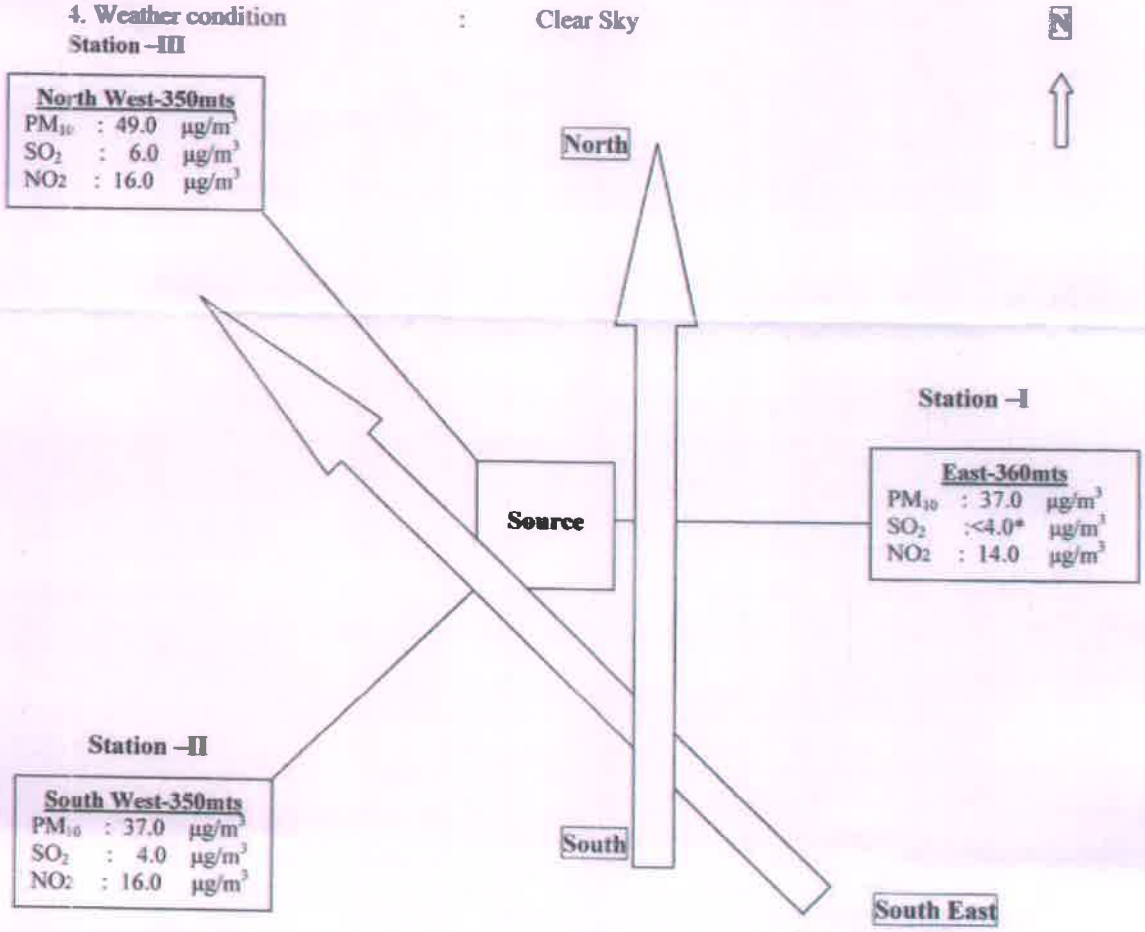
TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

AMBIENT AIR QUALITY SURVEY **24hrs Average**

Schematic Diagram Showing Location of Sampling

Report No.68/AEL – CBE/AAQ/SM/2019 – 2020, Dated 21.01.2020.

1. Name and Address of the Industry : M/s.ITC Limited., Paper Boards & Specialty Papers Division, Unit : Kovai, Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
2. Date of Survey : 06.01.2020 & 07.01.2020.
3. Predominant wind direction : South East → North West & South → North
4. Weather condition : Clear Sky



Note:- **All the values are expressed in µg/m³ and restricted to the sampling period of 24hrs.**

* Indicates Less than minimum detectable limit.

23/01/2020
J.E.S

23/01/2020
D.C.S.O

23/01/2020
[K.SELVARAJ]
Authorised Signatory
[Assistant Director (Lab)]

29

TAMILNADU POLLUTION CONTROL BOARD,
ADVANCED ENVIRONMENTAL LABORATORY,
COIMBATORE – 641 030.

Accredited Laboratory – (ISO/IEC 17025:2005) **NABL – TC-7025**

TEST REPORT **1st shift**

ULR-TC702519000000025P

Report No.68/AEL – CBE/ AAQS/2019 – 2020, Dated 21.01.2020.

1. Name of the Industry	:	M/s.ITC Limited., Paper Boards & Specialty Papers Division, Unit : Kovai,
2. Address of the Industry	:	Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
3. Date of Survey	:	06.01.2020 & 07.01.2020.
4. Duration of Survey	:	8 Hours
5. Category	:	Red / Large
6. Test Started on	:	14.01.2020.
7. Test Completed on	:	14.01.2020.
8. Matrix	:	Ambient Air Quality

Meteorological Conditions

Ambient Temperature (°C)	Min	Max	Relative Humidity (%)	Min	Max
	28.0	31.8		62	80
Weather Condition	Clear Sky		Rain Fall (mm)	Nil	
Predominant Wind Direction	East → West & South East → North West		Mean Wind Speed (km/hr)	1.3 Km/hr	

Ambient Air Quality Survey Results

Sl. No	Location	Direction *	Distance (m) *	Height Form GL(m)	Pollutants Concentration (microgram / m^3)				
					PM_{10}	SO_2		NO_2	
						1st – 4hrs	2nd – 4hrs	1st – 4hrs	2nd – 4hrs
1	On top of Scaffolding in the Agriculture Land of Thiru.E.Ashok raj kumar, S.F.No.407/2A-1&2A-2, Thekkampatty Village.	East	360	3.0	31.0	<4.0	<4.0	13.0	15.0
2	On top of scaffolding near R & D Lab of ITC Ltd.,	South West	350	3.0	34.0	4.0	5.0	16.0	18.0
3	On top of scaffolding near Secondary clarifier tank of ETP.	North West	350	3.0	55.0	5.0	6.0	18.0	14.0

Note:- * With respect to major emission sources.

The analytical **results are** restricted to the sampling period of 8 hrs.

Test Performed	Test Method
PM_{10}	IS 5182: (Part 23) – 2006
SO_2	Modified West – Gaeke / IS 5182: **(Part 2)** – 2001 RA: 2012
NO_2	Jacobs – Hochheiser / IS 5182: **(Part 6) – 2006 RA: 2012**

– End of Report –

J.E.S

D.C.S.O

[K.SELVARAJ]
Authorised Signatory
[Assistant Director (Lab)]

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TAMILNADU POLLUTION CONTROL BOARD,
ADVANCED ENVIRONMENTAL LABORATORY,
COIMBATORE – 641 030.

Accredited Laboratory – (ISO/IEC 17025:2005) NABL – TC-7025

TEST REPORT 2nd shift

ULR-TC702519000000025P

Report No.68/AEL – CBE/ AAQS/2019 – 2020, Dated 21.01.2020.

1. Name of the Industry	:	M/s.ITC Limited.,
2. Address of the Industry	:	Paper Boards & Specialty Papers Division, Unit : Kovai, Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
3. Date of Survey	:	06.01.2020 & 07.01.2020.
4. Duration of Survey	:	8 Hours
5. Category	:	Red / Large
6. Test Started on	:	14.01.2020.
7. Test Completed on	:	14.01.2020.
8. Matrix	:	Ambient Air Quality

Meteorological Conditions

Ambient Temperature (^{0}C)	Min	Max	Relative Humidity (%)	Min	Max
	25.4	27.8		80	92
Weather Condition	Clear Sky		Rain Fall (mm)	Nil	
Predominant Wind Direction	South East → North West & South → North		Mean Wind Speed (km/hr)	0.65 Km/hr	

Ambient Air Quality Survey Results

Sl. No	Location	Direction *	Distance (m) *	Height Form GL(m)	Pollutants Concentration (microgram / m^3)				
					PM_{10}	SO_2		NO_2	
						1st – 4hrs	2nd – 4hrs	1st – 4hrs	2nd – 4hrs
1	On top of Scaffolding in the Agriculture Land of Thiru.E.Ashok raj kumar, S.F.No.407/2A-1&2A-2, Thekkampatty Village.	East	360	3.0	33.0	<4.0	<4.0	14.0	12.0
2	On top of scaffolding near R & D Lab of ITC Ltd.,	South West	350	3.0	23.0	<4.0	<4.0	15.0	12.0
3	On top of scaffolding near Secondary clarifier tank of ETP.	North West	350	3.0	23.0	4.0	5.0	16.0	13.0

Note:- * With respect to major emission sources.
The analytical results are restricted to the sampling period of 8 hrs.

Test Performed	Test Method
PM_{10}	IS 5182: (Part 23) – 2006
SO_2	Modified West – Gaeke / IS 5182: (Part 2) – 2001 RA: 2012
NO_2	Jacobs – Hochheiser / IS 5182: (Part 6) – 2006 RA: 2012

– End of Report –

23/1/2020
J.E.S

23/01/2020
D.C.S.O

23/01/2020
[K.SELVARAJ]
Authorised Signatory
[Assistant Director (Lab)]

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TAMILNADU POLLUTION CONTROL BOARD,
ADVANCED ENVIRONMENTAL LABORATORY,
COIMBATORE – 641 030.

Accredited Laboratory – (ISO/IEC 17025:2005) NABL – TC-7025

TEST REPORT 3rd shift

ULR-TC702519000000025P

Report No.68/AEL – CBE/ AAQS/2019 – 2020, Dated 21.01.2020.

1. Name of the Industry	:	M/s.ITC Limited., Paper Boards & Specialty Papers Division, Unit : Kovai,
2. Address of the Industry	:	Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
3. Date of Survey	:	06.01.2020 & 07.01.2020.
4. Duration of Survey	:	8 Hours
5. Category	:	Red / Large
6. Test Started on	:	14.01.2020.
7. Test Completed on	:	14.01.2020.
8. Matrix	:	Ambient Air Quality

Meteorological Conditions

Ambient Temperature (^{0}C)	Min	Max	Relative Humidity (%)	Min	Max
	29.1	33.1		51	70
Weather Condition	Clear Sky		Rain Fall (mm)	Nil	
Predominant Wind Direction	South East → North West & South → North		Mean Wind Speed (km/hr)	2.0 Km/hr	

Ambient Air Quality Survey Results

SL No	Location	Direction *	Distance (m) *	Height Form GL(m)	Pollutants Concentration (microgram / m^3)				
					PM_{10}	SO_2		NO_2	
						1st – 4hrs	2nd – 4hrs	1st – 4hrs	2nd – 4hrs
1	On top of Scaffolding in the Agriculture Land of Thiru.E.Ashok raj kumar, S.F.No.407/2A-1&2A-2, Thekkampatty Village.	East	360	3.0	48.0	5.0	5.0	15.0	16.0
2	On top of scaffolding near R & D Lab of ITC Ltd.,	South West	350	3.0	54.0	5.0	7.0	16.0	19.0
3	On top of scaffolding near Secondary clarifier tank of ETP.	North West	350	3.0	70.0	7.0	7.0	17.0	19.0

Note:- * With respect to major emission sources.
The analytical results are restricted to the sampling period of 8 hrs.

Test Performed	Test Method
PM_{10}	IS 5182: (Part 23) – 2006
SO_2	Modified West – Gaeke / IS 5182: (Part 2) – 2001 RA: 2012
NO_2	Jacobs – Hochheiser / IS 5182: (Part 6) – 2006 RA: 2012

– End of Report –

23/1/2020
J.E.S

23/01/2020
D.C.S.O

23/1/2020
[K.SELVARAJ]
Authorised Signatory
[Assistant Director (Lab)]

32

TAMILNADU POLLUTION CONTROL BOARD,
ADVANCED ENVIRONMENTAL LABORATORY,
COIMBATORE – 641 030.

Accredited Laboratory – (ISO/IEC 17025:2005) **NABL – TC-7025**

TEST REPORT

ULR-TC702519000000025P

Report No.68/AEL – CBE/ SM/2019 – 2020, Dated 21.01.2020.

1. Name of the Industry	:	M/s.ITC Limited.,
2. Address of the Industry	:	Paper Boards & Specialty Papers Division, Unit : Kovai, Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
3. Date of Survey	:	06.01.2020 & 07.01.2020.
4. Test Started on	:	14.01.2020.
5. Test Completed on	:	14.01.2020.
6. Matrix	:	Stack Emission
7. Type of Industry	:	Duplex Board, Art Board, Cromo Board and Power Manufacturing.

Stack Monitoring Survey Results

Sl. No.	Stack attached to	Stack Temp °C	Velocity in (m/ sec)	Discharge rate in Nm^3/Hour	Pollutants (mg / Nm^3)		
					PM	So_2*	No_x*
1	Captive Power Plant Boiler – 60 T/Hr (After Electro Static Precipitator) [Fuel: Lignite, Saw dust]	120	8.90	42,911	22.0	85.3	191** mg/m^3

Note:-

Test Performed	Test Method
Particulate Matter	IS 11255: (Part 1) – 1985 (RA: 2003)

* - Test Not accredidated by NABL.

** - Measured by Flue gas analyser.

– End of Report –

J.E.S

D.C.S.O

[K.SELVARAJ]
Authorised Signatory
[Assistant Director (Lab)]

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TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

STACK DETAILS

Report No.68/AEL – CBE/SM/2019 – 2020, Dated 21.01.2020.

1. Name and Address of the Industry: M/s.ITC Limited.,
Paper Boards & Specialty Papers Division,
Unit : Kovai,
Vivekanandapuram (Post), Thekkampatty (Village),
Coimbatore – 641 113.

2. Date of Survey : 06.01.2020 & 07.01.2020.

Sl.No	Particulars	1
1.	Stack attached to	Captive Power Plant Boiler
2.	Details of process stack	Steam & Power Generation
3.	Height from G Level in (m)	84.0
4.	Diameter in (m)	1.5
5.	Port hole height from Ground Level or bends or ducts in (m)	42.0
6.	Fuel Used (with % Sulphur content)	Lignite, Saw dust.
7.	Fuel Consumption rate per day (mention units)	Lignite – 260 MT Saw dust – 99 MT
8.	Stack Capacity	60 TPH Make: Thermax Type: Water Tube
9.	APC Measures provided	Electro Static Precipitator
10.	APC functional status	Working
11.	Ambient temp in °K	305
12.	Temp of flue gas in °K	393
13.	Velocity of flue gas in m/sec	8.90
14.	Volume of flue gas sampled in m^3	1.000
15.	Gaseous Discharge rate per Nm^3/Hour	42,911

23/01/2020

J.E.S

D.C.S.O

23/01/2020

[K.SELVARAJ]
Authorised Signatory
[Assistant Director (Lab)]

TAMILNADU POLLUTION CONTROL BOARD,
ADVANCED ENVIRONMENTAL LABORATORY,
COIMBATORE – 641 030.

Accredited Laboratory – (ISO/IEC 17025:2005) NABL – TC-7025

AMBIENT/SOURCE NOISE LEVEL SURVEY - Report of Analysis

ULR-TC702519000000025P

Report No. 68/AEL – CBE/ NLS/2019 – 2020, Dated 21.01.2020.

1.	Name of the Industry	M/s.ITC Limited., Paper Boards & Specialty Papers Division,Unit : Kovai,
2.	Address of the Industry	Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
3.	Date of Survey	07.01.2020.

Category	Red/Large	Land use Classification	--
Type of Survey	Ambient	Time of Survey	Day Time
Meteorological conditions		Clear Sky	
Matrix		Sound Level	

Logging Parameters

Instrument Used	Larson & Davis		Serial No		824 A 2030
Logging Interval	10 Minutes each point		Measuring Range		50-110 dB(A)
Weighting	" A "	Peak Weighting	"C"	Time Weighting	FAST
Sound Incidence		RANDOM	Time in hrs		15.00 to 16.15 Hrs

Report of Noise Level Monitoring

Sl. No	Location At Ambient:-	Distance (M)	Direction	Sound Level – dB(A)					
				L_{eq}	L_{90}	L_{50}	L_{10}	Min	Max
1.	In the Agriculture land of Thiru.E.Ashok raj kumar.	360	East	47.6	46.1	47.4	48.4	45.3	56.9
2.	At North East corner near Rain water harvesting pond.	350	North East	44.6	44.3	44.5	45.0	44.0	49.1
3.	At South East Boundary opposite to shed – II (Lignite storage)	250	South East	52.2	51.4	51.9	53.2	49.4	56.0
4.	At North West corner near D.M.Plant.	200	North West	54.6	54.2	54.5	55.1	53.4	57.1
5.	Near R & D Lab.	350	South West	49.5	47.6	48.6	51.4	45.0	59.9

Note: L90 Value refers to background noise: L50 Value refers to mean noise.L10 value refers to nuisance or annoyance level :Leq value is the average energy for the measured period.

-- End of Report --

J.E.S

D.C.S.O

[K.SELVARAJ]
Authorised Signatory
[Assistant Director (Lab)]

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TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

GENERAL PARTICULARS

Report No.68/AEL – CBE/AAQ/SM/2019 - 20, Dated 21.01.2020.

Name and Address of the Industry : M/s.ITC Limited.,
Paper Boards & Specialty Papers Division,
Unit : Kovai,
Vivekanandapuram (Post), Thekkampatty (Village),
Coimbatore – 641 113.

Date of Survey : 06.01.2020 & 07.01.2020.

Sl. No.	Head of Particulars	Particulars
1.	Process Description	Duplex Board, Art Board, Cromo Board and Power Manufacturing.
2.	Emission Sources	Boilers.
3.	Fugitive Emission Sources	Vehicle Movements
4.	Raw Material Consumptions	Recycled Waste Paper 1. 06.01.2020 – 292.7 MT 2. 07.01.2020 – 299.5 MT
5.	Production Capacity as per Air Consent order No. & Date	1. Duplex Board, Art Board, Cromo Board and Power } – 10000 Tons/Month. 2. Power – 8 MWHR As per Air Consent order No. 170828064955 Dated 03.05.2017.
6.	Production on the day of Survey	1. 06.01.2020 – 308.5 MT 2. 07.01.2020 – 318.4 MT
7.	Air Consent Order No. Validity upto	Air Consent order No. 170828064955 Dated 03.05.2017 Validity upto 31.03.2022.
8.	Details of APC measures	Electro Static Precipitator
9.	Functional Status of APC measures	Working
10.	Field Observations	--

J.E.S

D.C.S.O

[K.SELVARAJ]
Authorised Signatory
[Assistant Director (Lab)]

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TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

INFERENCE REPORT NO.68/ AEL – CBE/ A.A.Q.S./ S.M. Dated 21.01.2020.

1. Name of Industry	:	M/s.ITC Limited., Paper Boards & Specialty Papers Division, Unit : Kovai, Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
2. Pollution Category	:	Red/Large
3. Date of A.A.Q. Survey	:	06.01.2020 & 07.01.2020.
4. Predominant Wind Direction	:	**North East → South West**
5. Weather condition	:	**Clear Sky**

STATUS OF POLLUTANTS LEVEL

I. AMBIENT AIR QUALITY:-

1. **Total No. of A.A.Q. stations** monitored : **3**

2. No. of A.A.Q. stations in which Pollutants Level exceeded the Boards standards (PM_{10}) : NIL

Maximum and Minimum 24hrs Average values of Pollutants Level observed:

SL No	POLLUTANT	Values in microgram/m^3		BOARD's STANDARD (As per consent order)
		Maximum	Minimum	
1.	Respirable Suspended particulate Matter: PM_{10}	49	37	100
2.	GASEOUS POLLUTANTS:-			
	(i) SO_2	6	<4.0	80
	(ii) NO_2	16	14	80

II. STACK MONITORING:-

1. **Total No. of Stacks Monitored** : 1

2. **No. of Stacks in which Pollutants level Exceeded the Boards standards** : NIL

J.E.S

D.C.S.O

[K.SELVARAJ]
Authorised Signatory
[Assistant Director (Lab)]

37

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

BILL

Report No.68/AEL – CBE/AAQ/SM/2019 – 2020, Dated 21.01.2020.

Bill No.	68/2019 – 20
Date	21.01.2020.

To
M/s.ITC Limited.,
Paper Boards & Specialty Papers Division,
Unit : Kovai,
Vivekanandapuram (Post), Thekkampatty (Village),
Coimbatore – 641 113.

Ref: 1. B.PMs.No.6 Dt.31.03.2009.
2. JCEE's Memo No.JCEE (M)/TNPCB/CBE/F.200/Tech/2020 Dated 02.01.2020.
3. This office Lr.No.TNPC Bd/AD (L)/AEL-CBE/Air survey/F.No.M.1/19 – 20 dated 16.05.2019 & 07.01.2020.
4. Your mail dated 23.01.2020.
5. The Previous Bill No.12/2018-19 Dated 14.06.2018 for Excess Payment Rs.12,200/-
6. Cash Receipt No.55640 dated 11.06.2019 for Rs.20,100/-.

******

Sl. No.	Description	Rate (Rs)	No. of Stations/Stacks	Amount (Rs)
1.	**SAMPLING CHARGES:**			
	(i). Ambient Air Quality Monitoring	2,000.00	3×3	18,000.00
	(ii). Source Emission Monitoring (PM, SO_2 NO_2 etc.,)	7,500.00	1	7,500.00
2.	**ANALYTICAL CHARGES:**			
	(i). Ambient Air Samples PM_{10} (each Rs.600/-).....	600.00	9	5,400.00
	(ii). Ambient Air Samples SO_2, NO_2 (each Rs.600/-).....	600.00	18 + 18	21,600.00
	(iii). Source Emission Samples PM, SO_2, NO_2 (each Rs.600/-).....	1,800.00	1	1,800.00
3.	**AMBIENT MONITORING CHARGES:**			
	(i). For first 5 stations	4,000.00	5	4,000.00
4.	**TRANSPORATION CHARGES:**	-	-	-
	Total			58,300.00
	Less: Advance – (Vide **Ref. No.5 & 6)**			32,300.00
	Balance to pay			26,000.00

23/1/2020
J.E.S

23/01/2020
D.C.S.O

23/01/2020
[K.SELVARAJ]
Authorised Signatory
[Assistant Director (Lab)]

Annexure-H

Amount incurred/spent towards disposal of plastic waste found embedded in the Unit premises

Details	Amount incurred/spent
	In Rs.
Manual segregation from July 2021 onwards	20,00,000
Engagement of Zigma in October 2022 and mechanised segregation/processing towards disposal of plastic waste from February 2023 onwards	35394389
Total	**3,73,94,389**

TAMIL NADU POLLUTION CONTROL BOARD

PROCEEDING No: T2/TNPCBd/F.0038/RL/CBN/W&A/2023, Dated: 29.12.2023

Sub: TNPCB – Industries– **M/s. ITC Limited, PSPD unit Kovai, S.F.no. 241/1 etc, Thekkampatty Village, Mettupalayam Taluk, Coimbatore District-Compliance of Hon'ble High Court of Madras order in the matter of Writ Petition No. 10495 of 2020 on 12.04.2023**– Direction under Section 33 A of the Water (Prevention and Control of Pollution) Act, 1974 as amended and under Section 31A of the Air (Prevention and control of pollution) Act, 1981 as amended – Issued-Regarding.

Ref:
1. Hon'ble High Court of Madras order in the matter of Writ Petition No. 10495 of 2020 on 12.04.2023
2. JCEE(M), CBE Lr. No. JCEE(M) / TNPCB / CBE / 200 / Tech / 2023, Dated: 11.12.2023

****

Whereas, M/s. ITC Limited, Paper Boards and Specialty Boards Division, Unit: Kovai, S.F No. 241/1, 409/1, etc Thekkampatty Village, Mettupalayam Taluk, Coimbatore District is an existing Paper Board, which has been issued with consent of the Board vide proc. dated: 18.07.2022 and further renewed with validity up to 31.03.2025. Further, the unit has been issued with CTE-Expansion vide Board Proc. dated: 18.01.2023 with validity upto 31.03.2027.

Whereas, an original application (O.A.No. 26 of 2019) filed by Thiru. E. Rajendran and Thiru. E Ashok Raj Kumar before Hon'ble National Green Tribunal (SZ), Chennai against the unit regarding discharge of untreated trade effluent in the agricultural land, causing soil & water contamination, dumping of solid wastes in the open yard in unscientific manner & causing air pollution.

Whereas, the Hon'ble NGT (SZ), in its order dated:13.12.2019, constituted a joint committee comprising of a Senior Scientist from CPCB & TNPCB and to inspect the unit to verify whether the "land fill" has been properly maintained and whether the industry is complying all the norms and to assess soil, water and air quality in that area. Also, the Hon'ble NGT directed the joint committee to take appropriate action in accordance with law, if any violation found and to submit a factual & action taken report to NGT. Accordingly, the joint committee inspection was carried out during January 06 to 08, 2020 and the report was furnished to Hon'ble NGT. Meanwhile TNPCB issued Show Cause Notice to the unit on 10.01.2020, based on the observations made on Jan 06 to 08, 2020.

Whereas, the JCEE (M)/Coimbatore has furnished the joint committee report (based on the inspection carried out on Jan 06 to 08,2020) to Board vide his letter dated 13.03.2020.The joint committee has furnished calculation for levying environmental compensation and recommended for levying interim environmental compensation calculated till 11.03.2020 ie. Rs.331.80 Lakhs and thereon each day Rs.30, 000 /day to be levied until compliance. Based on that TNPCB issued direction under Section 33 A of Water Act and Section 31A of the Air Act to the unit vide PROCEEDINGS NO.T1/ TNPCB/F.0038/CBN/RL/ W&A/2020 Dated: 17.03.2020 for compliance of certain instructions and levy of interim environmental compensation calculated till 11.03.2020 ie. Rs.331.80 Lakhs and thereon each day Rs.30, 000 /day to be levied until compliance.

No. 76, MOUNT SALAI, GUINDY, CHENNAI - 600 032.
Tel : 044-22353134 - 139 Fax : 044-22353068
Email : tnpcb-chn@gov.in Web : tnpcb.gov.in

Whereas, the TNPC Board had conducted personal hearing meeting with the unit of M/s. ITC Limited, Paper Boards and Specialty Boards Division, Unit: Kovai on **07.08.2020 @ 10.00 AM at Corporate Office, TNPCB, Guindy, Chennai.** During personal hearing meeting, the unit has requested to waive the Environmental Compensation.

Whereas, the Hon'ble NGT in its order dated 28.05.2021 (in O.A.No. 26 of 2019), has directed/mentioned as follows:

- The unit is directed to comply with the recommendations issued by the Joint Committee in the report dated 12.03.2020 in its letter and spirit.
- **The Tamil Nadu Pollution Control Board is directed to monitor the compliance of the recommendation made by the Committee and also directions issued by TNPCB vide proc. dated 17.03.2020,** which was challenged before the Hon'ble High Court of Madras to the extent of imposing compensation. If there are any violations or non-compliance found, then Pollution Control Board is directed to take action against the unit in accordance with law.
- As regards the compensation is concerned since the matter is sub-judice and pending before the Hon'ble High Court of Madras in W.P No. 10495 of 2020, we (i.e.Hon'ble NGT) are not passing any order regarding the same and that will be subject to final order passed by the Hon'ble High Court in the above writ petition and also on that Tamil Nadu Pollution Control Basis is directed to take action against the unit in respect of the same subject to the result of the writ petition mentioned above.
- The unit is directed to comply with all the pollution norms and conditions imposed in the clearance as well as in the consent and operate the unit in an environmental friendly manner without causing pollution to the environment or causing any disturbance to the neighbouring property owners.
- Liberty of the applicants to approach this Tribunal later, if there is non-compliance by unit is left open.

With the above directions, Hon'ble NGT disposed the application (O.A.No. 26 of 2019).

Whereas, a Writ Petition No.10495 of 2020 has been filed by the unit seeking for a Writ of Certiorari to call for the records on the file of the TNPC Board in Proceedings No.T1/TNPCB/F.0038/CBN/RL/W&A/2020, dated 17.03.2020, quash the same and for consequential orders by M/s. ITC Limited, Paper Boards and Specialty Boards Division, Unit: Kovai against the respondents 1. The District Environmental Engineer, Tamil Nadu Pollution Control Board, Coimbatore North and 2. The Chairman, Tamil Nadu Pollution Control Board, Chennai.

Whereas**, the Hon'ble High Court of Madras has passed the order in the matter of Writ Petition No.10495 of 2020 on 12.04.2023** as follows,

1) ***The order dated 17.03.2020 is set aside. The matter is remanded to the 2nd respondent. The 2nd respondent shall issue notice to the petitioner and fix the date of hearing on which day the petitioner shall appear and give its explanation.***

2) ***If the petitioner does not avail this opportunity the respondents can proceed and pass orders.***
3) ***The 2nd respondent shall pass a detailed speaking order taking into consideration all aspects including the Joint Inspection Report but the order shall not be predicated only on the basis of the Joint Inspection Report done presently.***
4) ***This exercise shall be completed within a period of three months from the date of receipt of a copy of this order.***

Whereas, in compliance of the above, High Court order, the TNPC Board had conducted personal hearing meeting with the unit of M/s. ITC Limited, Paper Boards and Specialty Boards Division, Unit: Kovai on 26.05.2023 & 09.06.2023 at Corporate Office, TNPCB, Guindy, Chennai.

Based on the Minutes of the personal Hearing dated:09.06.2023, the Board has decided to allow 12-15 months to complete the work on remaining excavation and disposal of plastic waste. TNPC Board will take necessary further action in accordance with law and pass a detailed speaking order taking into consideration all aspects including the Joint Inspection Report in order to comply with the Hon'ble High Court of Madras order dated:12.04.2023, in the matter of Writ Petition No. 10495 of 2020.

Further, frequent public complaints were received against the unit regarding the discharge of untreated effluent into the agricultural land and the disposal of sludge in and around the unit's premises without any treatment. In this regard, a joint inspection was carried out by the Officials of TNPCB, CBN along with the Assistant Director, Horticulture, Coimbatore on 18.05.2023 and certain directions were issued vide Letter No.F.No.1371 / R / L / DEE / TNPCB / CBN / 2023, Dated: 29.05.2023. Also the unit was inspected by the JCEE(M), CBE on 16.08.2023 and certain directions were issued vide Letter No. JCEE(M)/TNPCB/CBE/200/TECH/2023, Dated: 01.09.2023.

The JCEE(M), Coimbatore vide reference 2nd cited has furnished the present status and from the Status report of JCEE(M), CBE and DEE, CBE(N), it is observed that the unit shall carry out remaining excavation works & certain additional studies/report needs to be furnished, in order to take further decision on reassessing the Environmental Compensation imposed on the unit.

Therefore, in exercise of the powers conferred under Section 31A of the Air (P&CP) Act 1981 as amended and under Section 33 A of the Water (P&CP) Act, 1974 as amended and in order to comply with the Hon'ble High Court of Madras order dated:12.04.2023, TNPCB issues the following directions to **M/s. ITC Limited, PSPD unit Kovai, S.F.no. 241/1 etc, Thekkampatty Village, Mettupalayam Taluk, Coimbatore District** to comply with the following within 45 days period:

1. The unit shall carry out assessment study on the plastic dump site through reputed agencies to arrive at the following:
    - Total area of plastic dumped in hectares within the premises with breakup of area of Accumulated quantity of plastic waste & Excavated quantity of plastics dumped.
    - Total area in hectares; area already excavated in hectares; Remaining area to be excavated in hectares
    - Time/period needed for the remaining excavation works
2. The unit shall furnish the action plan and time completion chart for the remaining excavation works
3. From the inward, aggregates stock and disposal as on 30.11.2023 furnished by the unit, it is observed that 18870 MT of plastic waste segregated; whereas only 15344 MT is disposed to Dalmia, JSW Cements. The unit shall balance the detail of plastic waste excavated & disposed and furnish revised statement in this regard.
4. The unit shall furnish monthly progress report on the works being carried out to the JCEE(M), CBE and the Board regularly.
5. The unit shall carry out study on status of environmental impact with details on damage, remediation, etc in and around 500 m radius through reputed institutions with respect to water, air, soil, heavy metals and shall furnished within a month.
6. The unit shall remit the Environmental Compensation if levied by the TNPCB based on the study report, actual status and field status report furnished by TNPCB.
7. The unit shall carry out water audit so as to minimise water consumption and recycle maximum extent of treated effluent in its process itself, so as to avoid land and ground water pollution.
8. The unit shall furnish periodical ROA of water samples from 10 Nos. of piezometric wells provided at the land areas earmarked for utilizing treated trade effluent.
9. The unit shall furnish action plan for providing leachate collection system for the vermi composting area so as to enable the collected leachate to be treated in the ETP to achieve Board's Standards.
10. The unit shall furnish possible measures (like process / equipment modification, improved internal recycling practices, good housekeeping) to conserve the fresh water requirement and work towards the Bench Mark target as per CPCB guidelines, 2006 set by National Productivity Council.
11. The unit shall furnish details of generation & disposal of ETP sludge at present as per CPCB SOP along with ddetails of HWA obtained, details of quantity of plastic waste co processed, converted to fuel, chips etc.
12. The unit shall furnish details of online connectivity status of the flow meters provided at the inlet and out let of ETP to the online servers of CPCB and the online continuous monitor for effluent parameters flow, pH, BOD COD and TSS with Water Quality Watch of TNPCB.

TAMIL NADU POLLUTION CONTROL BOARD

13. The unit shall furnish present status of plastic waste collected during sorting of waste paper before pulping and method of disposal with supporting documents.

Failure to comply with the above said direction will lead to issue of further directions for closure and stoppage of power supply to the unit under the Section 33A of the Water (Prevention and Control of Pollution) Act, 1974 as amended and under Section 31A of the Air (Prevention and control of pollution) Act, 1981 as amended.

An action taken report shall be furnished to this office within 15 days without fail.

The receipt of this proceeding shall be acknowledged.

3.1.24

For Chairperson

To

The Unit Head,
M/s. ITC Limited, PSPD Unit Kovai, Vivekananda Puram (PO),
Thekkampathy Village,
Mettupalayam Taluk, Coimbatore District – 641 113.

Copy to

1. The Joint Chief Environmental Engineer (Monitoring),
   Tamil Nadu Pollution Control Board,
   Coimbatore- JCEE (M), Coimbatore shall inspect the site every month and send the progress made on Biomining of plastic waste with details such as whether any impact on the dumping waste to the nearby Agri lands and details of quantum of waste generated, accumulated, segregated, and its quantities sent to coprocessing etc in the standard format and following monthly report to Board.
2. The District Environmental Engineer,
   Tamil Nadu Pollution Control Board,
   Coimbatore North - for information and necessary action please.
3. Law section,
   Tamil Nadu Pollution Control Board.
4. Technical File.

ITC Limited
PAPERBOARDS & SPECIALTY PAPERS DIVISION
Unit: Kovai
Vivekanandapuram(PO), Thekkampatty(Village)
Coimbatore - 641113, Tamilnadu, India
Tel (O) : +91-4254-271234 / 284301
Fax +91-4254-284304
www.itcpspd.com

Enduring Value

ANNEXURE R6

25.01.2024

The Chairperson,
Tamil Nadu Pollution Control Board,
No. 76, Mount Salai, Guindy,
Chennai- 600 032

Dear Sir/Madam,

Sub: Proceedings No. T2/TNPCBd/F.0038/RL/CBN/W&A/2023 dated 29.12.2023/ 03.01.2024

In relation to our Unit being ITC Limited at Thekkampatty Village, Coimbatore District, we have received the subject proceedings/letter on 06.01.2024 directing us to comply with certain directions as stated therein within a period of 45 days and also directing us to submit action taken report within 15 days. In response to the subject proceedings/letter (hereinafter "**the subject letter**") we respectfully state as under.

1. The aforesaid Unit is being operated in conformity with all applicable environment protection laws, rules/norms, consent conditions and the due directions of TNPCB. Besides, as a responsible corporate citizen, having high regard for environment and sustainable development, we are voluntarily and constantly endeavoring to better various operations/processes at the Unit. Besides, complying with all environmental protection laws, rules and consent conditions, we have also been taking steps to follow the recommendations of TNPCB issued from time to time. The Unit has been under constant monitoring of TNPCB and Unit has been regularly submitting reports and data to TNPCB regarding compliance of requisite norms/ parameters and the directions/recommendations of TNPCB.

2. In response to the directions stated in the subject letter we submit point wise response as under.

S. No	Stated Directions in the subject letter	Response
1.	The Unit shall carry out assessment study on the plastic dump site through reputed agencies to arrive at the following: ▪ Total area of plastic dumped in hectares within the premises with breakup of area of accumulated quantity of plastic waste & excavated quantity of plastic dumped ▪ Total area in hectares; area already excavated in hectares; remaining area to be excavated in hectares ▪ Time/period needed for the remaining excavation works.	We request you to refer to our previous correspondences in this regard for the factual aspects. Unit has already got the survey done by Zigma Global Environ Solutions Pvt. Limited (Zigma"). Copy of the survey report is enclosed herewith as **Annexure- A.** Total area identified earlier for excavation was about 3.03 hectares based on survey carried out during Sep'2022. Subsequently survey was carried out in Jul'23, Oct'23 & Dec'23 during the progress of the work. As on Dec'23, we have excavated 3.03 hectares and extended the excavation work to another 0.2 hectares (approx.). Unit has been regularly sending updates to the Coimbatore office of the Board on the plastic waste being extracted from site and disposed of to cement plants. In the last update given to the Coimbatore office of the Board on 04/01/2024 Unit has updated month wise details as on Dec'23 as per which about 2,09,995 MT of soil has been excavated for segregation and 15,849 MT of plastic waste has already been disposed to the cement plants. Total excavation is targeted to be completed by Mar'24. The removed plastic waste is expected to be sent to the cement plants by Jun'24.
2	The Unit shall furnish the action plan and time completion chart for the remaining excavation works.	Please see the response above.
3	From the inward, aggregates stock and disposal as on 30.11.2023 furnished by the unit, it is observed that 18,870 MT of plastic waste segregated; whereas only 15,334MT is disposed to Dalmia, JSW Cements. The Unit shall balance the detail of plastic waste excavated & disposed and furnish revised statement in this regard.	As on 30.11.2023, the balance quantity indicated in this point was yet to be disposed of when the report was furnished to the local office of the Board. It may be noted that as on 31.12.2023, Zigma has excavated and segregated about 2,09,995 MT of soil and disposed of 15,849 MT of plastic waste to cement companies for co-processing.
4	The Unit shall furnish monthly progress report on the works being carried out to JCEE(M), CBE and the Board regularly.	As mentioned in response to point (1) above, Unit has been regularly sending the reports on progress of work to the Coimbatore Office of the Board- the last update being on 4/1/2024.

		Henceforth, Unit will send updates on monthly basis to O/o JCEE (M), CBE and the Board.
5	The Unit shall carry out study on status of environmental impact with details on damage, remediation, etc in and around 500m radius through reputed institutions with respect to water, air, soil heavy metals and shall furnished within a month.	Unit has engaged TNAU since takeover of the Unit by ITC in 2004 to study the impact of treated effluent on soil, ground water & heavy metals in and around the plant. Samples are collected on quarterly basis and reports are submitted on half yearly and annual basis by TNAU. Unit submitted annual report by TNAU for the period July'22-Jun'23 to O/o DEE Coimbatore through letter dated 22/08/2023. The report concludes that there has been no damage to the soil, no contamination of ground/surface water and that the treated water is fit for irrigation. The report also shows that the water has not been contaminated by heavy metals. The latest report of TNAU is attached herewith as **Annexure B**. The half yearly report for the period July '23 to December '24 from TNAU is awaited and we will share the same with the Board once made available. Ambient Air & Boiler stack are monitored by M/s Vimta Labs on monthly basis. Their report is being submitted on monthly basis to O/o DEE Coimbatore. The latest reports for parameters of the ambient air and emission points are enclosed herewith as **Annexure C.** Further, TNPCB is monitoring the parameters of air on annual basis. The reports indicate compliance to the norms. OCEMS for Boiler stack for PM is in place since April'2013 onwards. Since Sep'2020 onwards SO_2 & NO_2 were added in the stack OCEMS. Based on the regular monitoring and reporting on the status of water, air, soil and heavy metals in and around the Unit by TNAU and/or Vimta Lab and also the Board's Office at Coimbatore which has so far not reported any adverse impact on the environment it would be clear that Unit's operations has not caused any pollution or damage to the environment.
6	The Unit shall remit the Environmental Compensation if levied by the TNPCB based on the study report, actual status and field status report furnished by TNPCB.	Not applicable- in view of the response for point 5 above.

7	The Unit shall carry out water audit so as to minimise water consumption and recycle maximum extent of treated effluent in its process itself, so as to avoid land and ground water pollution.	Unit has been continuously taking steps to minimize water consumption and increase recycling of treated effluent water for processes. With such steps, the Unit has been able to reduce the fresh water consumption from 16.65m^3/MT (2011-12) to 8.9m^3/MT (2022-23) and has accordingly also reduced the discharge water. Further, TNAU has been engaged to study the impact of usage of treated effluent for irrigation and monitored the condition of the soil and ground water over last 2 decades which has found that the treated effluent is fit for irrigation and that there is no adverse impact on the water or soil. In this regard reference is made to the enclosed TNAU annual report for period July'22-Jun'23 at Annexure B.
8	The Unit shall furnish periodical ROA of water samples from 10 Nos. of piezometric wells provided at the land areas earmarked for utilizing treated trade effluent.	Samples at piezometric wells are analysed periodically by TNAU as part of other analysis being done by TNAU. Enclosed herein at Annexure B is the latest Annual Progress Report of TNAU for period Jul'22 to Jun'23 as per which the samples from piezometric wells have been analysed and reported. The report concludes that the treated effluent is fit for irrigation.
9	The Unit shall furnish action plan for providing leachate collection system for the vermicomposting area so as to enable the collected leachate to be treated in the ETP to achieve Board's standards.	Leachate collection system has been installed for vermicomposting area and connected to ETP inlet and commissioned. Enclosed herewith as **Annexure D** is the picture of the said system.
10	The Unit shall furnish possible measures (like process/equipment modification, improved internal recycling practices, good housekeeping) to conserve the fresh water requirement and work towards the benchmark target as per CPCB guidelines, 2006 set by the National Productivity Council.	Unit's water consumption was 16.65 KL/MT (2011-12) which was better than proposed benchmark standard of 19KL/MT by National Productivity Council, New Delhi in 2006 for the category of paper mills as that of the Unit. Since then, Unit has taken various water conservation measures which include installation of Petax filter, krofta clarifier to increase recycling of Machine back water, installation of cooling tower to recycle cooling water for compressors and vacuum pumps, reuse of Ultra Filter (UF) reject water as Power Plant Cooling tower make up water, installation of flowmeters measure more than 95% of the intake water, optimized Machine wire nozzles,

		closed loop system for heat exchanger cooling water etc. Above measures resulted in reduction of specific water consumption 16.65m^3/MT (2011-12) to 8.9m^3/MT (2022-23). Please find attached the trend of consumption as **Annexure-E** Further, as per ***Technical EIA Guidance Manual for Pulp & Paper Industries*** prepared by Ministry of Environment, Forest & Climate Change (MoEFF&CC) in 2010 India's best is 28m^3/BDMT and Global best is 8m^3/BDMT for waste paper-based mills. Reference Page is 83/238, table 3-29.
11	The Unit shall furnish details of generation & disposal of ETP sludge at present as per CPCB SOP along with details of HWA obtained, details of quantity of plastic waste co-processed, converted to fuel, chips etc.	Unit generates 10-15 MT of secondary sludge at 75-80% moisture and at present is being used for vermicomposting to use as manure as per HWA received. It is proposed to use the secondary sludge as alternate fuel in boiler as per CPCB SOP for Utilization of sludge in paper Industry 2016 for which Unit is in the process of submitting the application seeking authorization. Unit has already been reporting the quantity of the plastic waste sent to cement plants for co-processing on monthly basis to O/o DEE Coimbatore. Unit will continue to do the same. Further, Unit does not convert plastic waste into fuel, chips etc.
12	The Unit shall furnish details of online connectivity status of the flow meters provided at the inlet and outlet of ETP to the online servers of CPCB and the online continuous monitor for effluent parameters flow, pH, BOD, COD and TSS with water quality watch of TNPCB.	TNPCB OCEMS URL: http://wqwtnpcb.readmeter.in/itclps. OCEMS of ETP has been connected to TNPCB server in June' 2015 and the inlet flow meter has been added in Sep' 2020. Continuous monitoring and data transmission is going on since then to TNPCB & CPCB servers for effluent parameters of flow, pH BOD, COD and TSS. CPCB Connectivity URL: https://rtdms.cpcb.gov.in/industry-status
13	The Unit shall furnish present status of plastic waste collected during sorting of waste paper before pulping and method of disposal with supporting documents.	Unit does not sort waste paper manually. It is done through drum pulper which separates the plastic waste. The plastic waste separated is sent to cement plant for co-processing. Quantities sent is reported to O/o TNPCB, Coimbatore on monthly basis. Attached

		herewith as **Annexure F** are reports received from M/s Dalmia Cements for the month of Dec'23 as supporting document.

In view of the above submissions, we request you to close this matter. In case your good self wants any further document/clarification in this matter please let us know.

Thanking you

Yours faithfully,

For ITC Limited- Kovai Unit

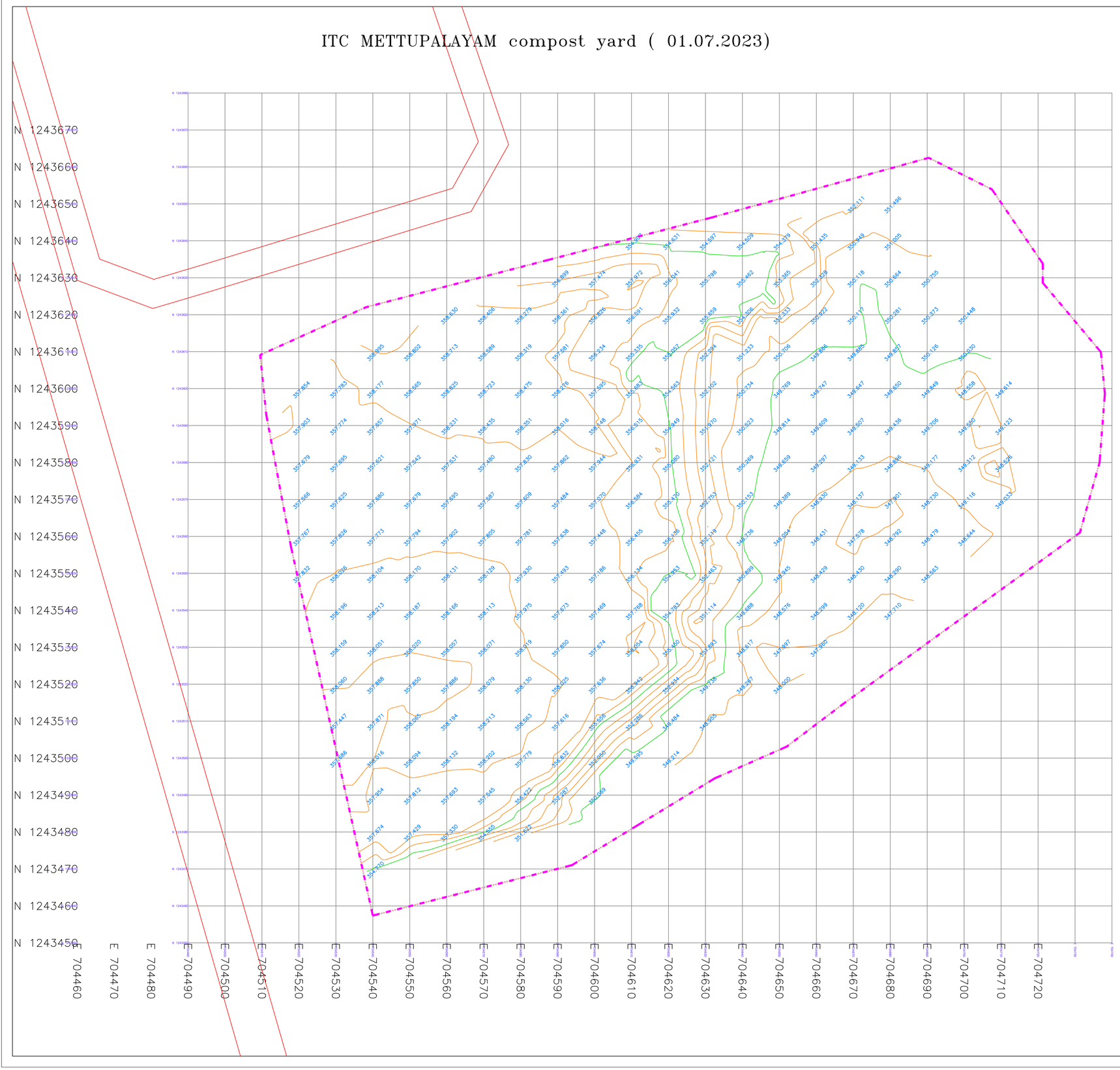
S Venkatarao
Unit Head

Encl: Annexures A to F.

Copy to

1. The Joint Chief Environmental Engineer (Monitoring)- TNPCB
2. The District Environmental Engineer - TNPCB

ITC METTUPALAYAM compost yard (01.07.2023)



NORTH

TYPE	BTM	TOP	QTY M3
AREA	30319.977	20450.000	
LEVEL (AVG)	348.00	353.972	
(AVG)	25,384.95	5.972	1,51,604.5

CLIENT:-

Zigma Global Environ Solutions Pvt Ltd
64, Periyanna Street,
Erode – 638 001,
Tamil Nadu, India.

TITLE:-

ITC compost yard

NAME OF WORK	Zigma Global Environ Solutions Pvt Ltd
DRAWING CONSULTANTS	STEP LAND SURVEY CONSULTANTS.
CLIENT	

SURVEYED BY:-

STEP LAND SURVEY CONSULTANTS

Surveyors & ENGINEERING
37, Ist Floor,
Vallar nagar
Lawspet, (Near Airport)

Pondicherry – 605 008. ☎ : 9445958509.

E-mail: stepcondy@gamil.com, anmlr@steplantsurveyconsultant.com

WEB: www.steplandsurveyconsultant.com

SHEET SIZE:- A0	DWG DATE:- 01.07.2023
CAD FILE NAME	C:\ZIGY\YARD\CSY\ITC.Dwg
SURVEYED BY	DRAWN BY / CHECKED BY
Mani	ccci / evvaa
DRAWING REFERENCE	Topo Map Of Boundary Surveyed Sketch

Scale:- 1:200

AREA DETAILS:-

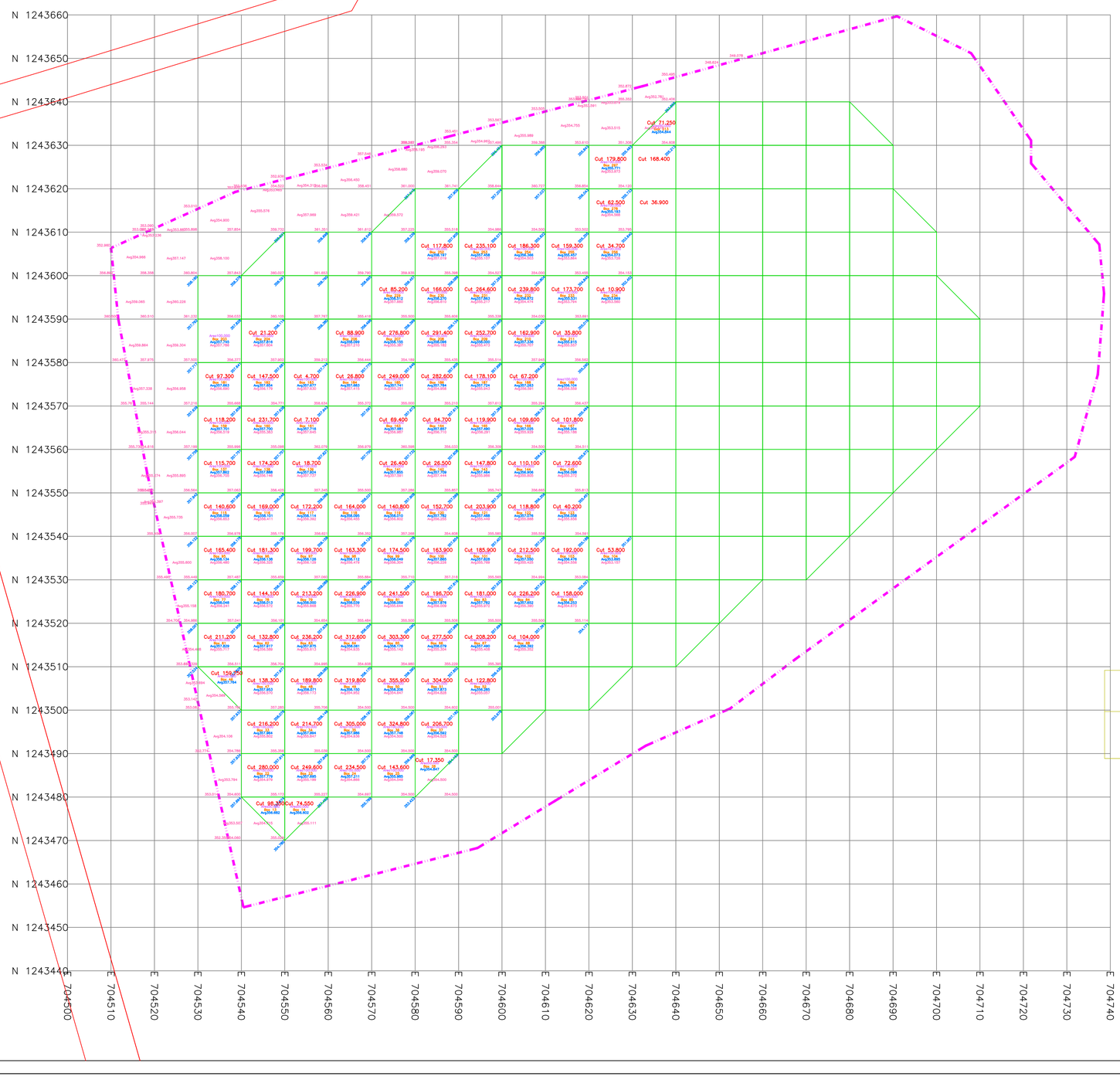
WASTE Area Details:-

DESCRIPTION	SQ.MT	SQ.FT	ACRE
COMPOUND WALL IN SQC	31642.537		

NOTES:-

1. All Dimensions Are In Metres & Feet.
2. Surveyed On 1st JUL 2023.
3. Bm: 349 Marked On ROAD TOP
4. Grid Intervel 10m
5. Spot Level Grid Intervel 10m X 10m

ITC METTUPALAYAM compost yard (22.9.2022 vs 01.07.2023)



22.9.2022 vs 01.07.2023 CUT

TYPE	BTM 22.9.2022	TOP 01.07.2023	QTY M3
AREA	30319.983	30319.983	
LEVEL (AVG)	355.264	355.925	
(AVG)	30319.983	0.661	20,0061

354.582	22.09.2022
358.094	01.07.2023

NOTE:–

1. Please note that in certain grid areas, the elevation has increased compared to the initial survey conducted on 22 September 2022, even though the waste in both cases has not been disturbed.
2. During the initial survey on 22 September 2022, the height of the vegetation above the waste was estimated to be in the range of 2–4 meters due to inaccessibility, and the corresponding volume was subtracted from the total volume.
3. In the current survey, with the removal of the vegetation, the elevation now accurately represents the actual height of the waste. The reduced volume (20,061 cu.m) from the initial survey has been documented separately on a survey map for reference.
4. So the initial volume as of 22 September 2022 is 2,00,614.89 cu.m

CLIENT:–

Zigma Global Environ Solutions Pvt Ltd

64, Periyanna Street,
Erode – 638 001,
Tamil Nadu, India.

TITLE:–

ITC compost yard

NAME OF WORK	Zigma Global Environ Solutions Pvt Ltd
DRAWING CONSULTANTS	STEP LAND SURVEY CONSULTANTS
CLIENT	

SURVEYED BY:–

STEP LAND SURVEY CONSULTANTS

Surveyors & ENGINEERING
37, Ist Floor,
Valar nagar
Lawspet, (Near Airport)

Pondicherry – 605 008. ☎ , 9445958509.

E–mail: stepcondy@gamil.com, anmin@steplantsurveyconsultant.com

WEB: www.steplandsurveyconsultant.com

SHEET SIZE:– A0	DWG DATE:– 01.07.2023
CAD FILE NAME	C:\ESO\YARD\CSF\ITC.Dwg.

SURVEYED BY	DRAWN BY	CHECKED BY
Mani	ann	evva

DRAWING REFERENCE: Topo Map Of Boundary Surveyed Sketch

Scale:– 1:200

AREA DETAILS:–

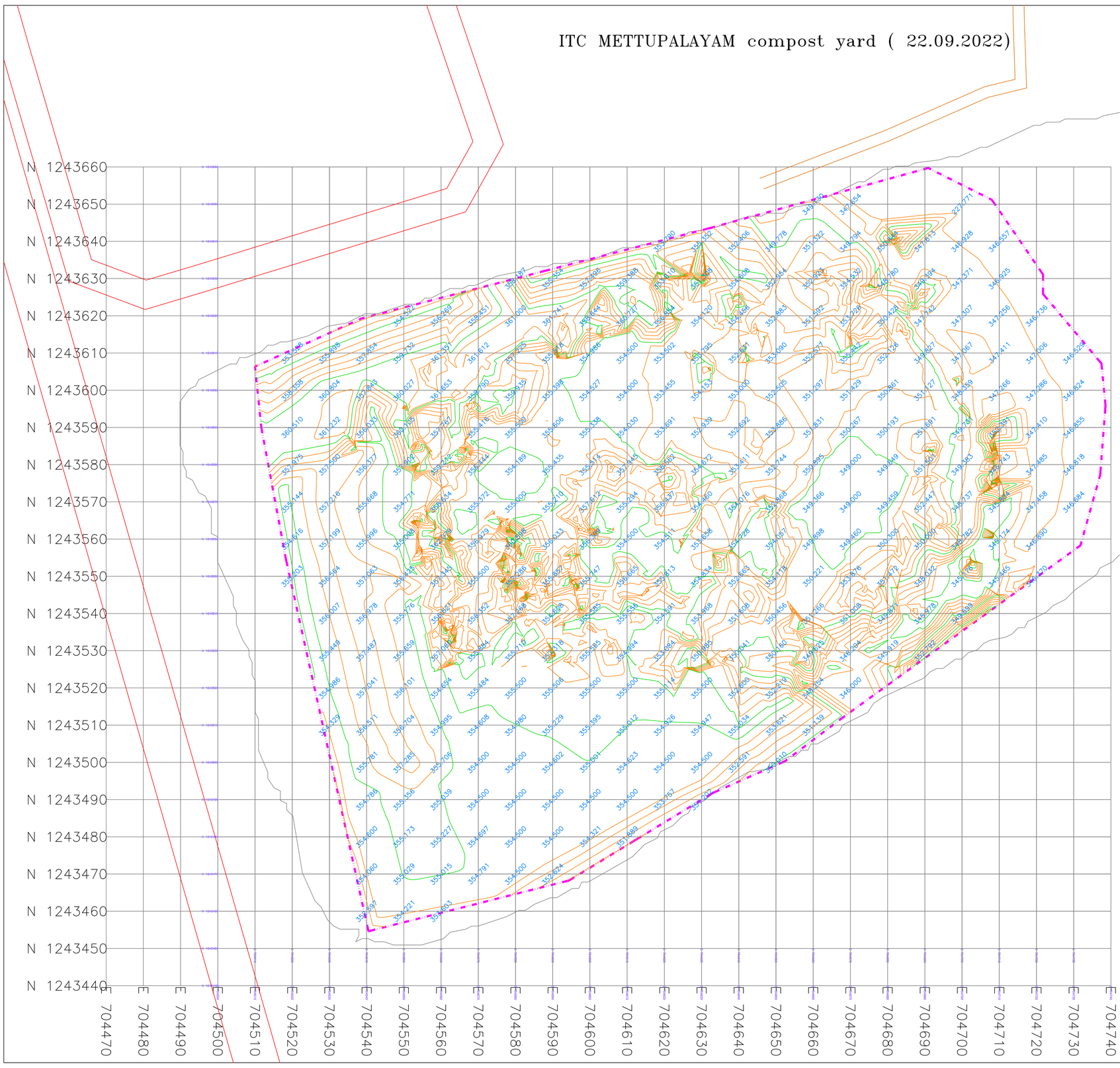
WASTE Area Details:–

DESCRIPTION	SQ.MT	SQ.FT	ACRE
COMPOUND WALL IN SIDE	31642.537		

NOTE:–

1. All Dimensions Are In Metres & Feet.
2. Surveyed On 1st JUL 2023.
3. Bm: 349 Marked On ROAD TOP
4. Grid Interval 10m
5. Spot Level Grid Interval 10m X 10m
5. Tree location only average deducted 2.5m

ITC METTUPALAYAM compost yard (22.09.2022)



TYPE	BTM	TOP	QTY M3
AREA	30319.977	20450.000	
LEVEL (AVG)	348.00	355.112	
(AVG)	25,384.95	7.112	1,80,553.89

NOTE:–

1. Please note that in certain grid areas, the elevation has increased compared to the initial survey conducted on 22 September 2022, even though the waste in both cases has not been disturbed.
2. During the initial survey on 22 September 2022, the height of the vegetation above the waste was estimated to be in the range of 2–4 meters due to inaccessibility, and the corresponding volume was subtracted from the total volume.
3. In the current survey, with the removal of the vegetation, the elevation now accurately represents the actual height of the waste. The reduced volume (20,061 cu.m) from the initial survey has been documented separately on a survey map for reference.
4. So the initial volume as of 22 September 2022 is 2,00,614.89 cu.m

CLIENT:–

Zigma Global Environ Solutions Pvt Ltd

64, Periyanna Street,
Erode – 638 001,
Tamil Nadu, India.

TITLE:–

ITC compost yard

NAME OF WORK	Zigma Global Environ Solutions Pvt Ltd
DRAWING CONSULTANTS	STEP LAND SURVEY CONSULTANTS
CLIENT	

SURVEYED BY:–

STEP LAND SURVEY CONSULTANTS

Surveyors & ENGINEERING
37, Ist Floor,
Valar nagar
Lawspet, (Near Airport)

Pondicherry – 605 008. ☎ , 9445958509.

E–mail: stepcondy@gamil.com, anmin@steplantsurveyconsultant.com

WEB: www.steplandsurveyconsultant.com

SHEET SIZE:– A0	DWG DATE:– 22.09.2022
CAD FILE NAME	C:\ESO\YARD\CSF\ITC.Dwg.

SURVEYED BY	DRAWN BY	CHECKED BY
Mani	ann	evva

DRAWING REFERENCE: Topo Map Of Boundary Surveyed Sketch

Scale:– 1:200

AREA DETAILS:–

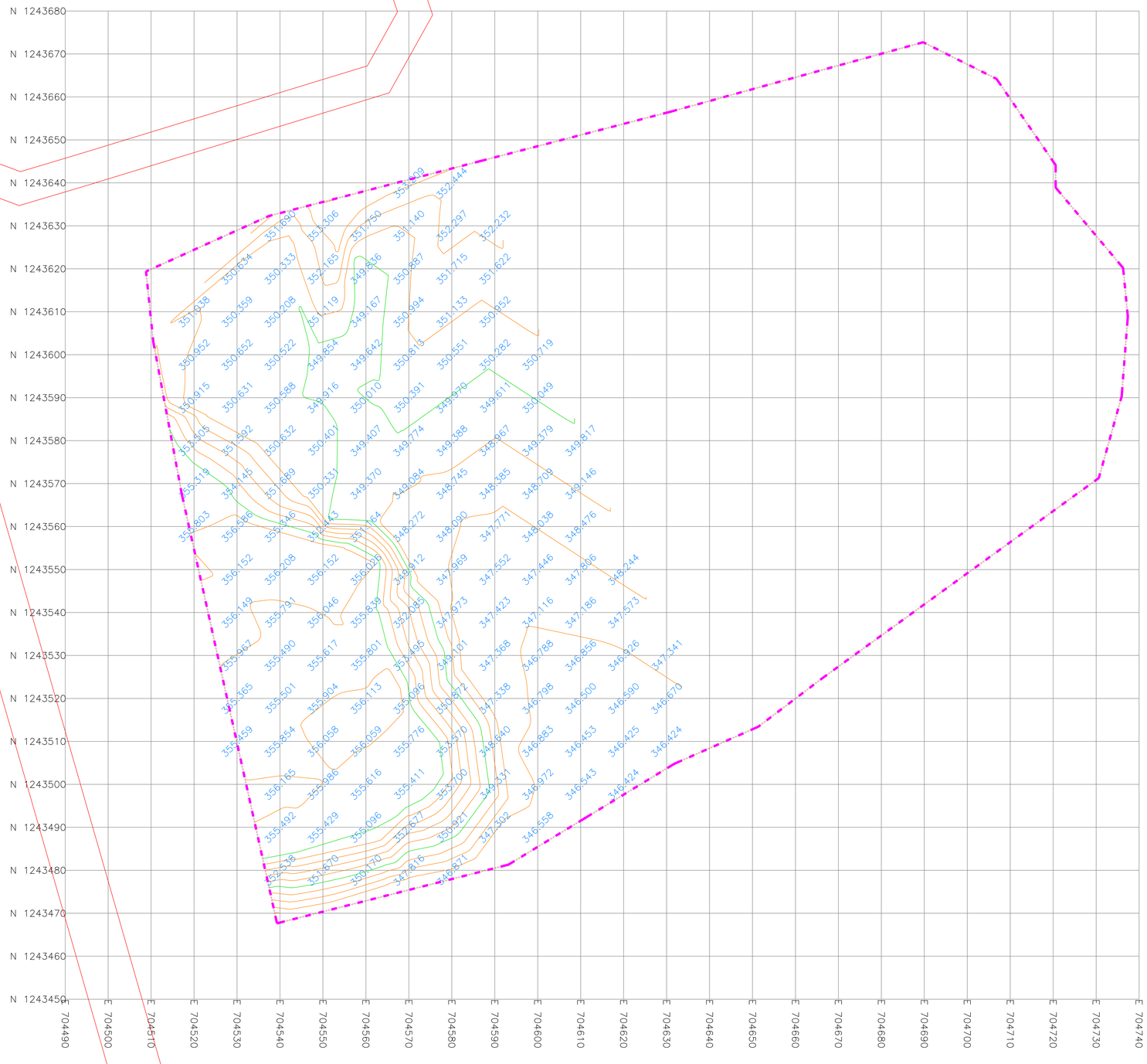
WASTE Area Details:–

DESCRIPTION	SQ.MT	SQ.FT	ACRE
COMPOUND WALL IN SIDE	31642.537		

NOTE:–

1. All Dimensions Are In Metres & Feet.
2. Surveyed On 22nd SEP 2022..
3. Bm: 349 Marked On ROAD TOP
4. Grid Interval 10m
5. Spot Level Grid Interval 10m X 10m

ITC METTUPALAYAM compost yard (04.10.2023)



NORTH

TYPE	BTM	TOP	QTY M3
AREA	10092.470	4827.888	
LEVEL (AVG)	348.00	353.806	
(AVG)	7,460.175	5.806	43,320.325

CLIENT:-

Zigma Global Environ Solutions Pvt Ltd

64, Periyanna Street,
Erode – 638 003,
Tamil Nadu, India.

TITLE:-

ITC compost yard

NAME OF WORK	Zigma Global Environ Solutions Pvt Ltd
DRAWING CONSULTANTS	STEP LAND SURVEY CONSULTANTS
CLIENT	

SURVEYED BY:-

STEP LAND SURVEY CONSULTANTS

Surveyors & ENGINEERING
37, Ist Floor,
Valluvar nagar
Lawspet, (Near Airport)

Pondicherry – 605 008. ☎ : 9445958509.

E-mail: stepcpdy@gmail.com, anmol@steplandsurveyconsultant.com

WEB: www.steplandsurveyconsultant.com

SHEET SIZE:- A0		DWG DATE:- 04.10.2023
CAD FILE NAME	C:\ZGC\YARD\CIF\ITC.Dwg	
SURVEYED BY	DRAWN BY	CHECKED BY
Mani	CDS	PVKA
DRAWING REFERENCE	Topo Map Of Boundary Surveyed Sketch	

Scale:- 1:200

AREA DETAILS:-

WASTE Area Details:-

DESCRIPTION	SQ.MT	SQ.FT	ACRE
COMPOUND WALL IN SIDE	31642.537		

NOTES:-

1. All Dimensions Are In Metres & Feet.
2. Surveyed On 4th OCT 2023.
3. Bm: 349 Marked On ROAD TOP
4. Grid Intervel 10m
5. Spot Level Grid Intervel 10m X 10m
5. Tree location only overage deducted 2.5m

ZIGMA GLOBAL ENVIRON SOLUTIONS PRIVATE LIMITED
H.O : 64, First Floor, Kalaimagal Kalvi Nilayam Road, Erode - 638 001 ✆ 0424 - 2225157
connect@zigma.in www.zigma.in | CIN : U74999TZ2015PTC021251

Ref No : ZGESPL/AL/ITC/23-24/454
Date : 18.01.2024
Place : Erode

To

Mr. Narayanan Alagiri,
Head – Engineering,
ITC Limited,
Paperboards & Specialty Papers Division,
Unit Kovai,
Vivekanandapuram (PO), Thekkampatty (Village),
Coimbatore – 641113.

Email: n.alagiri@itc.in

Respected Sir,

Sub: Project Status – Excavation, segregation & Processing and Disposal of Legacy Plastic Waste at Unit Kovai - Reg.

Ref: As requested by you during our team's meeting with you at ITC-PSPD Kovai on 17.01.2024

Greeting from Zigma Global Environ Solutions Pvt Ltd.,

With reference to the above subject and reference cited, we would like to put forward the current status of the project in the format as requested by you.

ITC PROJECT STATUS									
Survey number	Conducted on	Area handed over by ITC		Area cleared by Zigma in hectares		Soil processed in metric tons (weigh bridge data)		Plastic waste disposed in Metric tons	
		in acres	in Hectares	Between two consecutive surveys	Cumulative	Between two consecutive surveys	Cumulative	Between two consecutive surveys	Cumulative
Initial survey / Survey 1	22-Sep-22	7.49	3.03	-	-	-	-	-	-
Survey 2	1-Jul-23	7.49	3.03	-	-	56,869.66	56,869.66	4,903.88	4,903.88
Survey 3	4-Oct-23	7.49	3.03	2.02	2.02	97,252.41	1,54,122.07	6,998.46	11,902.34

Survey 4	29-Dec-23	7.49	3.03	1.01	3.03	53,410.39	2,07,532.46	3,820.58	15,722.92
Survey is not conducted, the values in this row are based on weigh bridge	15-Jan-24	7.49	3.03			8,258.07	2,15,790.53	269.90	15,992.82
Note: Till 15 Jan 2024 we have dispatched 15,992.82 metric tons of plastic waste and we have stock of around 1,000 metric tons at site									

ZIGMA®

This is for your kind information.

Thank you,
Yours Faithfully,
For Zigma Global Environ Solutions Pvt Ltd.,

Mr. N.V. Balamurali,
GM – Admin.

Zigma Global Environ Solutions Pvt. Ltd.,
Erode
638001

ITC Limited
PAPERBOARDS & SPECIALTY PAPERS DIVISION
Unit: Kovai
Vivekanandapuram(PO), Thekkampatty(Village)
Coimbatore - 641113, Tamilnadu, India.
Tel (O) : +91-4254-271234 / 284301
Fax : +91-4254-284304
www.itcpspd.com

Enduring Value

By Registered post (A/D)

22.08.2023

ITCK / UTY / 2023-2024

The District Environmental Engineer,
Tamil Nadu Pollution Control Board,
No-5, Ramasamy Nagar,
Opposite to fire service station,
Kavundampalayam,
Coimbatore – 641 025

Dear Sir,

Sub: -Submission of TNAU Annual Progress report Jul22 to Jun23

Please find enclosed herewith the TNAU Annual Progress report Jul22 to Jun23.

This is for your kind information.

Thanking you,

Yours faithfully,
For ITC Limited – PSPD, Unit: Kovai.

S. Venkatrao
Unit Head

Encl: - 1. TNAU Annual Progress report Jul22 to Jun23

CONFIDENTIAL

TNAU - ITC Ltd., (PSPD UNIT), KOVAI - COLLABORATIVE RESEARCH PROJECT

ANNUAL PROGRESS REPORT

(JULY, 2022 – JUNE, 2023)

"STUDIES ON THE IMPACT OF ITC KOVAI PAPER BOARD MILL TREATED EFFLUENT ALONG WITH SLUDGE ON SOIL HEALTH AND CROP PRODUCTIVITY"

TEAM

Dr. M. MAHESWARI

Dr. R. JAYASHREE

E. RAJESHKUMAR

SCHEME SPONSORED BY

ITC Ltd., PSPD, UNIT - KOVAI, THEKKAMPATTY VILLAGE,

COIMBATORE – 641 113.

DEPARTMENT OF ENVIRONMENTAL SCIENCES

TAMIL NADU AGRICULTURAL UNIVERSITY

COIMBATORE – 641 003

2023

ANNUAL PROGRESS REPORT (JULY, 2022 – JUNE, 2023)

1.	Project Title	**:**	**"Studies on the impact of ITC kovai paper board mill treated effluent along with sludge on soil health and crop productivity"**
2.	Name of the Project Leader(s) and Designation	**:**	**PI: Dr. M. Maheswari** Professor and Head, Dept. of Environmental Sciences, TNAU, Coimbatore – 641 003. **Co-PI: Dr. R. Jayashree** Associate Professor (Env.scinences) Dept. of Environmental Sciences TNAU, Coimbatore – 641 003.
3.	Project duration	:	3 Years (2020-2023)
4.	Objectives	:	

1. Characterisation of raw and treated effluent from Effluent Treatment Plant (ETP) of ITC Paper Board mill, Thekkampatty
2. Continuous monitoring of soil and ground water qualities in and around the premises of ITC factory (Bench Mark sites)
3. Piezometers and lysimeter studies in the areas irrigated with ITC paper board treated effluent for agriculture purpose
4. Evaluating different methods of irrigation by using treated effluent for different crops
5. ETP Sludge management for effective usage

Activity I: Characterization of ITC Ltd., (PSPD), effluent for physico-chemical properties at periodical intervals

The raw and treated effluent samples were collected once in three months during the sampling period up to June, 2023 from ITC Ltd., PSPD and they were analyzed for its physical and chemical properties. At quarterly intervals samples were collected during September, 2022, December, 2022, March, 2023 and June, 2023. Samples collected were analyzed as per the standard analytical methods and the results are presented in Table 1.

Table 1. Characteristics of the Raw and Treated Effluent of ITC

Parameters	Unit	Values									
		Raw Effluent					Treated Effluent				
		Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
pH	-	7.86	7.89	7.79	7.73	**7.82**	7.76	7.73	7.68	7.63	**7.70**
EC	dS m^{-1}	1.98	1.92	1.98	2.01	**1.97**	1.61	1.68	1.81	1.74	**1.71**
TDS	mg L^{-1}	1267	1345	1299	1278	**1297**	1030	1018	1081	1056	**1046**
TSS	mg L^{-1}	938	962	969	973	**960.50**	83.4	85.3	82	89	**84.93**
DO	mg L^{-1}	3.51	3.46	3.53	3.60	**3.53**	5.59	5.28	5.45	5.62	**5.49**
BOD	mg L^{-1}	153.27	169.13	167.03	165.81	**163.81**	18.5	19.43	28.93	24.72	**22.90**
COD	mg L^{-1}	476.85	485.67	489.12	483.21	**483.71**	95.46	105.23	91.71	92.36	**96.19**
Nitrogen	mg L^{-1}	37.16	34.82	31.19	31.86	**33.76**	16.34	19.61	11.93	13.63	**15.38**
Phosphorus	mg L^{-1}	2.16	2.59	1.96	1.92	**2.16**	1.13	1.27	1.35	1.29	**1.26**
Potassium	mg L^{-1}	30.46	34.28	31.86	31.62	**32.06**	22.28	25.62	24.72	27.36	**25.00**
Calcium	mg L^{-1}	272.39	269.30	271.9	268.4	**270.50**	208.16	218.60	282	289	**249.44**
Magnesium	mg L^{-1}	54.09	52.85	46.98	51.45	**51.34**	34.73	36.92	46.65	44.43	**40.68**
Sodium	mg L^{-1}	248.13	243.64	248.61	256.55	**249.23**	159.51	159.64	154.34	156.85	**157.59**
Carbonate	mg L^{-1}	159.72	149.91	153.86	155.67	**154.79**	108.62	115.28	113.95	119.55	**114.35**
Bicarbonate	mg L^{-1}	328.13	315.76	388.67	374.56	**351.78**	118.49	123.52	115.65	129.12	**121.70**
Chloride	mg L^{-1}	268.60	273.51	263.26	261.28	**266.66**	198.51	193.85	226.76	224.32	**210.86**
Sulphate	mg L^{-1}	221.39	214.83	221.29	226.56	**221.02**	128.35	120.36	132.34	136.63	**129.42**

Characteristics of the raw effluent

Based on the results obtained, the pH of the raw effluent was 7.86 in September, 2022, 7.89 in December, 2022, 7.79 in March, 2023 and 7.73 in June, 2023 which tends to be neutral with an EC of 1.98 dSm^{-1} in September, 2022, 1.92 dSm^{-1} in December, 2022, 1.98 dSm^{-1} in March, 2023 and 2.01 dSm^{-1} in June, 2023. TDS range was reported as 1267 mg L^{1}, 1345 mg L^{-1}, 1299 mg L^{-1} and 1278 mg L^{-1} in September, 2022, December,2022 March, 2023 and June, 2023 , respectively. As far as TSS is concerned, the values were 938 mg L^{-1} in September, 2022,962 mg L^{-1} in December, 2022, 969 mg L^{-1} in March, 2023 and 973 mg L^{-1} in June, 2023, respectively. The values of 3.51 mg L^{-1}, 3.46 mg L^{-1}, 3.53 mg L^{-1} and 3.60 mg L^{-1} were recorded for DO in September, 2022, December, 2022 and March, 2023 and June, 2023, respectively. Similarly, the values of 153.27 mg L^{-1}, 169.13 mg L^{-1}, 167.03 mg $L^{-1}$and 165.81 mg L^{-1} were recorded for BOD in September, 2022, December, 2022, March, 2023 and June, 2023, respectively.

While comparing with the COD of September, 2022 which was found to be 476.85 mg L^{-1}, the COD values recorded during December, 2022, March, 2023 and June, 2023 were 485.67, 489.12, and 483.21 mg L^{-1}, respectively. The values of nitrogen were found to be 37.16 mg L^{-1} in September, 2022 and 34.82 mg L^{-1} in December, 2022, 31.19 mg L^{-1} in March, 2023 and 31.86 mg L^{-1} in June, 2023. Phosphorus content in the effluent was found to be 2.16 mg L^{-1} in September, 2022, 2.59 mg L^{-1} in December, 2022, 1.96 mg L^{-1} in March, 2023 and 1.92 mg L^{-1} in June, 2023. In the effluent, potassium was recorded to be 30.46 mg L^{-1} in September, 2022, 34.28 mg L^{-1} in December, 2022, 31.86 mg L^{-1} in March, 2023 and 31.62 mgL^{-1} in June, 2023. The calcium was found to be 272.39 mg L^{-1} in September, 2022, 269.30 mg L^{-1} in December, 2022, 271.9 mg L^{-1} in March, 2023 and 268.4 mg L^{-1} in June, 2023.In the effluent, 54.09 mg L^{-1} of Magnesium in September, 2022, 52.85 mg L^{-1} in December, 2022, 46.98 mg L^{-1} in March, 2023 and 51.45 mg L^{-1} in June, 2023 and the values of 248.13 mg L^{-1} in September, 2022, 243.64 mg L^{-1} in December, 2022, 248.61 mg L^{-1} in March, 2023 and showed an increase of 256.55 mg L^{-1} in June, 2023 was found to be the sodium content of the effluent. Bicarbonate, it was found to be 328.13 mg L^{-1} in September, 2022 which increased to 315.76 mg L^{-1} in December, 2022, then showed a increase to 388.67 mg L^{-1} in March, 2023 and 374.56 mg L^{-1} in June, 2023. Chloride content was found to be 268.60 mg L^{-1} in September, 2022 which stepped up 273.51 mg L^{-1} in December, 2022, increased to 263.26 mg L^{-1} in the month of March, 2023 and 261.28 mg L^{-1} in June, 2023. Sulphate content was found to be 221.39 mg L^{-1} in September, 2022 which stepped up 214.83 mg L^{-1} in December, 2022, increased to 221.29 mgL^{-1} in the month of March, 2023 and 226.56 mg L^{-1} in June, 2023

Characteristics of the treated effluent

Based on the results obtained the pH value of treated effluent during September, 2022 was found to be 7.76, pH values recorded during December, 2022, March, 2023 and June, 2023 were 7.73, 7.68, and 7.63, respectively. The treated effluent tends to be neutral with an EC of 1.61 dSm^{-1} in September, 2022, 1.68 dSm^{-1} in December, 2022, 1.81 dSm^{-1} in March, 2023 and 1.74 dSm^{-1}in June, 2023. TDS range was reported as 1030 mg L^{-1}, 1018 mg L^{-1}, 1081 mg L^{-1} and 1056 mg L^{-1} in September, 2022, December, 2022 March, 2023 and June, 2023, respectively. As far as TSS is concerned, the values were 83.4 mg L^{-1} in September, 2022, 85.3 mg L^{-1} in December, 2022, 82 mg L^{-1} in March, 2023 and 89 mg L^{-1} in June, 2023, respectively. The DO values of 5.59 mg L^{-1}, 5.28 mg L^{-1}, 5.45 mg L^{-1} and 5.62 mg L^{-1} were recorded during September, 2022, December, 2022 and March, 2023 , and June, 2023, respectively. Similarly, the values of 18.5 mg L^{-1}, 19.43 mg L^{-1}, 28.93 mg L^{-1} and 24.72 mg L^{-1} were recorded for BOD during September, 2022, December, 2022, March, 2023 and June, 2023, respectively.

While comparing with the COD of September, 2022 which was found to be 95.46 mg L^{-1}, the COD values recorded during December, 2022, March, 2023 and June, 2023 were 105.23, 91.71, and 92.36 mg L^{-1}, respectively. The values of nitrogen were found to be 16.34 mg L^{-1} in September, 2022 and 19.61 mg L^{-1} in December, 2022, 11.93 mg L^{-1} in March, 2023 and 13.63 mg L^{-1} in June, 2023. Phosphorus content in the treated effluent was found to be 1.13 mg L^{-1} in September, 2022, 1.27 mg L^{-1} in December, 2022, 1.35 mg L^{-1} in March, 2023 and 1.29 mg L^{-1} in June, 2023. In the treated effluent, potassium was recorded to be 22.28 mg L^{-1} in September, 2022, 25.62 mg L^{-1} in December, 2022, 24.72 mg L^{-1} in March, 2023 and 27.36 mg L^{-1} in June, 2023. The calcium was found to be 208.16 mg L^{-1} in September, 2022, 218.60 mgL^{-1} in December, 2022, 282 mg L^{-1} in March, 2023 and 289 mg L^{-1} in June, 2023. In the treated effluent, 34.73 mg $L^{-1}$of Magnesium in September, 2022, 36.92 mg L^{-1} in December, 2022, 46.65 mg L^{-1} in March, 2023 and 44.43 mg L^{-1} in June, 2023 and the values of 159.51 mg L^{-1} in September, 2022, 159.64 mg L^{-1} in December, 2022, 154.34 mg L^{-1} in March, 2023 and showed an increase of 156.85 mg L^{-1} in June, 2023 was found to be the sodium content of the treated effluent. Bicarbonate, it was found to be 118.49 mg L^{-1} in September, 2022 which increased to 123.52 mg L^{-1} in December, 2022, then showed a decrease to 115.65 mg L^{-1} in March, 2023 and 129.12 mg L^{-1} in June, 2023.

Chloride content was found to be 198.51 mg L^{-1} in September, 2022 which stepped down to 193.85 mg L^{-1} in December, 2022, increased to 226.76 mg L^{-1} in the month of March, 2023 and 224.32 mg L^{-1} in June, 2023. Sulphate content was found to be 128.35 mg L^{-1} in September, 2022 which stepped up 120.36 mg L^{-1} in December, 2022, increased to 132.34 mg L^{-1} in the month of March, 2023 and 136.63 mg L^{-1} in June, 2023.

Activity II: Monitoring soil and groundwater quality in and around the premises of the ITC factory

1. The soil and water samples were collected from the bench mark sites (Table 2) (in and around factory Premises) during the sampling duration from September, 2022 to November, 2022, December, 2022 to February, 2023, March, 2023 to May, 2023 and June, 2023 to August, 2022. The analyzed data are presented in the tables 3 to 12.
2. Piezometers were installed at different locations of factory premises for assessing the groundwater quality.

Table 2.a. Bench mark sites for continuous monitoring of soil and groundwater quality in ITC factory Premises

Sl. No	SF No.	Village	Block	Locations	Type
1	938/1	KEM	B	SLF-1	Piezo well
2	938/2	KEM	B	SLF-2	Piezo well
3	938/2	KEM	B	SLF-3	Piezo well
4	940	KEM	B	Coconut farm – 8	Piezo well
5	943	KEM	B	Coconut farm - 9a	Piezo meter
6	940	KEM	B	Coconut farm - 9b	Piezo meter
7	936	KEM	B	Iyer thottam- TNAU Trail Plot	Piezo meter
8	936	KEM	B	Casurina field	Piezo meter
9	415	TKP	A	Admin Block	Piezo meter
10	411	TKP	A	Old Boiler	Closed
11	426/1B	TKP	A	Factory Block A	Piezo well
12	415/3A	TKP	A	Admn Block office	Piezo well
13	418	TKP	A	Old time office	Piezo well

Sl. No	SF No.	Village	Block	Locations	Type
14	426/1D	TKP	A	Back side of Raw water tank- Cogeneration plant	Piezo well
15	923/2A	KEM	B	Factory Block B-ETP	Piezo well
16	925/1	KEM	B	Factory Block B-Hostel	Piezo well
17	922/2	KEM	B	LSTC- Vagaimara thoppu	Piezo well
18	884/2	KEM	E	Kandi thottam	Piezo well
19	891/2B1	KEM	E	Kandi thottam	Piezo well
20	891/2B2	KEM	E	Kandi thottam	Piezo well
21	939/1A1	KEM	B	Bamboo garden	Piezo well
22	939/1A2	KEM	B	Coconut farm	Piezo well
23	932	KEM	B	Coconut farm	Piezo well
24	940	KEM	B	Coconut farm	Piezo well
25	877/2B	KEM	C-2	Block C-2 (Hospital medu)	Piezo well
26	879/2	KEM	C-1	Block C-1 (Hospital medu)	Piezo well
27	141/2A	KEM	D	KVK	Piezo well
28	893	KEM	E	Pichankadu	Piezo well
29	850	KEM	F	Mysore G. Thottam	Piezo well
30	779	KEM	G	KLR	Piezo well
31	962	KEM	G	KLR- Eucalyptus field	Piezo well

*411 - Open well closed due to erection of solar plant

Table 2.b. Bench mark sites for continuous monitoring of soil and groundwater quality in ITC factory Premises

Sample	SF	Type of well	Owner's name	Village
1	426	Test bore Well	Block A (Near coal Godown)	Thekkampatty
2	923	Test bore Well	Block B (ETP)	Kemmarampalayam
3	925	Test bore Well	Block B (Canteen)	Kemmarampalayam
4	942	Test bore Well	Block B (Field - 9)	Kemmarampalayam
5	932	Test bore Well	Block B (Field - 8)	Kemmarampalayam
6	411	Open Well	Block A (Closed)	Thekkampatty
7	923	Open Well	Block B (ETP)	Kemmarampalayam
8	922	Open Well	Block B (Canteen)	Kemmarampalayam
9	884	Open Well	Block E (Kandithoppu)	Kemmarampalayam
10	893	Open Well	Block E (Pichankadu)	Kemmarampalayam
11	851	Open Well	Block F (Mysore G. Thottam)	Kemmarampalayam
12	850	Bore Well	Block F (Mysore G. Thottam)	Kemmarampalayam
13	778	Bore Well	Block G (KLR)	Kemmarampalayam
14	779	Open Well	Block G (KLR)	Kemmarampalayam
15	962	Bore Well	Block G (KLR- Eucalyptus)	Kemmarampalayam
16	141	Bore Well	Block D (KVK)	Kemmarampalayam
17	416	Open Well	Nachimuthu	Thekkampatty
18	424	Open Well	Selvaraj	Thekkampatty
19	427	Open Well	Pettiyan (Servall)	Thekkampatty
20	-	Stream	Near Varatharajthottam	Thekkampatty
21	93	Open Well	Velumaniammal	Thekkampatty
22	414	Open Well	Batheri	Thekkampatty
23	916	Open Well	Kalikutty&Rajan	Kemmarampalayam
24	911	Open Well	Rangaraj	Kemmarampalayam
25	937	Open Well	Rangasamy	Kemmarampalayam
26	881	Open Well	NatarajGounder	Kemmarampalayam
27	876	Open Well	Subbaiyan	Kemmarampalayam
28	884	Open Well	Annamalai Gr, Thottam	Kemmarampalayam
29	131	Open Well	Somanur Gr, Thottam	Kemmarampalayam
30	-	River water	Control	-

Table 2.c. Geo co-ordinates of benchmark sites

S.No.	Sample Site	Co-ordinate
1	Coal Yard	11° 14' 46" N 76° 52' 42" E
2	Canteen	11° 14' 74" N 76° 52' 21" E
3	ETP	11° 14' 53" N 76° 52' 12" E
4	Block-D	11° 14' 17" N 76° 52' 48" E
5	Block-G	11° 14' 37" N 76° 52' 37" E
6	Block-F (850)	11° 14' 33" N 76° 50' 52" E
7	Block- F (851)	11° 14' 33" N 76° 50' 48" E
8	Annamalai gr thottam	11° 14' 22" N 76° 51' 37" E
9	Block-E (884)	11° 14' 25" N 76° 51' 30" E
10	Block-E (893)	11° 14' 25" N 76° 51' 29" E
11	Pettaiyan	11° 15' 01" N 76° 52' 43" E
12	Stream	11° 14' 41" N 76° 52' 44" E
13	Coconut farm 8	11° 14' 24" N 76° 52' 87" E
14	Coconut farm 9	11° 14' 30" N 76° 52' 09" E
15	Bamboo garden	11° 14' 34" N 76° 52' 19" E
16	SLF1	11° 14' 40" N 76° 52' 18" E
17	SLF3	11° 14' 30" N 76° 52' 14" E
18	Rangaraj	11° 14' 31" N 76° 52' 15" E
19	Kandasamy	11° 14' 36" N 76° 52' 17" E
20	Natraj gr thottam	11° 14' 52" N 76° 52' 37" E
21	Velumani Ammal Thoppu	11° 15' 01" N 76° 52' 30" E
22	Near Admin Block	11° 14' 65" N 76° 52' 38" E
23	Sambal Medu	11° 14' 40" N 76° 52' 29" E
24	Raw Water Borewell (Factory)	11° 14' 51" N 76° 52' 51" E
25	Somanur	11° 14' 26" N 76° 52' 16" E
26	Nachimuthu	11° 13' 26" N 76° 52' 13" E
27	TNAU Trail Plot	11° 14' 61" N 76° 52' 14" E
28	Casuarina field	11° 14' 66" N 76° 52' 21" E
29	Kalikuty and Rajan	11° 14' 40" N 76° 52' 13" E
30	Old time office	11° 14' 64" N 76° 52' 37" E

Table 3 a. pH, EC, TDS and Sodium content of the ground water samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	pH					EC(dS m^{-1})					TDS (mg L^{-1})					Sodium (mg L^{-1})				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426	Factory (Block A)	NC	NC	7.11	7.13	**7.12**	NC	NC	1.31	1.34	**1.3**	NC	NC	879.3	865.4	**872.4**	NC	NC	82.72	89.4	**86.1**
2	923	Factory (Block B)	8.05	8.09	NW	NW	**8.07**	1.35	1.39	NW	NW	**1.4**	864	889.6	NW	NW	**876.8**	82.9	81.24	NW	NW	**82.1**
3	925	Factory (Block B)	7.00	7.07	7.31	.24	**7.16**	2.86	2.91	2.32	2.39	**2.6**	1430.4	1862.4	874.2	879.5	**1261.6**	117.6	116.84	112.2	117.9	**116.1**
4	942	Factory (Block B)	7.24	7.20	7.39	7.28	**7.28**	2.62	2.64	2.42	2.49	**2.5**	1676.8	1689.6	1671.4	1624.5	**1665.6**	71.8	71.58	73.4	71.9	**72.2**
5	932	Factory (Block B)	7.74	7.68	7.12	7.23	**7.44**	0.94	0.93	0.95	1.13	**1.0**	601.6	595.2	612.4	623.5	**608.2**	50.9	51.67	57.9	59.3	**54.9**
6	411	Block A (Closed)	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
7	923	Factory (Block B)	7.81	7.86	7.89	7.74	**7.83**	1.48	1.54	1.51	1.58	**1.5**	947.2	985.6	938.6	946.3	**954.4**	62.58	62.32	61.24	64.15	**62.6**
8	922	Factory (Block B)	7.74	7.78	7.49	7.52	**7.63**	1.39	1.43	1.24	1.29	**1.3**	889.6	915.2	904	923.4	**908.1**	81.9	82.69	83.6	81.21	**82.4**
9	884	Factory (Block E)	7.63	7.72	7.81	7.88	**7.76**	1.41	1.45	1.46	1.47	**1.4**	902.4	928	913.4	925.3	**917.3**	50.1	51.53	52.1	53.2	**51.7**
10	893	Factory (Block E)	7.80	7.85	7.25	7.19	**7.52**	0.88	0.92	0.93	1.01	**0.9**	563.2	588.8	592.1	583.6	**581.9**	49.7	50.21	50.9	52.4	**50.8**
11	851	Factory (Block F)	8.31	8.36	8.01	8.12	**8.20**	0.96	0.93	0.89	0.91	**0.9**	614.4	595.2	591.4	589.3	**597.6**	37.6	38.37	37.8	34.7	**37.1**
12	850	Factory (Block F)	8.42	8.40	8.27	8.21	**8.33**	0.99	0.96	1.15	1.02	**1.0**	633.6	614.4	611.6	619.9	**619.9**	63.3	64.21	67.6	67.2	**65.6**
13	778	Factory (Block G)	NC	NC	7.32	7.24	**7.28**	NC	NC	1.11	1.15	**1.1**	NC	NC	625.7	631.6	**628.7**	NC	NC	62.4	65.9	**64.2**
14	779	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-

15	962	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	
16	141	Factory (Block D)	8.16	8.12	NC	NC	**8.14**	0.89	0.86	NC	NC	**0.88**	569.6	550.4	NC	NC	**560.0**	103.7	104.28	NC	NC	**104.0**
17	416	Nachimuthu	7.67	7.63	7.26	7.64	**7.55**	2.67	2.63	1.41	1.47	**2.65**	598.8	683.2	731	734.2	**786.8**	73.8	74.06	78.5	76.9	**75.8**
18	424	Selvaraj	7.46	7.48	7.68	NC	**7.54**	2.57	2.62	2.35	NC	**2.51**	644.8	676.8	631.4	NC	**751.0**	58.1	60.26	81.3	NC	**66.6**
19	427	Pettiyan (Servall)	7.62	7.64	7.26	7.39	**7.47**	0.93	0.90	1.43	1.51	**1.19**	595.2	576	959.4	951.4	**770.5**	64.4	65.04	68.5	63.5	**65.4**
20	-	Stream near Varatharajthottam	7.84	7.81	7.57	7.61	**7.58**	0.81	0.85	0.95	0.92	**0.88**	518.4	544	572.4	581.3	**554.0**	83.2	83.52	79.4	77.3	**80.9**
21	93	Velumani ammal	NC	NC	NC	NC	-	NC	NC	NC	NC	-	NC	NC	NC	NC	-	NC	NC	NC	NC	-
22	414	Batheri	NC	NC	7.71	7.83	**7.77**	NC	NC	0.91	1.01	**0.96**	NC	NC	621.3	624.2	**622.8**	NC	NC	53.4	56.3	**54.9**
23	916	Kalikutty &Rajan	7.91	7.95	7.81	7.85	**7.88**	0.95	0.98	1.23	1.12	**1.32**	608	627.2	831.8	839.3	**726.6**	217.1	218.61	212.3	198.6	**211.7**
24	911	Rangaraj	7.65	7.68	7.84	7.87	**7.76**	1.12	1.16	1.51	1.53	**1.33**	660.8	102.4	944.6	971.5	**669.8**	176.2	178.23	179.4	183.5	**179.3**
25	937	Kandasamy	7.16	7.19	7.31	7.48	**7.28**	1.46	1.51	1.52	1.51	**1.5**	934.4	966.4	964.6	975.9	**960.3**	193.4	192.89	202.5	205.4	**198.5**
26	881	Natraj Gounder	7.86	7.83	7.83	7.79	**7.82**	1.92	1.93	1.41	1.45	**1.68**	1228.8	1235.2	933.5	931.6	**1082.3**	38.5	37.64	43.2	45.7	**41.3**
27	876	Subbaiyan	NC	NC	7.83	NC	**7.83**	NC	NC	1.32	NC	**1.32**	NC	NC	871.4	NC	**871.4**	NC	NC	42.6	NC	**42.6**
28	884	Annamalai Gr, Thottam	7.37	7.39	7.62	7.70	**7.52**	1.23	1.26	1.11	1.13	**1.18**	787.2	806.4	753.6	761.4	**777.2**	49.2	48.39	42.6	43.5	**45.9**
29	131	Somanur Gr, Thottam	7.64	7.61	7.51	7.58	**7.58**	0.88	0.84	1.24	1.28	**1.06**	563.2	537.6	932.5	949.5	**745.7**	46.4	47.14	46.5	47.3	**46.8**
30	-	River water (Control)	8.12	8.15	7.31	7.41	**7.74**	0.74	0.70	0.89	1.13	**0.86**	473.6	448	621.4	629.9	**543.2**	127.5	129.49	128.36	131.5	**129.2**
		Mean	**7.74**	**7.75**	**7.71**	**7.75**	-	**1.35**	**1.38**	**1.30**	**1.31**	-	**866.23**	**882.62**	**889.35**	**865.2**	-	**86.79**	**86.83**	**87.34**	**85.12**	-

*NW - No Water * NC- Not collected

Table 3 b. Potassium, Calcium, Magnesium and Carbonate content of the ground water samples collected from the bench mark sites for continuous monitoring of ground water quality

	SF	Sample ID	Potassium (mg L^{-1})					Calcium (mg L^{-1})					Magnesium (mg L^{-1})					Carbonate (mg L^{-1})				
			Sep., 2022	Dec., 2022	March ..2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March ..2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March ..2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March ..2023	June., 2023	Mean
1	426	Factory (Block A)	NC	NC	2.1	2.4	**2.25**	NC	NC	94	87	**90.50**	NC	NC	61.4	53.5	**57.45**	NC	NC	279	281	**280.00**
2	923	Factory (Block B)	3.27	3.25	NW	NW	**3.26**	72.6	72.1	NW	NW	**72.35**	58.4	59.30	NW	NW	**58.85**	189	192	NW	NW	**190.50**
3	925	Factory (Block B)	2.10	2.18	1.82	1.65	**1.94**	73.8	74.53	71	77	**74.08**	62.6	63.61	63.8	61.5	**62.88**	171	174	184	179	**177.00**
4	942	Factory (Block B)	8.43	8.37	7.4	8.3	**8.13**	38.1	40.15	36.3	40.4	**38.74**	43.7	44.56	41.6	42.7	**43.14**	168	169	161	164	**165.50**
5	932	Factory (Block B)	5.1	5.16	4.5	4.9	**4.92**	161.8	162.34	163.6	167.4	**163.79**	81.5	82.32	81.8	86.4	**83.01**	217	218	219	221	**218.75**
6	411	Block A (Closed)	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	-
7	923	Factory (Block B)	3.92	3.86	6.2	6.7	**5.17**	51.9	52.64	51.4	53.4	**52.34**	15.2	16.59	13.2	13.5	**14.62**	11	14	12	15	**13.00**
8	922	Factory (Block B)	2.91	2.95	3.32	3.41	**3.15**	54.6	55.09	51.6	53.5	**53.70**	40.4	41.07	41.5	39.6	**40.64**	92	96	90	94	**93.00**
9	884	Factory (Block E)	3.97	3.94	2.92	2.87	**3.43**	36.4	37.17	48.2	49.4	**42.79**	14.3	15.41	17.5	19.5	**16.68**	27	31	22	29	**27.25**
10	893	Factory (Block E)	2.83	2.87	3.86	3.82	**3.35**	54.8	55.36	52.4	53.6	**54.04**	13.4	14.63	14.2	16.5	**14.68**	146	142	141.3	139.2	**142.13**
11	851	Factory (Block F)	3.12	4.19	2.94	2.93	**3.30**	121.5	123.668	127.4	121.7	**123.57**	15.1	16.85	11.9	15.6	**14.86**	173	177	174	169	**173.25**
12	850	Factory (Block F)	4.63	4.45	3.9	4.1	**4.27**	21.7	20.58	21.5	23.2	**21.75**	51.9	52.53	53.6	51.9	**52.48**	38	42	53	61	**48.50**
13	778	Factory (Block G)	NC	NC	4.53	4.61	**4.57**	NC	NC	51.6	53.8	**52.70**	NC	NC	23.6	24.9	**24.25**	NC	NC	32	36	**34.00**
14	779	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-
15	962	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-
16	141	Factory (Block D)	3.28	3.39	NC	NC	**2.25**	32.8	33.52	NC	NC	**90.50**	16.8	17.78	NC	NC	-	41	46	NC	NC	-

17	416	Nachimuthu	4.81	4.78	4.6	4.51	**4.68**	110.5	111.67	112	118	**113.04**	40.8	40.69	40.31	41.54	**40.84**	169	171	174	173	**171.75**
18	424	Selvaraj	2.92	2.86	2.45	NC	**2.74**	107.5	108.54	106	NC	**107.35**	90.2	90.2	94.1	NC	**91.50**	74	76	82	NC	**77.33**
19	427	Pettiyan (Servall)	2.67	2.82	2.53	3.02	**2.76**	111.8	150.26	142.3	141.2	**136.39**	11.3	12.51	10.3	10.9	**11.25**	68	72	61	69	**67.50**
20	-	Stream near Varatharaj thottam	3.34	3.45	2.96	3.15	**3.23**	81.6	82.68	81.5	83.5	**82.32**	56.4	57.23	54.6	59.4	**56.91**	33	35	39	43	**37.50**
21	93	Velumani ammal	NC	NC	NC	NC	-	NC	NC	NC	NC	-	NC	NC	NC	NC	-	NC	NC	NC	NC	-
22	414	Batheri	NC	NC	3.14	3.26	**3.20**	NC	NC	132.4	129.9	**131.15**	NC	NC	62.5	61.7	**62.10**	NC	NC	44	40	**42.00**
23	916	Kalikutty &Rajan	3.46	3.50	2.4	2.5	**2.97**	82.6	81.39	82.6	83.6	**82.55**	93.2	94.72	93.7	98.2	**94.96**	141	145	139	132	**139.25**
24	911	Rangaraj	1.95	1.87	1.79	1.71	**1.83**	114.4	115.61	118.3	12.6	**90.23**	51.6	52.59	60.4	59.2	**55.95**	98	103	99	101	**100.25**
25	937	Kandasamy	4.68	5.24	4.91	4.89	**4.93**	94.5	95.21	95.3	92.4	**94.35**	50.2	50.84	52.5	51.7	**51.31**	83	81	89	94	**86.75**
26	881	Natraj Gounder	6.27	6.18	6.36	6.28	**6.27**	80.1	81.26	84.1	79.4	**81.22**	41.6	41.21	40.9	41.3	**41.25**	117	123	121	119	**120.00**
27	876	Subbaiyan	NC	NC	5.52	NC	**5.52**	NC	NC	69.2	NC	**69.20**	NC	NC	60	NC	**60.00**	NC	NC	92	NC	**92.00**
28	884	Annamalai Gr, Thottam	9.28	9.36	8.92	9.16	**9.18**	129.2	130.97	121.4	130.5	**128.02**	53.1	53.26	54.2	51.2	**52.94**	43	46	49	51	**47.25**
29	131	SomanurGr, Thottam	7.92	7.83	7.45	8.32	**7.88**	91.0	92.42	91.4	92.9	**91.93**	23.5	23.81	24.43	24.91	**24.16**	56	62	56	59	**58.25**
30	-	Riverwater (Control)	5.16	5.47	6.93	5.92	**5.87**	63.5	64.61	61.5	67.8	**64.35**	41.2	41.42	45.83	47.98	**44.11**	41	43	44.2	49.3	**44.38**
		Mean	**4.36**	**4.45**	**4.31**	**4.47**	-	**81.21**	**83.72**	**86.13**	**82.37**	-	**43.93**	**44.69**	**46.58**	**44.26**	-	**99.82**	**102.64**	**102.35**	**105.39**	-

*NW - No Water * NC- Not collected

Table 3 c. Bicarbonate, Sulphate and Chloride content of the ground water samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No.	SF	Sample ID	Bicarbonate (mg L^{-1})					Sulphate (mg L^{-1})					Chloride (mg L^{-1})				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426	Factory (Block A)	NC	NC	36	39	**37.50**	NC	NC	92.4	95.32	**93.86**	NC	NC	172.5	171.3	**171.9**
2	923	Factory (Block B)	28	25	NW	NW	**26.50**	92.1	93.67	NW	NW	**92.88**	140.5	142.64	NW	NW	**141.57**
3	925	Factory (Block B)	23	27	21	23	**23.50**	74.5	76.58	70.4	72.6	**73.52**	121.6	123.67	121.3	125.8	**123.09**
4	942	Factory (Block B)	71	76	81	76	**76.00**	27.0	28.21	23.5	25.42	**26.03**	115.0	118.51	119.3	114.5	**116.82**
5	932	Factory (Block B)	226	235	222	236	**229.75**	63.5	64.34	64.34	63.82	**64**	121.4	123.64	127.4	128.1	**125.13**
6	411	Block A	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	-
7	923	Factory (Block B)	148	156	158.4	151.2	**153.40**	55.1	56.94	55.42	55.56	**55.75**	169.0	170.24	170.6	174.9	**171.18**
8	922	Factory (Block B)	161	169	162.7	164.3	**164.25**	196.4	198.42	190.4	191.14	**194.09**	62.5	63.91	63.2	62.7	**63.07**
9	884	Factory (Block E)	130	135	142	148	**138.75**	120.4	123.76	128.32	124.54	**124.25**	113.5	115.61	118.9	120.6	**117.15**
10	893	Factory (Block E)	351	356	331.4	336.6	**343.75**	30.7	31.34	29.6	30.18	**30.45**	61.8	62.28	64.2	65.6	**63.47**
11	851	Factory (Block F)	289	294	292	291	**291.50**	71.5	73.26	72.86	74.65	**73.06**	99.4	97.34	97.4	98.2	**98.08**
12	850	Factory (Block F)	251	255	253	262	**255.25**	23.5	24.91	24.16	23.57	**24.03**	169.5	170.16	168.4	169.9	**169.49**
13	778	Factory (Block G)	NC	NC	241.4	250.2	**245.80**	NC	NC	24.4	29.1	**26.75**	NC	NC	56.4	52.6	**54.5**
14	779	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-
15	962	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-

16	141	Factory (Block D)	249	243	NC	NC	**246**	33.7	34.50	NC	NC	**34.1**	63.5	65.60	NC	NC	**64.55**
17	416	Nachimuthu	221	232	225	217	**223.75**	21.6	21.73	20.12	19.42	**20.71**	226.7	224.21	226.3	219.2	**224.10**
18	424	Selvaraj	165	174	178	NC	**172.33**	131.8	132.67	137.85	NC	**134.10**	220.4	223.57	229.6	NC	**224.52**
19	427	Pettiyan (Servall)	190	196	185	178	**187.25**	30.6	33.64	32.56	31.55	**32.08**	124.9	125.24	121.6	123.8	**123.88**
20	-	Stream near Varatharajthottam	412	418	401	419	**412.5**	42.9	44.25	43.5	41.6	**43.06**	321.0	323.61	321.4	320.8	**321.70**
21	93	Velumaniammal	NC	NC	NC	NC	-	NC	NC	NC	NC	-	NC	NC	NC	NC	-
22	414	Batheri	NC	NC	159	167	**163**	NC	NC	58.3	51.7	**55**	NC	NC	189.06	180.11	**184.58**
23	916	Kalikutty&Rajan	149	154	129	137	**142.25**	36.2	38.36	33.7	35.6	**35.96**	162.4	160.32	156.8	153.9	**158.35**
24	911	Rangaraj	437	449	444	421	**437.75**	58.5	57.62	50.7	51.6	**54.60**	143.0	144.29	125.87	129.5	**135.66**
25	937	Kandasamy	158	167	164	159	**162**	43.4	46.94	47.5	42.6	**45.11**	130.9	132.46	118.91	109.71	**122.99**
26	881	Natraj Gounder	219	232	219	222	**223**	136.3	138.31	141.51	139.66	**138.94**	391.2	387.62	396.3	390.7	**391.45**
27	876	Subbaiyan	NC	NC	181	NC	**181**	NC	NC	20.21	NC	**20.21**	NC	NC	343.7	NC	**343.7**
28	884	Annamalai Gr, Thottam	148	156	145	151	**150**	54.9	56.84	57.34	51.66	**55.18**	141.6	143.32	190.8	193.9	**167.40**
29	131	Somanur Gr, Thottam	281	275	280	284	**280**	82.8	85.34	85.72	81.53	**83.84**	98.7	95.26	95.73	106.9	**99.14**
30	-	River water (Control)	271	279	286	293	**282.25**	60.2	64.20	61.74	62.22	**62.09**	116.2	118.39	117.93	105.76	**114.57**
		Mean	**208.09**	**213.77**	**205.70**	**210.24**	**201.89**	**67.62**	**69.36**	**65.27**	**63.41**	**65.14**	**150.67**	**151.45**	**163.07**	**150.84**	**157.39**

*NW - No Water * NC- Not collected

Table 3 d. SAR, RSC and SSP content of the ground water samples collected from the bench mark sites for continuous monitoring of ground waterquality

S. No.	SF	Sample ID	SAR					RSC					SSP				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426	Factory (Block A)	-	-	0.00	1.52	**0.76**	-	-	0.12	1.17	**0.65**	-	-	26.71	30.47	**28.59**
2	923	Factory (Block B)	1.46	1.43	-	-	**1.45**	-1.74	-1.74	-	-	**-1.74**	29.58	29.04	-	-	**29.31**
3	925	Factory (Block B)	2.04	2.01	1.96	2.02	**2.01**	-2.83	-2.78	-2.36	-2.62	**-2.65**	36.33	35.87	35.37	36.24	**35.95**
4	942	Factory (Block B)	1.62	1.58	1.69	1.60	**1.62**	1.22	1.16	1.33	1.13	**1.21**	35.14	34.40	36.84	35.06	**35.36**
5	932	Factory (Block B)	0.65	0.66	0.74	0.75	**0.70**	-3.94	-3.86	-3.83	-4.44	**-4.02**	12.85	12.94	14.28	14.11	**13.55**
6	411	Block A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	923	Factory (Block B)	1.51	1.49	1.51	1.55	**1.52**	-1.07	-0.99	-0.79	-0.78	**-0.91**	40.71	39.71	41.02	41.28	**40.68**
8	922	Factory (Block B)	1.70	1.70	1.75	1.70	**1.71**	-0.39	-0.21	-0.34	-0.15	**-0.27**	36.59	36.51	37.25	36.81	**36.79**
9	884	Factory (Block E)	1.40	1.42	1.28	1.28	**1.35**	0.02	0.10	-0.71	-0.85	**-0.36**	41.16	40.85	36.49	35.69	**38.55**
10	893	Factory (Block E)	1.19	1.19	1.23	1.24	**1.21**	6.76	6.58	6.42	6.22	**6.50**	35.48	34.96	36.19	35.43	**35.52**
11	851	Factory (Block F)	0.63	0.64	0.63	0.58	**0.62**	3.17	3.13	3.21	3.03	**3.14**	18.07	17.82	18.10	16.82	**17.70**
12	850	Factory (Block F)	1.53	1.56	1.62	1.60	**1.58**	-0.03	0.17	0.52	0.73	**0.35**	33.24	33.59	34.25	34.33	**33.85**
13	778	Factory (Block G)	-	-	1.44	1.48	**1.46**	-	-	0.62	0.46	**0.54**	-	-	36.78	36.98	**36.88**
14	779	Factory (Block G)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

15	962	Factory (Block G)	-	-	-	-	**-**	-	-	-	-	**-**	-	-	-	-	**-**
16	141	Factory (Block D)	2.95	2.92	-	-	**2.94**	2.41	2.36	-	-	**2.39**	59.07	58.29	-	-	**58.68**
17	416	Nachimuthu	1.19	1.19	1.26	1.21	**1.21**	0.33	0.53	0.40	0.07	**0.33**	26.18	26.14	27.33	26.08	**26.43**
18	424	Selvaraj	0.84	0.86	1.16	-	**0.95**	-7.72	-7.56	-	-	**-7.64**	16.31	16.76	21.12	-	**18.06**
19	427	Pettiyan (Servall)	1.14	1.00	1.08	1.01	**1.06**	-1.15	-2.94	-3.02	-2.60	**-2.43**	29.79	24.69	27.03	25.55	**26.77**
20	-	Stream near Varatharajthottam	1.43	1.42	1.37	1.30	**1.38**	-0.93	-0.88	-0.46	-0.93	**-0.80**	28.98	28.77	28.41	26.74	**28.23**
21	93	Velumaniammal	-	-	-	-	**-**	-	-	-	-	**-**	-	-	-	-	**-**
22	414	Batheri	-	-	0.76	0.81	**0.79**	-	-	-7.62	-7.63	**-7.63**	-	-	16.32	17.28	**16.80**
23	916	Kalikutty&Rajan	3.33	3.36	3.26	3.00	**3.24**	-4.75	-4.60	-5.06	-5.63	**-5.01**	44.06	44.09	43.48	41.00	**43.16**
24	911	Rangaraj	2.73	2.74	2.69	4.53	**3.17**	0.41	0.63	-0.75	4.98	**1.32**	43.21	43.15	41.50	58.73	**46.65**
25	937	Kandasamy	3.22	3.20	3.34	3.43	**3.30**	-3.55	-3.56	-3.57	-3.14	**-3.46**	48.22	47.87	48.72	49.66	**48.62**
26	881	Natraj Gounder	0.70	0.68	0.77	0.83	**0.75**	0.02	0.41	0.06	0.21	**0.18**	17.99	17.61	19.45	20.78	**18.96**
27	876	Subbaiyan	-	-	0.76	-	**0.76**	-	-	-	-	**-**	-	-	17.72	-	**17.72**
28	884	Annamalai Gr, Thottam	0.73	0.71	0.64	0.64	**0.68**	-7.03	-6.90	-6.48	-6.63	**-6.76**	16.13	15.78	14.62	14.64	**15.29**
29	131	Somanur Gr, Thottam	0.86	0.87	0.86	0.86	**0.86**	-0.04	-0.03	-0.08	-0.16	**-0.08**	23.11	23.14	22.93	22.87	**23.01**
30	-	River water(Control)	2.51	2.53	2.50	2.46	**2.50**	-0.80	-0.68	-0.62	-1.12	**-0.81**	45.13	45.21	44.11	43.13	**44.40**
		Mean	**1.61**	**1.60**	**1.43**	**1.61**	**-**	**-0.98**	**-0.98**	**-1.05**	**-0.85**	**-**	**32.61**	**32.15**	**30.25**	**31.80**	**-**

*NW - No Water * NC- Not collected

Table 3 e. Ni, As and Cd content of the ground water samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	Ni (ppm)					As (ppm)					Cd (ppm)				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426	Factory (Block A)	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-
2	923	Factory (Block B)	BDL	BDL	NW	NW	-	BDL	BDL	NW	NW	-	BDL	BDL	NW	NW	-
3	925	Factory (Block B)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
4	942	Factory (Block B)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
5	932	Factory (Block B)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
6	411	Block A	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
7	923	Factory (Block B)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
8	922	Factory (Block B)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
9	884	Factory (Block E)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
10	893	Factory (Block E)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
11	851	Factory (Block F)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
12	850	Factory (Block F)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
13	778	Factory (Block G)	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-
14	779	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-
15	962	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-

16	141	Factory (Block D)	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
17	416	Nachimuthu	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
18	424	Selvaraj	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-
19	427	Pettiyan (Servall)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
20	-	Stream near Varatharajthottam	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
21	93	Velumaniammal	NC	NC	NC	NC	-	NC	NC	NC	NC	-	NC	NC	NC	NC	-
22	414	Batheri	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-
23	916	Kalikutty&Rajan	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
24	911	Rangaraj	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
25	937	Kandasamy	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
26	881	Natraj Gounder	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
27	876	Subbaiyan	NC	NC	BDL	NC	-	NC	NC	BDL	NC	-	NC	NC	BDL	NC	-
28	884	Annamalai Gr, Thottam	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
29	131	Somanur Gr, Thottam	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
30	-	River water (Control)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
		Mean	-	-	-	-		-	-	-	-	-	-	-	-	-	-

*NW - No Water *BDL – Below Detectable Limit * NC- Not collected

Table 3 f. Pb and Cr content of the ground water samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No.	SF	Sample ID	Pb (ppm)					Cr (ppm)				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426	Factory (Block A)	NC	NC	1.03	0.98	1.01	NC	NC	BDL	BDL	-
2	923	Factory (Block B)	0.53	0.47	NW	NW	0.50	BDL	BDL	NW	NW	-
3	925	Factory (Block B)	0.86	0.81	0.90	0.92	0.87	BDL	BDL	BDL	BDL	-
4	942	Factory (Block B)	0.53	0.50	0.41	0.43	0.47	BDL	BDL	BDL	BDL	-
5	932	Factory (Block B)	1.09	1.21	0.90	0.94	1.04	BDL	BDL	BDL	BDL	-
6	411	Block A	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
7	923	Factory (Block B)	0.62	0.58	0.49	0.42	0.53	BDL	BDL	BDL	BDL	-
8	922	Factory (Block B)	0.41	0.46	0.61	0.69	0.54	BDL	BDL	BDL	BDL	-
9	884	Factory (Block E)	0.28	0.23	0.31	0.37	0.30	BDL	BDL	BDL	BDL	-
10	893	Factory (Block E)	0.07	0.12	BDL	BDL	0.10	BDL	BDL	BDL	BDL	-
11	851	Factory (Block F)	0.3	0.25	0.05	0.08	0.17	BDL	BDL	BDL	BDL	-
12	850	Factory (Block F)	0.41	0.36	0.06	0.08	0.23	BDL	BDL	BDL	BDL	-
13	778	Factory (Block G)	NC	NC	0.02	0.08	0.05	NC	NC	BDL	BDL	-
14	779	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-
15	962	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-
16	141	Factory (Block D)	0.14	0.17	NC	NC	0.16	BDL	BDL	NC	NC	-
17	416	Nachimuthu	0.23	0.27	0.16	0.19	0.21	BDL	BDL	BDL	BDL	-
18	424	Selvaraj	0.50	0.42	0.23	NC	0.38	BDL	BDL	BDL	NC	-

19	427	Pettiyan (Servall)	0.23	0.27	0.53	0.61	0.41	BDL	BDL	BDL	BDL	-
20	-	Stream near Varatharajthottam	0.22	0.25	0.21	0.27	0.24	BDL	BDL	BDL	BDL	-
21	93	Velumaniammal	NC	NC	NC	NC	-	NC	NC	NC	NC	-
22	414	Batheri	NC	NC	0.30	0.26	0.28	NC	NC	BDL	BDL	-
23	916	Kalikutty&Rajan	0.31	0.38	0.33	0.31	0.33	BDL	BDL	BDL	BDL	-
24	911	Rangaraj	0.36	0.42	0.46	0.47	0.43	BDL	BDL	BDL	BDL	-
25	937	Kandasamy	0.23	0.29	0.13	0.23	0.22	BDL	BDL	BDL	BDL	-
26	881	Natraj Gounder	0.17	0.12	0.27	0.21	0.19	BDL	BDL	BDL	BDL	-
27	876	Subbaiyan	NC	NC	0.07	NC	0.07	NC	NC	BDL	NC	-
28	884	Annamalai Gr, Thottam	0.08	0.05	0.08	0.06	0.07	BDL	BDL	BDL	BDL	-
29	131	Somanur Gr, Thottam	0.13	0.18	0.11	0.17	0.15	BDL	BDL	BDL	BDL	-
30	-	River water (Control)	0.3	0.26	0.31	0.37	0.31	BDL	BDL	BDL	BDL	-
		Mean	**0.36**	**0.37**	**0.35**	**0.39**	-	-	-	-	-	-

*NW - No Water *BDL – Below Detectable Limit * NC- Not collected

Table 4 a. pH, EC, TDS and Sodium content of the bore well water samples collected from the bench mark sites for continuous monitoring of ground water quality

S.No	SF	Sample ID	pH					EC (dSm^{-1})					TDS ($mg\ L^{-1}$)					Sodium ($mg\ L^{-1}$)				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426/1D	Backside of raw water unit	7.55	7.51	7.57	NC	**7.54**	0.22	0.25	0.28	NC	**0.25**	140.8	160	151	NC	**113.01**	12.35	14.58	13.52	NC	**13.48**
2	418	Old time office	7.48	7.53	7.55	7.41	**7.49**	1.38	1.35	1.45	1.41	**1.40**	883.2	864	869	880	**699.52**	125.50	128.25	121.53	127.42	**125.68**
3	415/3A	Admin block office	7.08	7.15	7.16	7.19	**7.15**	1.12	1.18	1.12	1.27	**1.17**	716.8	755.2	765	782	**604.03**	89.65	86.94	81.3	88.32	**86.55**
4	939/1A1	Bamboo garden	7.90	7.84	7.92	NC	**7.89**	1.65	1.74	1.61	NC	**1.67**	1056	1113.6	1175	NC	**836.57**	128.36	128.36	126.93	NC	**127.88**
5	940	Coconut farm	7.65	7.72	7.61	NC	**7.66**	1.72	1.63	1.73	NC	**1.69**	1100.8	1043.2	1128	NC	**818.42**	133.25	130.67	137.6	NC	**133.84**
6	932	Coconut farm	7.66	7.53	7.59	NC	**7.59**	1.65	1.69	1.53	NC	**1.62**	1056	1081.6	1036	NC	**793.81**	134.58	138.32	138.2	NC	**137.03**
		Mean	**7.55**	**7.55**	**7.57**	**7.30**	**7.55**	**1.29**	**1.31**	**1.29**	**1.34**	**1.30**	**825.60**	**836.27**	**854.00**	**831.00**	**644.23**	**103.95**	**104.52**	**103.18**	**107.87**	**104.08**

* NC- Not collected

Table 4b. Potassium, Calcium, Magnesium and Carbonate content of the bore well water samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	Potassium (mg L^{-1})					Calcium (mg L^{-1})					Magnesium (mg L^{-1})					Carbonate (mg L^{-1})				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426/1D	Backside of raw water unit	1.90	2.53	1.87	NC	**2.10**	31.25	33.64	39.52	NC	**34.80**	14.50	12.28	12.9	NC	**18.62**	12.55	14.28	12.16	NC	**13.00**
2	418	Old time office	6.96	7.29	7.74	8.03	**7.51**	56.32	55.42	50.62	52.73	**53.77**	33.26	35.61	35.15	37.27	**39.01**	29.36	27.08	25.61	27.50	**27.39**
3	415/3A	Admin block office	3.15	3.05	2.99	3.15	**3.09**	89.65	86.39	86.68	88.98	**87.93**	39.65	37.98	31.43	32.80	**45.96**	26.35	25.92	28.83	27.39	**27.12**
4	939/1A1	Bamboo garden	1.80	2.36	1.89	NC	**2.02**	98.87	96.12	98.01	NC	**97.67**	38.85	36.15	40.56	NC	**53.31**	21.21	23.21	22.63	NC	**22.35**
5	940	Coconut farm	2.40	3.74	2.84	NC	**2.99**	120.01	122.38	121.16	NC	**121.18**	48.85	47.29	42.65	NC	**64.99**	33.87	35.73	30.22	NC	**33.27**
6	932	Coconut farm	8.25	7.81	7.91	NC	**7.99**	132.20	132.57	123.28	NC	**129.35**	53.30	53.20	48.50	NC	**71.09**	20.2	18.26	25.21	NC	**21.22**
		Mean	**4.08**	**4.46**	**4.21**	**5.59**	**4.28**	**88.05**	**87.75**	**86.55**	**70.86**	**87.45**	**38.07**	**37.09**	**35.20**	**35.04**	**48.83**	**23.92**	**24.08**	**24.11**	**27.45**	**24.06**

* NC- Not collected

Table 4c. Bicarbonate, Sulphate and Chloride content of the bore well water samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	Bicarbonate (mg L^{-1})					Sulphate (mg L^{-1})					Chloride (mg L^{-1})				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426/1D	Backside of raw water unit	122.27	120.25	128.67	NC	**123.73**	5.65	12.33	12.76	NC	**10.25**	39.65	37.59	41.12	NC	**32.15**
2	418	Old time office	219.65	217.46	230.25	228.22	**223.90**	56.32	55.28	57.95	58.30	**56.96**	248.87	245.23	250.21	248.62	**209.98**
3	415/3A	Admin block office	287.46	286.28	281.62	285.73	**285.27**	58.87	56.39	65.63	60.30	**60.30**	210.23	213.64	213.89	190.63	**177.74**
4	939/1A1	Bamboo garden	312.25	311.92	326.25	NC	**316.81**	121.23	120.56	119.23	NC	**120.34**	265.89	268.60	264.15	NC	**229.75**
5	940	Coconut farm	245.58	243.64	250.19	NC	**246.47**	156.35	154.72	148.42	NC	**153.16**	310.25	305.28	304.56	NC	**268.31**
6	932	Coconut farm	300.27	285.36	295.76	NC	**293.80**	198.89	196.31	195.70	NC	**196.97**	310.26	304.82	311.29	NC	**280.83**
		Mean	**247.91**	**244.15**	**252.12**	**256.98**	**248.33**	**99.55**	**99.27**	**99.95**	**59.30**	**99.66**	**230.86**	**229.19**	**230.87**	**219.63**	**199.79**

* NC- Not collected

Table 4 d. SAR, Calcium, RSC and SSP content of the bore well water samples collected from the bench mark sites for continuous monitoring of ground water quality

S.No	SF	Sample ID	SAR					RSC					SSP				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426/1D	Backside of raw water unit	0.36	0.43	0.37	-	**0.39**	3.42	4.03	3.11	-	**3.52**	16.00	18.62	15.94	-	**16.85**
2	418	Old time office	2.66	2.70	2.64	2.71	**2.68**	7.80	6.85	6.85	7.17	**7.17**	48.62	48.48	48.29	48.22	**48.40**
3	415/3A	Admin block office	1.57	1.56	1.49	1.59	**1.55**	5.71	5.85	7.27	6.63	**6.37**	33.13	33.33	33.46	34.58	**33.63**
4	939/1A1	Bamboo garden	2.18	2.22	2.15	-	**2.18**	4.01	5.03	4.61	-	**4.55**	40.42	41.46	39.85	-	**40.58**
5	940	Coconut farm	2.04	2.00	2.14	-	**2.06**	5.24	5.84	4.56	-	**5.21**	36.38	35.87	38.18	-	**36.81**
6	932	Coconut farm	1.97	2.02	2.10	-	**2.03**	0.60	-0.30	3.05	-	**1.12**	34.19	34.81	36.60	-	**35.20**
		Mean	**1.80**	**1.82**	**1.82**	**2.15**	**1.82**	**4.46**	**4.55**	**4.91**	**6.90**	**4.66**	**34.79**	**35.43**	**35.39**	**41.40**	**35.24**

* NC- Not collected

Table 4 e. Ni, As and Cd content of the bore well water samples collected from the bench mark sites for continuous monitoring of ground water quality

S.No	SF	Sample ID	Ni (ppm)					As (ppm)					Cd (ppm)				
			Sep., 2022	Dec., 2022	March., 2023	June. 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June. 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June. 2023	Mean
1	426/1D	Backside of raw water unit	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-
2	418	Old time office	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
3	415/3A	Admin block office	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
4	939/1A1	Bamboo garden	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-
5	940	Coconut farm	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-
6	932	Coconut farm	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-
		Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* NC- Not collected *BDL – Below Detectable Limit

Table 4 f. Pb and Cr content of the bore well water samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	Pb (ppm)					Cr (ppm)				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426/1D	Backside of raw waterunit	0.08	0.06	0.07	NC	**0.07**	BDL	BDL	BDL	NC	-
2	418	Old time office	0.14	0.24	0.0053	0.007	**0.10**	BDL	BDL	BDL	BDL	-
3	415/3A	Admin block office	0.03	0.05	0.02	0.03	**0.03**	BDL	BDL	BDL	BDL	-
4	939/1A1	Bamboo garden	0.85	0.71	0.79	NC	**0.78**	BDL	BDL	BDL	NC	-
5	940	Coconut farm	0.09	0.06	BDL	NC	**0.08**	BDL	BDL	BDL	NC	-
6	932	Coconut farm	0.11	0.17	0.34	NC	**0.21**	BDL	BDL	BDL	NC	-
		Mean	**0.22**	**0.22**	**0.25**	**0.02**	**0.21**	-	-	-	-	-

*BDL – Below Detectable Limit * NC- Not collected

Table 5 a. pH, EC and OC content of the soil samples collected in ITC factory and surroundings area

Sample No.	SF	Sample ID	pH					EC (dSm^{-1})					OC(%)				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426	Factory (Block A)	7.68	7.62	7.59	7.47	**7.59**	0.34	0.39	0.36	0.31	**0.35**	0.48	0.52	0.43	0.57	**0.50**
2	923	Factory (Block B)	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-
3	925	Factory (Block B)	7.34	7.43	NC	NC	**7.39**	0.51	0.55	NC	NC	**0.53**	0.34	0.31	NC	NC	**0.33**
4	942	Factory (Block B)	6.89	6.85	NC	NC	**6.87**	0.63	0.66	NC	NC	**0.65**	0.21	0.26	NC	NC	**0.24**
5	932	Factory (Block B)	7.62	7.68	NC	NC	**7.65**	0.58	0.62	NC	NC	**0.60**	0.56	0.62	NC	NC	**0.59**
6	411	Factory (Block A)	7.54	7.48	7.39	7.36	**7.44**	0.29	0.31	0.37	0.39	**0.34**	0.45	0.53	0.58	0.56	**0.53**
7	923	Factory (Block B)	7.46	7.52	7.51	7.58	**7.52**	0.76	0.73	0.86	0.80	**0.79**	0.55	0.51	0.59	0.58	**0.56**
8	922	Factory (Block B)	7.84	7.89	7.81	7.68	**7.81**	0.78	0.72	0.69	0.74	**0.73**	0.64	0.68	0.72	0.78	**0.71**
9	884	Factory (Block E)	7.51	7.56	7.58	7.61	**7.57**	0.28	0.33	0.29	0.28	**0.30**	0.34	0.30	0.31	0.36	**0.33**
10	893	Factory (Block E)	7.74	7.80	NC	NC	**7.77**	0.46	0.50	NC	NC	**0.48**	0.62	0.58	NC	NC	**0.60**
11	851	Factory (Block F)	7.62	7.69	7.65	7.76	**7.68**	0.34	0.38	0.41	0.48	**0.40**	0.59	0.63	0.57	0.59	**0.60**
12	850	Factory (Block F)	8.03	8.23	7.96	7.91	**8.03**	0.31	0.29	0.29	0.27	**0.29**	0.82	0.84	0.75	0.89	**0.83**
13	778	Factory (Block G)	7.61	7.72	7.71	7.76	**7.70**	0.42	0.39	0.39	0.46	**0.42**	0.50	0.53	0.49	0.56	**0.52**
14	779	Factory (Block G)	7.38	7.34	NC	NC	**7.36**	0.64	0.67	NC	NC	**0.66**	0.38	0.42	NC	NC	**0.40**
15	962	Factory (Block G)	6.94	6.89	NC	NC	**6.92**	0.72	0.75	NC	NC	**0.74**	0.61	0.65	NC	NC	**0.63**
16	141	Factory (Block D)	7.82	7.86	7.79	7.73	**7.80**	0.62	0.66	0.76	0.72	**0.69**	0.75	0.82	0.90	0.87	**0.84**
17	416	Nachimuthu	7.56	7.52	7.56	7.61	**7.56**	1.25	1.21	1.16	1.21	**1.21**	0.42	0.38	0.35	0.39	**0.39**
18	424	Selvaraj	7.61	7.64	7.57	-	**7.61**	0.86	0.82	0.93	-	**0.87**	0.58	0.62	0.67	-	**0.62**
19	427	Pettiyan (Servall)	7.75	7.65	7.51	7.60	**7.63**	1.28	1.25	1.29	1.27	**1.27**	0.42	0.37	0.45	0.52	**0.44**

20	-	Varatharajthottam	8.13	8.05	7.98	7.89	**8.01**	0.31	0.33	0.35	0.48	**0.37**	0.48	0.52	0.27	0.24	**0.38**
21	93	Velumaniammal	7.42	7.38	NC	NC	**7.40**	0.62	0.68	NC	NC	**0.65**	0.64	0.62	NC	NC	**0.63**
22	414	Batheri	NC	NC	7.47	7.39	**7.43**	NC	NC	0.22	0.27	**0.25**	NC	NC	0.34	0.47	**0.41**
23	916	Kalikutty&Rajan	7.74	7.63	7.76	7.68	**7.70**	0.30	0.34	0.41	0.38	**0.36**	0.63	0.59	0.54	0.61	**0.59**
24	911	Rangaraj	7.54	7.45	7.50	7.57	**7.52**	1.51	1.55	1.54	1.39	**1.50**	0.46	0.49	0.49	0.37	**0.45**
25	937	Rangasamy	7.49	7.56	7.61	7.69	**7.59**	0.85	0.90	0.80	0.89	**0.86**	0.54	0.56	0.51	0.49	**0.53**
26	881	NatrajGounder	7.58	7.62	7.76	7.67	**7.66**	1.21	1.19	1.15	1.27	**1.21**	0.30	0.34	0.29	0.31	**0.31**
27	876	Subbaiyan	NC	NC	7.89	7.98	**7.94**	NC	NC	0.22	0.26	**0.24**	NC	NC	0.29	0.28	**0.29**
28	884	Annamalai Gr, Thottam	7.58	7.62	7.50	7.68	**7.60**	0.23	0.28	0.21	0.17	**0.22**	0.53	0.56	0.52	0.59	**0.55**
29	131	Somanur Gr, Thottam	6.89	6.81	NC	NC	**6.85**	0.52	0.60	NC	NC	**0.56**	0.49	0.54	NC	NC	**0.52**
		Mean	**7.55**	**7.56**	**7.66**	**7.66**	-	**0.64**	**0.66**	**0.64**	**0.63**	-	**0.51**	**0.53**	**0.50**	**0.53**	-

* RSS– Repeated Sample Site * NC- Not collected

Table 5 b. Available Nitrogen, Phosphorus and Potassium content of the soil samples collected in ITC factory and surroundings area

Sample No.	SF	Sample ID	Available Nitrogen (kg ha^{-1})					Available Phosphorus (kg ha^{-1})					Available Potassium (kg ha^{-1})				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426	Factory (Block A)	128.94	131.29	121.56	114.44	**124.06**	22.64	24.25	23.27	26.32	**24.12**	181.34	178.03	179.89	181.63	**180.22**
2	923	Factory (Block B)	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-
3	925	Factory (Block B)	98.27	103.67	NC	NC	**100.97**	19.34	22.59	NC	NC	**20.97**	165.05	163.68	NC	NC	**164.37**
4	942	Factory (Block B)	124.32	122.39	NC	NC	**123.36**	12.08	14.24	NC	NC	**13.16**	142.38	140.27	NC	NC	**141.33**
5	932	Factory (Block B)	89.19	91.25	NC	NC	**90.22**	23.65	25.67	NC	NC	**24.66**	124.12	123.16	NC	NC	**123.64**
6	411	Factory (Block A)	119.58	114.65	115.16	120.15	**117.39**	17.92	16.98	16.76	18.43	**17.52**	188.11	186.25	182.35	183.61	**185.08**
7	923	Factory (Block B)	139.57	142.83	140.84	141.61	**141.21**	28..34	31.05	28.89	25.41	**28.45**	98.04	97.91	92.78	97.94	**96.67**
8	922	Factory (Block B)	268.67	270.28	254.70	257.36	**262.75**	96.28	94.26	95.54	97.16	**95.81**	218.72	209.43	201.56	211.80	**210.38**
9	884	Factory (Block E)	125.91	128.39	130.15	126.47	**127.73**	21.82	23.42	21.22	27.85	**23.58**	172.15	169.71	180.59	180.13	**175.65**
10	893	Factory (Block E)	128.61	125.62	NC	NC	**127.12**	30.52	28.15	NC	NC	**29.34**	158.39	161.58	NC	NC	**159.99**
11	851	Factory (Block F)	139.58	141.97	148.48	147.95	**144.50**	21.37	19.36	21.18	21.65	**20.89**	160.51	158.47	156.27	179.43	**163.67**
12	850	Factory (Block F)	96.91	92.14	96.78	97.17	**95.75**	19.64	22.48	19.85	19.76	**20.43**	169.43	165.63	164.57	166.50	**166.53**

13	778	Factory (Block G)	102.94	108.29	107.33	105.65	**106.05**	22.64	23.97	22.47	24.84	**23.48**	99.24	102.38	96.43	95.70	**98.44**
14	779	Factory (Block G)	112.34	115.95	NC	NC	**114.15**	24.35	25.82	NC	NC	**25.09**	128.17	131.08	NC	NC	**129.63**
15	962	Factory (Block G)	128.05	132.41	NC	NC	**130.23**	26.37	28.23	NC	NC	**27.30**	139.31	141.26	NC	NC	**140.29**
16	141	Factory (Block D)	134.85	128.76	124.63	126.75	**128.75**	26.34	29.60	30.18	29.64	**28.94**	88.25	91.28	89.65	79.14	**87.08**
17	416	Nachimuthu	135.90	137.51	129.83	125.60	**132.21**	21.66	23.27	23.70	20.60	**22.31**	310.42	313.62	312.14	298.75	**308.73**
18	424	Selvaraj	105.81	109.34	101.33	-	**105.49**	31.24	33.08	33.52		**32.61**	95.28	92.70	95.17	-	**94.38**
19	427	Pettiyan (Servall)	128.13	126.34	126.68	120.72	**125.47**	29.34	30.86	30.72	29.16	**30.02**	223.27	220.84	226.92	229.85	**225.22**
20	-	Varatharajthottam	149.07	151.36	151.78	157.36	**152.39**	20.39	23.75	23.82	25.74	**23.43**	100.37	109.34	107.16	103.78	**105.16**
21	93	Velumaniammal	152.64	154.27	NC	NC	**153.46**	22.64	23.16	NC	NC	**22.90**	124.08	128.05	NC	NC	**126.07**
22	414	Batheri	NC	NC	127.12	126.63	**126.88**	NC	NC	28.14	26.98	**27.56**	NC	NC	140.73	142.75	**141.74**
23	916	Kalikutty&Rajan	136.90	132.82	130.49	122.84	**130.76**	30.23	32.21	30.16	31.64	**31.06**	82.46	84.42	80.88	88.49	**84.06**
24	911	Rangaraj	135.61	138.90	136.96	139.51	**137.75**	26.92	28.76	28.18	27.65	**27.88**	323.42	319.52	330.77	290.68	**316.10**
25	937	Rangasamy	101.92	108.16	109.12	105.17	**106.09**	36.08	35.84	35.0	34.16	**35.27**	97.15	99.50	97.93	95.34	**97.48**
26	881	NatrajGounder	130.61	129.42	121.52	129.25	**127.70**	24.31	26.43	26.80	28.82	**26.59**	232.08	227.16	221.71	226.60	**226.89**
27	876	Subbaiyan	NC	NC	170.54	164.58	**167.56**	NC	NC	19.35	20.35	**19.85**	NC	NC	109.73	115.96	**112.85**
28	884	Annamalai Gr, Thottam	98.30	95.61	94.47	98.42	**96.70**	19.07	18.38	21.72	21.62	**20.20**	188.19	186.31	181.54	176.58	**183.16**
29	131	Somanur Gr, Thottam	123.64	118.25	NC	NC	**120.95**	26.16	24.19	NC	NC	**25.18**	162.46	159.43	NC	NC	**160.95**
		Mean	**128.32**	**128.92**	**131.97**	**133.03**	-	**26.92**	**28.08**	**29.02**	**29.36**	-	**160.48**	**160.04**	**162.44**	**165.51**	-

* RSS– Repeated Sample Site * NC- Not collected

Table 5 c. Ex. Calcium, Magnesium, Sodium and Potassium content of the soil samples collected in ITC factory and surroundings area

S. No	SF	Sample ID	Ex. Sodium (cmol (p^+) kg^{-1})					Ex. Potassium (cmol (p^+) kg^{-1})					Ex. Calcium (cmol (p^+) kg^{-1})					Ex. Magnesium (cmol (p^+) kg^{-1})				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426	Factory (Block A)	0.81	0.85	0.79	0.83	**0.82**	1.15	1.19	1.12	1.21	**1.17**	0.51	0.62	0.60	0.65	**0.60**	0.32	0.36	0.81	0.75	**0.56**
2	923	Factory (Block B)	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	R SS	-	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-
3	925	Factory (Block B)	0.91	0.96	NC	NC	**0.94**	0.93	0.85	NC	NC	**0.89**	0.46	0.54	NC	NC	**0.50**	0.49	0.53	NC	NC	**0.51**
4	942	Factory (Block B)	0.74	0.82	NC	NC	**0.78**	1.31	1.36	NC	NC	**1.34**	0.95	1.20	NC	NC	**1.08**	0.61	0.65	NC	NC	**0.63**
5	932	Factory (Block B)	0.68	0.73	NC	NC	**0.71**	1.28	1.34	NC	NC	**1.31**	1.25	1.32	NC	NC	**1.29**	0.73	0.81	NC	NC	**0.77**
6	411	Factory (Block A)	0.70	0.75	0.69	0.81	**0.74**	1.09	1.14	1.21	1.19	**1.16**	0.58	0.46	0.45	0.59	**0.52**	0.46	0.52	0.91	0.82	**0.68**
7	923	Factory (Block B)	0.98	0.92	0.89	0.90	**0.92**	0.56	0.62	0.58	0.62	**0.60**	0.89	0.92	0.90	0.92	**0.91**	0.68	0.73	0.51	0.48	**0.60**
8	922	Factory (Block B)	0.65	0.73	0.72	0.71	**0.70**	1.24	1.28	1.15	1.22	**1.22**	0.81	0.88	0.79	0.72	**0.80**	0.69	0.72	0.68	0.61	**0.68**
9	884	Factory (Block E)	1.12	1.25	1.19	0.98	**1.14**	1.16	1.22	1.23	1.20	**1.20**	0.38	0.45	0.44	0.41	**0.42**	0.24	0.28	0.30	0.22	**0.26**
10	893	Factory (Block E)	0.95	0.89	NC	NC	**0.92**	0.94	0.87	NC	NC	**0.91**	0.60	0.57	NC	NC	**0.59**	1.29	1.32	NC	NC	**1.31**
11	851	Factory (Block F)	0.92	0.96	0.95	0.87	**0.93**	1.08	1.13	1.15	1.24	**1.15**	0.83	0.94	0.89	0.81	**0.87**	0.64	0.57	0.59	0.55	**0.59**
12	850	Factory (Block F)	0.82	0.88	0.86	0.84	**0.85**	1.21	1.27	1.25	1.10	**1.21**	0.73	0.86	0.79	0.81	**0.80**	0.42	0.37	0.31	0.46	**0.39**

13	778	Factory (Block G)	0.81	0.86	0.90	0.87	**0.86**	0.61	0.65	0.64	0.60	**0.63**	0.80	0.91	0.90	0.98	**0.90**	0.71	0.66	0.65	0.72	**0.69**
14	779	Factory (Block G)	0.73	0.68	NC	NC	**0.71**	0.73	0.68	NC	NC	**0.71**	0.56	0.62	NC	NC	**0.59**	0.39	0.43	NC	NC	**0.41**
15	962	Factory (Block G)	0.61	0.65	NC	NC	**0.63**	1.26	1.35	NC	NC	**1.31**	0.58	0.62	NC	NC	**0.60**	1.36	1.41	NC	NC	**1.39**
16	141	Factory (Block D)	1.13	1.34	1.21	1.11	**1.20**	1.24	1.32	1.31	1.27	**1.29**	0.75	0.83	0.81	0.75	**0.79**	0.56	0.62	0.59	0.48	**0.56**
17	416	Nachimuthu	2.19	2.26	2.28	1.91	**2.16**	1.92	2.08	2.07	1.91	**2.00**	0.56	0.60	0.64	0.72	**0.63**	0.28	0.33	0.45	0.51	**0.39**
18	424	Selvaraj	0.82	0.79	0.77	-	**0.79**	0.62	0.74	0.69	-	**0.68**	0.64	0.75	0.71	-	**0.70**	0.34	0.40	0.35	-	**0.36**
19	427	Pettiyan (Servall)	1.39	1.43	1.56	1.45	**1.46**	1.86	1.94	1.85	1.91	**1.89**	0.77	0.81	0.88	0.80	**0.82**	0.39	0.42	0.58	0.55	**0.49**
20	-	Varatharajth ottam	1.42	1.46	1.38	1.41	**1.42**	0.64	0.71	0.77	0.68	**0.70**	0.91	0.89	0.85	0.82	**0.87**	0.64	0.73	0.59	0.72	**0.67**
21	93	Velumania mmal	1.08	1.17	NC	NC	**1.13**	1.04	1.23	NC	NC	**1.14**	1.12	1.19	NC	NC	**1.16**	0.81	0.79	NC	NC	**0.80**
22	414	Batheri	NC	NC	0.65	0.79	**0.72**	NC	NC	0.19	0.24	**0.22**	NC	NC	1.51	1.39	**1.45**	NC	NC	0.69	0.61	**0.65**
23	916	Kalikutty& Rajan	1.34	1.31	1.38	1.45	**1.37**	0.67	0.73	0.72	0.69	**0.70**	0.71	0.67	0.68	0.72	**0.70**	0.59	0.64	0.57	0.51	**0.58**
24	911	Rangaraj	2.62	2.54	2.50	1.42	**2.27**	1.83	1.92	1.87	1.82	**1.86**	0.56	0.61	0.65	0.69	**0.63**	0.34	0.38	0.42	0.47	**0.40**
25	937	Rangasamy	0.93	0.87	0.97	0.81	**0.90**	0.49	0.58	0.51	0.61	**0.55**	0.62	0.66	0.75	0.84	**0.72**	0.16	0.23	0.28	0.31	**0.25**
26	881	Natraj Gounder	1.25	1.31	1.44	1.26	**1.32**	1.38	1.45	1.38	1.34	**1.39**	0.71	0.79	0.84	0.79	**0.78**	0.57	0.52	0.58	0.62	**0.57**
27	876	Subbaiyan	NC	NC	0.95	0.82	**0.89**	NC	NC	0.65	0.51	**0.58**	NC	NC	1.17	1.02	**1.10**	NC	NC	0.69	0.80	**0.75**
28	884	Annamalai Gr, Thottam	0.84	0.87	0.81	0.84	**0.84**	1.08	1.19	1.21	1.22	**1.18**	0.42	0.38	0.61	0.67	**0.52**	0.52	0.63	0.91	0.98	**0.76**
29	131	Somanur Gr, Thottam	0.68	0.63	NC	NC	**0.66**	1.26	1.32	NC	NC	**1.29**	0.87	0.93	NC	NC	**0.90**	1.06	1.23	NC	NC	**1.15**
		Mean	**1.04**	**1.07**	**1.14**	**1.06**	**-**	**1.10**	**1.16**	**1.08**	**1.08**	**-**	**0.71**	**0.77**	**0.79**	**0.79**	**-**	**0.59**	**0.63**	**0.57**	**0.59**	**-**

* NC- Not collected *RSS – Repeated Sample Site

Table 5 d. Ni, As and Cd content of the soil samples collected in ITC factory and surroundings area

Sample No	SF	Sample ID	Ni (ppm)					As (ppm)					Cd (ppm)				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426	Factory (Block A)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
2	923	Factory (Block B)	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-
3	925	Factory (Block B)	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
4	942	Factory (Block B)	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
5	932	Factory (Block B)	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
6	411	Factory (Block A)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
7	923	Factory (Block B)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
8	922	Factory (Block B)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
9	884	Factory (Block E)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
10	893	Factory (Block E)	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
11	851	Factory (Block F)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
12	850	Factory (Block F)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-

13	778	Factory (Block G)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
14	779	Factory (Block G)	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
15	962	Factory (Block G)	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
16	141	Factory (Block D)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
17	416	Nachimuthu	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
18	424	Selvaraj	BDL	BDL	BDL	-	-	BDL	BDL	BDL	-	-	BDL	BDL	BDL	-	-
19	427	Pettiyan (Servall)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
20	-	Varatharajthottam	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
21	93	Velumaniammal	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
22	414	Batheri	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-
23	916	Kalikutty&Rajan	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
24	911	Rangaraj	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
25	937	Rangasamy	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
26	881	NatrajGounder	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
27	876	Subbaiyan	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-
28	884	Annamalai Gr, Thottam	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
29	131	Somanur Gr, Thottam	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
		Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* RSS– Repeated Sample Site * NC- Not collected *BDL – Below Detectable Limit

Table 5 e. Pb and Cr content of the soil samples collected in ITC factory and surroundings area

Sample No	SF	Sample ID	Pb (ppm)					Cr (ppm)				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426	Factory (Block A)	1.08	1.13	1.08	1.02	**1.08**	BDL	BDL	BDL	BDL	-
2	923	Factory (Block B)	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-
3	925	Factory (Block B)	0.38	0.45	NC	NC	**0.42**	BDL	BDL	NC	NC	-
4	942	Factory (Block B)	0.27	0.24	NC	NC	**0.26**	BDL	BDL	NC	NC	-
5	932	Factory (Block B)	0.20	0.23	NC	NC	**0.22**	BDL	BDL	NC	NC	-
6	411	Factory (Block A)	0.48	0.52	0.41	0.47	**0.47**	BDL	BDL	BDL	BDL	-
7	923	Factory (Block B)	1.13	1.11	1.14	1.02	**1.10**	BDL	BDL	BDL	BDL	-
8	922	Factory (Block B)	1.03	1.13	0.93	0.84	**0.98**	BDL	BDL	BDL	BDL	-
9	884	Factory (Block E)	0.05	0.08	BDL	BDL	**0.07**	BDL	BDL	BDL	BDL	-
10	893	Factory (Block E)	1.34	1.39	NC	NC	**1.37**	BDL	BDL	NC	NC	-
11	851	Factory (Block F)	0.21	0.25	0.30	0.37	**0.28**	BDL	BDL	BDL	BDL	-
12	850	Factory (Block F)	0.26	0.23	0.21	0.28	**0.25**	BDL	BDL	BDL	BDL	-
13	778	Factory (Block G)	0.42	0.37	0.62	0.57	**0.50**	BDL	BDL	BDL	BDL	-
14	779	Factory (Block G)	0.35	0.32	NC	NC	**0.34**	BDL	BDL	NC	NC	-

15	962	Factory (Block G)	1.21	1.24	NC	NC	**1.23**	BDL	BDL	NC	NC	-
16	141	Factory (Block D)	1.35	1.38	1.21	1.18	**1.28**	BDL	BDL	BDL	BDL	-
17	416	Nachimuthu	0.21	0.19	0.23	0.25	**0.22**	BDL	BDL	BDL	BDL	-
18	424	Selvaraj	0.06	0.08	BDL	-	**0.07**	BDL	BDL	BDL	-	-
19	427	Pettiyan (Servall)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
20	-	Varatharajthottam	0.18	0.22	0.22	0.20	**0.21**	BDL	BDL	BDL	BDL	-
21	93	Velumaniammal	0.13	0.15	NC	NC	**0.14**	BDL	BDL	NC	NC	-
22	414	Batheri	NC	NC	0.27	0.32	**0.30**	NC	NC	BDL	BDL	-
23	916	Kalikutty&Rajan	0.24	0.28	0.45	0.57	**0.39**	BDL	BDL	BDL	BDL	-
24	911	Rangaraj	0.67	0.72	0.46	0.42	**0.57**	BDL	BDL	BDL	BDL	-
25	937	Rangasamy	0.18	0.17	0.24	0.25	**0.21**	BDL	BDL	BDL	BDL	-
26	881	NatrajGounder	0.16	0.19	0.17	0.19	**0.18**	BDL	BDL	BDL	BDL	-
27	876	Subbaiyan	NC	NC	0.45	0.56	**0.51**	NC	NC	BDL	BDL	-
28	884	Annamalai Gr, Thottam	1.14	1.18	0.15	0.21	**0.67**	BDL	BDL	BDL	BDL	-
29	131	Somanur Gr, Thottam	0.09	0.06	NC	NC	**0.08**	BDL	BDL	NC	NC	-
		Mean	**0.51**	**0.53**	**0.50**	**0.51**	**0.52**	-	-	-	-	-

* RSS– Repeated Sample Site * NC- Not collected *BDL – Below Detectable Limit

Table 6 a. pH, EC and OC content of the soil samples collected in ITC factory premises

S. No	SF	Sample ID	pH					EC (dSm^{-1})					OC %				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426/1D	Backside of raw water unit	8.08	8.11	8.05	7.99	**8.06**	0.18	0.16	0.19	0.17	**0.18**	0.66	0.69	0.52	0.60	**0.62**
2	418	Old time office	7.81	7.78	7.73	7.89	**7.80**	0.26	0.29	0.24	0.25	**0.26**	0.51	0.48	0.43	0.51	**0.48**
3	415/3A	Admin block office	8.21	8.24	8.17	8.29	**8.23**	0.28	0.22	0.31	0.29	**0.28**	0.66	0.68	0.59	0.57	**0.63**
4	939/1A1	Bamboo garden	7.62	7.65	7.67	7.61	**7.64**	0.62	0.65	0.63	0.67	**0.64**	0.57	0.54	0.53	0.59	**0.56**
5	940	Coconut farm	7.27	7.32	7.37	7.34	**7.33**	0.91	0.96	0.89	0.95	**0.93**	0.34	0.36	0.37	0.32	**0.35**
6	932	Coconut farm	6.96	6.85	6.78	6.93	**6.88**	0.78	0.75	0.81	0.88	**0.81**	0.42	0.40	0.22	0.30	**0.34**
		Mean	**7.66**	**7.66**	**7.63**	**7.68**	**7.66**	**0.51**	**0.51**	**0.51**	**0.54**	**0.51**	**0.53**	**0.53**	**0.44**	**0.48**	**0.49**

* NC- Not collected

Table 6 b. Available Nitrogen, Phosphorus and Potassium content of the soil samples collected in ITC factory premises

S.No	SF	Sample ID	Available N (kg ha^{-1})					Available P (kg ha^{-1})					Available K (kg ha^{-1})				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426/1D	Backside of raw water unit	160.31	163.28	159.82	158.79	**160.55**	21.08	24.29	25.22	22.34	**23.23**	246.28	252.68	256.12	247.61	**250.67**
2	418	Old time office	211.34	215.36	215.88	210.91	**213.37**	22.64	21.59	20.16	21.45	**21.46**	272.36	270.13	274.84	261.72	**269.76**
3	415/3A	Admin block office	181.06	185.94	176.78	181.91	**181.42**	25.67	22.67	22.41	23.51	**23.57**	185.20	181.42	184.52	190.17	**185.33**
4	939/1A1	Bamboo garden	221.04	224.18	206.76	198.37	**212.59**	26.94	28.49	24.76	23.62	**25.95**	122.36	120.36	124.16	121.78	**122.17**
5	940	Coconut farm	192.37	187.29	188.63	198.49	**191.70**	26.37	28.92	26.78	23.72	**26.45**	240.14	238.25	249.42	231.56	**239.84**
6	932	Coconut farm	141.64	136.57	135.62	141.46	**138.82**	25.08	29.76	26.81	27.58	**27.31**	153.61	152.42	151.62	156.48	**153.53**
		Mean	**184.63**	**185.44**	**180.58**	**181.66**	**183.08**	**24.63**	**25.95**	**24.36**	**23.70**	**24.66**	**203.33**	**202.54**	**206.78**	**201.55**	**203.55**

* NC- Not collected

Table 6 c. Ex.Calcium, Magnesium, Sodium and Potassium content of the soil samples collected in ITC factory premises

S. No	SF	SampleID	Exchangeable Na (cmol (p^+) kg^{-1})					Exchangeable K (cmol (p^+) kg^{-1})					Exchangeable Ca (cmol (p^+) kg^{-1})					Exchangeable Mg (cmol (p^+) kg^{-1})				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426/1D	Backside of raw water unit	1.21	1.89	1.71	1.64	**1.61**	1.61	1.66	1.65	1.60	**1.63**	0.81	0.78	0.96	0.87	**0.86**	0.42	0.37	0.50	0.49	**0.45**
2	418	Old time office	1.14	1.18	1.015	1.18	**1.13**	1.24	1.27	1.22	1.18	**1.23**	0.65	0.68	0.72	0.79	**0.71**	0.39	0.36	0.35	0.41	**0.38**
3	415/3A	Admin block office	0.85	0.75	0.88	0.91	**0.85**	0.76	0.74	0.78	0.70	**0.75**	0.76	0.75	0.80	0.86	**0.79**	0.57	0.58	0.51	0.46	**0.53**
4	939/1A1	Bamboo garden	1.36	1.35	1.46	1.49	**1.42**	1.30	1.33	1.29	1.38	**1.33**	0.78	0.69	0.71	0.79	**0.74**	0.56	0.59	0.52	0.54	**0.55**
5	940	Coconut farm	1.38	1.31	1.30	1.42	**1.35**	1.17	1.22	1.19	1.15	**1.18**	0.52	0.56	0.51	0.63	**0.56**	0.28	0.32	0.35	0.37	**0.33**
6	932	Coconut farm	1.57	1.64	1.61	1.58	**1.60**	0.69	0.72	0.70	0.78	**0.72**	0.72	0.75	0.69	0.78	**0.74**	0.42	0.40	0.47	0.49	**0.45**
		Mean	**1.25**	**1.35**	**1.33**	**1.37**	**1.33**	**1.13**	**1.16**	**1.14**	**1.13**	**1.14**	**0.71**	**0.70**	**0.73**	**0.79**	**0.73**	**0.44**	**0.44**	**0.45**	**0.46**	**0.45**

* NC- Not collected

Table 6 d. Ni, As and Cd content of the soil samples collected in ITC factory premises

Sample No	SF	Sample ID	Ni (ppm)					As (ppm)					Cd (ppm)				
			Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March., 2023	June., 2023	Mean
1	426/1D	Backside of raw water unit	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
2	418	Old time office	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
3	415/3A	Admin block office	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
4	939/1A1	Bamboo garden	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
5	940	Coconut farm	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
6	932	Coconut farm	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
		Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*BDL – Below Detectable Limit * NC- Not collected

Table 6 e. Pb and Cr content of the soil samples collected in ITC factory premises

S.No	SF	Sample ID	Pb (ppm)					Cr (ppm)				
			Sep., 2022	Dec., 2022	March, 2023	June., 2023	Mean	Sep., 2022	Dec., 2022	March, 2023	June., 2023	Mean
1	426/1D	Backside of raw water unit	0.09	0.07	0.16	0.10	**0.11**	BDL	BDL	BDL	BDL	-
2	418	Old time office	0.25	0.19	0.21	0.24	**0.22**	BDL	BDL	BDL	BDL	-
3	415/3A	Admin block office	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
4	939/1A1	Bamboo garden	1.14	1.17	1.11	0.98	**1.10**	BDL	BDL	BDL	BDL	-
5	940	Coconut farm	0.54	0.42	0.65	0.52	**0.53**	BDL	BDL	BDL	BDL	-
6	932	Coconut farm	0.76	0.63	0.70	0.74	**0.71**	BDL	BDL	BDL	BDL	-
		Mean	**0.56**	**0.50**	**0.57**	**0.52**	-	-	-	-	-	-

*BDL – Below Detectable Limit * NC- Not collected

Table 7 a. pH, EC, TDS and Sodium content of the piezometer samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	pH			EC (dSm^{-1})			TDS ($mg\ L^{-1}$)			Sodium ($mg\ L^{-1}$)		
			Sep., 2022 & Dec.,2022	March.,2023 &June., 2023	Mean	Sep., 2022 & Dec., 2022	March.,2023 &June., 2023	Mean	Sep., 2022 &Dec.,2022	March.,2023 &June.,2023	Mean	Sep., 2022 & Dec.,2022	March.,2023 &June.,2023	Mean
1	938/1	SLF – 1	7.24	NW	**7.24**	1.21	NW	**1.21**	774.4	NW	**774.4**	98.52	NW	**98.52**
2	938/2	SLF – 2	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
3	938/2	SLF – 3	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
4	940	Coconut farm - 8	7.81	NW	**7.81**	1.73	NW	**1.73**	1107.2	NW	**1107.2**	121.39	NW	**121.39**
5	943	Coconut farm -9a	7.68	NW	**7.68**	0.95	NW	**0.95**	608	NW	**608**	51.2	NW	**51.2**
6	940	Coconut farm -9b	6.15	7.56	**6.855**	0.85	1.21	**1.03**	544	674.8	**609.4**	125.91	122.4	**124.155**
7	936	TNAU Trail Plot	7.12	7.51	**7.315**	1.24	1.21	**1.225**	793.6	763.2	**778.4**	70.19	81.7	**75.945**
8	936	Casurina field	7.15	NW	**7.15**	1.25	NW	**1.25**	800	NW	**800**	67.26	NW	**67.26**
9	415/3A	Admin block office Opposite to Lorry Yard	7.05	7.13	**7.09**	1.14	1.22	**1.18**	729.6	712.5	**721.05**	88.04	91.4	**89.72**
10	411	Factory (Block A)	Closed	Closed	-	Closed	Closed	-	Closed	Closed	-	Closed	Closed	-
		Mean	**7.17**	**7.40**	-	**1.20**	**1.21**	-	**765.26**	**716.83**	-	**88.93**	**98.50**	-

*NW - No Water

Table 7 b. Potassium, Calcium, Magnesium and Carbonate content of the piezometer samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	Potassium (mg L^{-1})			Calcium (mg L^{-1})			Magnesium (mg L^{-1})			Carbonate (mg L^{-1})		
			Sep., 2022 &Dec.,2022	March.,2023 &June., 2023	Mean	Sep., 2022 & Dec., 2022	March.,2023 &June.,2023	Mean	Sep., 2022 & Dec., 2022	March.,2023 &June.,2023	Mean	Sep., 2022 & Dec.,2022	March., 2023 & June., 2023	Mean
1	938/1	SLF – 1	4.15	NW	**4.15**	98.19	NW	**98.19**	45.57	NW	**45.57**	30.19	NW	**30.19**
2	938/2	SLF – 2	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
3	938/2	SLF – 3	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
4	940	Coconut farm - 8	1.67	NW	**1.67**	91.24	NW	**91.24**	39.67	NW	**39.67**	125.16	NW	**125.16**
5	943	Coconut farm -9a	6.60	NW	**6.6**	162.4	NW	**162.4**	85.9	NW	**85.9**	117.42	NW	**117.42**
6	940	Coconut farm -9b	6.98	6.81	**6.895**	82.84	84.1	**83.47**	56.91	59.4	**58.155**	35.64	36.2	**35.92**
7	936	TNAU Trail Plot	8.45	8.75	**8.6**	98.34	96.76	**97.55**	73.61	74.34	**73.975**	117.28	115.4	**116.34**
8	936	Casurina field	8.36	NW	**8.36**	98.02	NW	**98.02**	72.31	NW	**72.31**	115.06	NW	**115.06**
9	415/3A	Admin block office Opposite to Lorry Yard	3.25	3.68	**3.465**	89.71	90.55	**90.13**	38.35	37.43	**37.89**	27.48	25.34	**26.41**
10	411	Factory (Block A)	Closed	Closed	-	Closed	Closed	-	Closed	Closed	-	Closed	Closed	-
		Mean	**5.64**	**6.41**	-	**102.96**	**90.47**	-	**58.90**	**57.06**	-	**81.18**	**58.98**	-

*NW - No Water

Table 7 c. Bicarbonate Sulphate and Chloride content of the piezometer samples collected from the bench mark sites for continuous monitoring ofground water quality

S.No	SF	Sample ID	Bicarbonate (mg L^{-1})			Sulphate (mg L^{-1})			Chloride (mg L^{-1})		
			Sep., 2022 &Dec.,2022	March.,2023 &June., 2023	Mean	Sep., 2022 & Dec., 2022	March.,2023& June.,2023	Mean	Sep., 2022 & Dec., 2022	March.,2023& June.,2023	Mean
1	938/1	SLF – 1	277.52	NW	**277.52**	61.28	NW	**61.28**	208.43	NW	**208.43**
2	938/2	SLF – 2	NW	NW	-	NW	NW	-	NW	NW	-
3	938/2	SLF – 3	NW	NW	-	NW	NW	-	NW	NW	-
4	940	Coconut farm - 8	312.82	NW	**312.82**	126.16	NW	**126.16**	269.91	NW	**269.91**
5	943	Coconut farm -9a	226.5	NW	**226.5**	69.25	NW	**69.25**	127.36	NW	**127.36**
6	940	Coconut farm -9b	254.64	243.15	**248.895**	93.14	92.1	**92.62**	140.26	132.96	**136.61**
7	936	TNAU Trail Plot	189.37	183.81	**186.59**	75.68	76.2	**75.94**	143.61	136.53	**140.07**
8	936	Casurina field	185.46	NW	**185.46**	75.69	NW	**75.69**	143.08	NW	**143.08**
9	415/3A	Admin block office Opposite to Lorry Yard	289.72	284.15	**286.935**	57.46	56.85	**57.155**	209.37	206.43	**207.9**
10	411	Factory (Block A)	Closed	Closed	-	Closed	Closed	-	Closed	Closed	-
		Mean	**248.00**	**237.04**	-	**79.81**	**75.05**	-	**177.43**	**158.64**	-

*NW - No Water

Table 7 d. SAR, Calcium, RSC and SSP content of the piezometer samples collected from the bench mark sites for continuous monitoring of groundwater quality

S. No	SF	Sample ID	SAR			RSC			SSP		
			Sep., 2022 &Dec.,2022	March.,2023& June., 2023	Mean	Sep., 2022 & Dec., 2022	March.,2023& June.,2023	Mean	Sep., 2022 & Dec., 2022	March.,2023& June.,2023	Mean
1	938/1	SLF – 1	0.61	NW	**0.61**	-2.14	NW	**-2.14**	11.96	NW	-
2	938/2	SLF – 2	NW	NW	-	NW	NW	-	NW	NW	-
3	938/2	SLF – 3	NW	NW	-	NW	NW	-	NW	NW	-
4	940	Coconut farm – 8	2.12	NW	**2.12**	-3.64	NW	**-3.64**	40.02	NW	**40.02**
5	943	Coconut farm -9a	0.65	NW	**0.65**	-11.25	NW	**-11.25**	12.60	NW	**12.6**
6	940	Coconut farm -9b	2.15	2.06	**2.105**	-7.62	-3.96	**-5.79**	37.66	35.70	**36.68**
7	936	TNAU Trail Plot	1.08	1.26	**1.17**	-7.04	-4.17	**-5.605**	21.31	20.72	**21.02**
8	936	Casurina field	1.04	NW	**1.04**	-6.99	NW	**-6.99**	20.79	NW	**20.79**
9	415/3A	Admin block office Opposite to Lorry Yard	1.55	1.61	**1.58**	-6.71	-2.14	**-4.425**	33.02	31.50	**32.27**
10	411	Factory (Block A)	Closed	Closed	-	Closed	Closed	-	Closed	Closed	-
		Mean	**1.43**	**1.64**	-	**-7.21**	**-3.42**	-	**27.57**	-	-

*NW - No Water

Table 7 e. Ni, As and Cd content of the piezometer samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	Ni (ppm)			As (ppm)			Cd (ppm)		
			Sep., 2022 &Dec.,2022	March.,2023& June., 2023	Mean	Sep., 2022 & Dec., 2022	March.,2023& June.,2023	Mean	Sep., 2022 & Dec., 2022	March.,2023& June.,2023	Mean
1	938/1	SLF – 1	BDL	NW	-	BDL	NW	-	BDL	NW	-
2	938/2	SLF – 2	NW	NW	-	NW	NW	-	NW	NW	-
3	938/2	SLF – 3	NW	NW	-	NW	NW	-	NW	NW	-
4	940	Coconut farm - 8	BDL	NW	-	BDL	NW	-	BDL	NW	-
5	943	Coconut farm -9a	BDL	NW	-	BDL	NW	-	BDL	NW	-
6	940	Coconut farm -9b	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
7	936	TNAU Trail Plot	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
8	936	Casurina field	BDL	NW	-	BDL	NW	-	BDL	NW	-
9	415/3A	Admin block office Opposite to Lorry Yard	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
10	411	Factory (Block A)	Closed	Closed	-	Closed	Closed	-	Closed	Closed	-
		Mean	-	-	-	-	-	-	-	-	-

*NW–No Water *BDL – Below Detectable Limit

Table 7 f. Pb and Cr content of the piezometer samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	Pb (ppm)			Cr (ppm)		
			Sep., 2022 &Dec.,2022	March.,2023& June., 2023	Mean	Sep., 2022 & Dec., 2022	March.,2023& June.,2023	Mean
1	938/1	SLF – 1	0.08	NW	**0.08**	BDL	NW	-
2	938/2	SLF – 2	NW	NW	-	NW	NW	-
3	938/2	SLF – 3	NW	NW	-	NW	NW	-
4	940	Coconut farm - 8	0.12	NW	**0.12**	BDL	NW	-
5	943	Coconut farm -9a	0.09	NW	**0.09**	BDL	NW	-
6	940	Coconut farm -9b	0.15	0.11	**0.13**	BDL	BDL	-
7	936	TNAU Trail Plot	0.13	0.18	**0.155**	BDL	BDL	-
8	936	Casurina field	0.18	NW	**0.18**	BDL	NW	-
9	415/3A	Admin block office Opposite to Lorry Yard	0.08	0.06	**0.07**	BDL	BDL	-
10	411	Factory (Block A)	Closed	Closed	-	Closed	Closed	-
		Mean	**0.12**	**0.12**	**0.12**	-	-	-

*NW–No Water *BDL – Below Detectable Limit

Table 8 a. pH, EC, TDS and Sodium content of the piezo well samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	pH			EC (dSm^{-1})			TDS (mg L^{-1})			Sodium (mg L^{-1})		
			Sep.,2022& Dec.,2022	March.,2023 & June., 2023	Mean	Sep., 2022 &Dec.,2022	March., 2023& June., 2023	Mean	Sep., 2022 & Dec.,2022	March., 2023& June., 2023	Mean	Sep., 2022 & Dec., 2022	March.,2023& June., 2023	Mean
1	426/1B	Near to Raw water Tank	NC	NW	-	NC	NW	-	NC	NW	-	NC	NW	-
2	415/3A	Opposite to Lorry Yard	7.08	NW	**7.08**	1.12	NW	**1.12**	716.8	NW	**716.8**	89.65	NW	**89.65**
3	418	Old time office	NC	NW	-	NC	NW	-	NC	NW	-	NC	NW	-
4	426/1D	Cogeneration Plant	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
5	923/2A	ETP	6.28	NW	**6.28**	1.24	NW	**1.24**	793.6	NW	**793.6**	65.28	NW	**65.28**
6	925/1	Hostel	6	6.12	**6.06**	1.09	1.11	**1.1**	697.6	NW	**697.6**	56.81	117.4	**87.105**
7	922/2	LSTC- Vagaimara thoppu	NC	7.53	**7.53**	NC	1.23	**1.23**	NC	770.6	**770.6**	NC	83.9	**83.9**
8	938/1	SLF- 1	7.16	NW	**7.16**	1.18	NW	**1.18**	755.2	NW	**755.2**	96.8	NW	**96.8**
9	938/2	SLF- 2	NW	7.11	**7.11**	NW	1.10	**1.1**	NW	726.4	**726.4**	NW	90.27	**90.27**
10	938/2	SLF- 3	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
11	939/1A1	Bamboo garden	7.90	7.32	**7.61**	1.5	1.62	**1.56**	960	1056	**1008**	128.36	130.51	**129.435**
12	939/1A2	Coconut farm	7.85	NC	**7.85**	1.71	NC	**1.71**	997.1	NC	**997.1**	124.42	NC	**124.42**
13	932	Coconut farm	7.63	7.41	**7.52**	0.98	1.17	**1.075**	608.2	NW	**608.2**	52.5	50.1	**51.3**
14	943	Coconut farm	6.17	NC	**6.17**	0.89	NC	**0.89**	549.2	NC	**549.2**	128.67	NC	**128.67**
15	932	Coconut farm	7.71	NW	**7.71**	0.96	NW	**0.96**	611.8	NW	**611.8**	59.2	NW	**59.2**
16	877/2B	Hospital medu	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
17	879/2	Hospital medu	NW	NC	-	NW	NC	-	NW	NC	-	NW	NC	-
18	141/2A	KVK	8.16	7.36	**7.76**	0.89	1.12	**1.005**	569.6	659.1	**614.35**	103.7	45.38	**74.54**
19	884/2	Kandi thottam	7.58	8.11	**7.845**	1.38	1.23	**1.305**	895.4	653.8	**774.6**	52.37	64.6	**58.485**
20	891/2B1	Kandi thottam	NC	NC	-	NC	NC	-	NC	NC	-	NC	NC	-

21	891/2B1	Kandi thottam	7.28	NC	**7.28**	1.33	NC	**1.33**	913.5	NC	913.5	56.69	NC	56.69
22	850	Coconut Field	7.36	NC	**7.36**	1.17	NC	**1.17**	826.3	NC	826.3	128.84	NC	128.84
23	779	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
24	778/2C	Coconut Field	NC	NC	-	NC	NC	-	NC	NC	-	NC	NC	-
25	962	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
		Mean	**7.24**	**7.28**	-	**1.19**	**1.23**	-	**761.10**	**773.18**	-	**87.95**	**83.17**	-

*NW–No Water * NC- Not collected

Table 8 b. Potassium, Calcium, Magnesium and Carbonate content of the piezo well samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	Potassium (mg L^{-1})			Calcium (mg L^{-1})			Magnesium (mg L^{-1})			Carbonate (mg L^{-1})		
			Sep.,2022 &Dec.,2022	March.,2023 &June.,2023	Mean	Sep., 2022 &Dec.,2022	March.,2023& June.,2023	Mean	Sep., 2022 &Dec.,2022	March.,2023 &June., 2023	Mean	Sep.,2022 &Dec.,2022	March.,2023& June., 2023	Mean
1	426/1B	Near to Raw water Tank	NC	NW	-	NC	NW	-	NC	NW	-	NC	NW	-
2	415/3A	Opposite to Lorry Yard	3.15	NW	**3.15**	89.65	NW	**89.65**	39.65	NW	**39.65**	26.35	NW	**26.35**
3	418	Old time office	NC	NW	-	NC	NW	-	NC	NW	-	NC	NW	-
4	426/1D	Cogeneration Plant	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
5	923/2A	ETP	3.94	NW	**3.94**	117.04	NW	**117.04**	67.65	NW	**67.65**	39.81	NW	**39.81**
6	925/1	Hostel	5.61	4.80	**5.205**	105.38	104	**104.69**	49.27	46.7	**47.985**	49.19	36.4	**42.795**
7	922/2	LSTC-Vagaimara thoppu	NC	3.70	**3.7**	NC	59.72	**59.72**	NC	17.0	**17**	NC	18.2	**18.2**
8	938/1	SLF- 1	3.68	NW	**3.68**	94.98	NW	**94.98**	41.64	NW	**41.64**	28.29	NW	**28.29**
9	938/2	SLF- 2	NW	3.55	**3.55**	NW	92.58	**92.58**	NW	39.14	**39.14**	NW	27.11	**27.11**
10	938/2	SLF- 3	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
11	939/1A1	Bamboo garden	1.80	1.81	**1.805**	98.87	96.45	**97.66**	38.85	39.85	**39.35**	21.21	22.6	**21.905**
12	939/1A2	Coconut farm	1.85	NC	**1.85**	95.26	NC	**95.26**	36.28	NC	**36.28**	122.75	NC	**122.75**
13	932	Coconut farm	6.4	4.9	**5.65**	165.4	164	**164.7**	84.1	84.2	**84.15**	115.29	116.5	**115.895**
14	943	Coconut farm	7.29	NC	**7.29**	80.82	NC	**80.82**	54.83	NC	**54.83**	33.16	NC	**33.16**
15	932	Coconut farm	6.24	NW	**6.24**	164.5	NW	**164.5**	84.9	NW	**84.9**	55.62	NW	**55.62**
16	877/2B	Hospital medu	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
17	879/2	Hospital medu	NW	NC	-	NW	NC	-	NW	NC	-	NW	NC	-
18	141/2A	KVK	3.28	3.57	**3.425**	32.8	33.4	**33.1**	16.8	16.4	**16.6**	41	37.5	**39.25**
19	884/2	Kandi thottam	5.29	4.9	**5.095**	144.08	140	**142.04**	65.86	62.1	**63.98**	38.92	36.4	**37.66**
20	891/2B1	Kandi thottam	NC	NC	-	NC	NC	-	NC	NC	-	NC	NC	-

21	891/2B1	Kandi thottam	4.59	NC	**4.59**	38.91	NC	**38.91**	16.42	NC	**16.42**	29.34	NC	**29.34**
22	850	Coconut Field	2.39	NC	**2.39**	124.25	NC	**124.25**	51.24	NC	**51.24**	35.51	NC	**35.51**
23	779	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
24	778/2C	Coconut Field	NC	NC	-	NC	NC	-	NC	NC	-	NC	NC	-
25	962	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
		Mean	**102.89**			**51.32**			**54.00**			**227.81**		

*NW–No Water * NC- Not collected

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Table 8 c. Bicarbonate, Sulphate and Chloride content of the piezo well samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	Bicarbonate (mg L^{-1})			Sulphate (mg L^{-1})			Chloride (mg L^{-1})		
			Sep.,2022& Dec.,2022	March.,2023& June., 2023	Mean	Sep., 2022 & Dec., 2022	March., 2023 &June., 2023	Mean	Sep., 2022 & Dec., 2022	March., 2023 & June., 2023	Mean
1	426/1B	Near to Raw water Tank	NC	NW	-	NC	NW	-	NC	NW	-
2	415/3A	Opposite to Lorry Yard	287.46	NW	**287.46**	58.87	NW	**58.87**	210.23	NW	**210.23**
3	418	Old time office	NC	NW	-	NC	NW	-	NC	NW	-
4	426/1D	Cogeneration Plant	NW	NW	-	NW	NW	-	NW	NW	-
5	923/2A	ETP	181.06	NW	**181.06**	148.27	NW	**148.27**	181.26	NW	**181.26**
6	925/1	Hostel	169.34	163.5	**166.42**	135.29	132.1	**133.695**	125.04	125.5	**125.27**
7	922/2	LSTC- Vagaimara thoppu	NC	151.8	**151.8**	NC	36.5	**36.5**	NC	63.6	**63.6**
8	938/1	SLF- 1	272.16	NW	**272.16**	59.34	NW	**59.34**	215.12	NW	**215.12**
9	938/2	SLF- 2	NW	274.15	**274.15**	NW	54.18	**54.18**	NW	205.34	**205.34**
10	938/2	SLF- 3	NW	NW	-	NW	NW	-	NW	NW	-
11	939/1A1	Bamboo garden	312.25	316.20	**314.225**	121.23	123.1	**122.165**	265.89	264.37	**265.13**
12	939/1A2	Coconut farm	315.34	NC	**315.34**	123.45	NC	**123.45**	269.91	NC	**269.91**
13	932	Coconut farm	223.48	219.3	**221.39**	65.1	64.7	**64.9**	125.7	122.4	**124.05**
14	943	Coconut farm	256.70	NC	**256.7**	93.14	NC	**93.14**	142.72	NC	**142.72**
15	932	Coconut farm	239.14	NW	**239.14**	65.4	NW	**65.4**	117.6	NW	**117.6**
16	877/2B	Hospital medu	NW	NW	-	NW	NW	-	NW	NW	-
17	879/2	Hospital medu	NW	NC	-	NW	NC	-	NW	NC	-
18	141/2A	KVK	248.35	242.1	**245.225**	33.7	32.8	**33.25**	63.5	64.5	**64**
19	884/2	Kandi thottam	201.29	202.13	**201.71**	23.69	23.5	**23.595**	208.94	191.4	**200.17**
20	891/2B1	Kandi thottam	NC	NC	-	NC	NC	-	NC	NC	-
21	891/2B1	Kandi thottam	135.16	NC	**135.16**	123.7	NC	**123.7**	116.2	NC	**116.2**
22	850	Coconut Field	248.25	NC	**248.25**	154.56	NC	**154.56**	312.43	NC	**312.43**

23	779	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-
24	778/2C	Coconut Field	NC	NC	-	NC	NC	-	NC	NC	-
25	962	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-
		Mean	**104.91**	**237.69**	**224.17**	**-**	**92.75**	**66.70**	**-**	**181.12**	**148.16**

*NW–No Water * NC- Not collected

Table 8 d. SAR, Calcium, RSC and SSP content of the piezo well samples collected from the bench mark sites for continuous monitoring of groundwater quality

S. No	SF	Sample ID	SAR			RSC			SSP		
			Sep., 2022 & Dec.,2022	March.,2023 &June., 2023	Mean	Sep., 2022 & Dec., 2022	March., 2023 &June., 2023	Mean	Sep., 2022 & Dec., 2022	March., 2023 & June., 2023	Mean
1	426/1B	Near to Raw water Tank	-	-	-	-	-	-	-	-	-
2	415/3A	Opposite to Lorry Yard	1.57	-	**1.57**	-2.20	-	**-2.2**	-2.20	-	**-2.2**
3	418	Old time office	-	-	-	-	-	-	-	-	-
4	426/1D	Cogeneration Plant	-	-	-	-	-	-	-	-	-
5	923/2A	ETP	0.96	-	**0.96**	-7.19	-	**-7.19**	-7.19	-	**-7.19**
6	925/1	Hostel	0.91	1.91	**1.41**	-4.96	-5.20	**-5.08**	-4.96	-	**-4.96**
7	922/2	LSTC- Vagaimara thoppu	-	1.90	**1.9**	-	-1.31	**-1.31**	-	-	-
8	938/1	SLF- 1	1.65	-	**1.65**	-2.81	-	**-2.81**	-2.81	-	**-2.81**
9	938/2	SLF- 2	-	1.57	**1.57**	-	-2.49	**-2.49**	-	-	-
10	938/2	SLF- 3	-	-	-	-	-	-	-	-	-
11	939/1A1	Bamboo garden	2.18	2.23	**2.205**	-2.36	-2.21	**-2.285**	-2.36	40.79	**19.215**
12	939/1A2	Coconut farm	2.16	-	**2.16**	1.47	-	**1.47**	1.47	-	**1.47**
13	932	Coconut farm	0.67	0.64	**0.655**	-7.77	-7.74	**-7.755**	-7.77	12.46	**2.345**
14	943	Coconut farm	-	-	-	-	-	-	-	-	-
15	932	Coconut farm	0.75	-	**0.75**	-9.53	-	**-9.53**	-9.53	-	**-9.53**
16	877/2B	Hospital medu	-	-	-	-	-	-	-	-	-
17	879/2	Hospital medu	-	-	-	-	-	-	-	-	-
18	141/2A	KVK	2.95	1.29	**2.12**	2.40	2.18	**2.29**	2.40	-	**2.4**

19	884/2	Kandi thottam	0.72	0.91	**0.815**	-8.10	-7.65	**-7.875**	-8.10	-	**-8.1**
20	891/2B1	Kandi thottam	-	-	-	-	-	-	-	-	-
21	891/2B1	Kandi thottam	1.52	-	**1.52**	-0.12	-	**-0.12**	-0.12	-	**-0.12**
22	850	Coconut Field	1.94	-	**1.94**	-5.23	-	**-5.23**	-5.23	-	**-5.23**
23	779	Eucalyptus field	-	-	-	-	-	-	-	-	-
24	778/2C	Coconut Field	-	-	-	-	-	-	-	-	-
25	962	Eucalyptus field	-	-	-	-	-	-	-	-	-
		Mean	**1.50**	**1.49**	-	**-3.87**	**-3.49**	-	**-3.87**	**26.63**	-

*NW–No Water * NC- Not collected

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Table 8 e. Ni, As and Cd content of the piezo well samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	Ni (ppm)			As (ppm)			Cd (ppm)		
			Sep., 2022 & Dec.,2022	March.,2023 &June., 2023	Mean	Sep., 2022 & Dec., 2022	March., 2023 &June., 2023	Mean	Sep., 2022 & Dec., 2022	March.,2023 & June., 2023	Mean
1	426/1B	Near to Raw water Tank	NC	NW	-	NC	NW	-	NC	NW	-
2	415/3A	Opposite to Lorry Yard	BDL	NW	-	BDL	NW	-	BDL	NW	-
3	418	Old time office	NC	NW	-	NC	NW	-	NC	NW	-
4	426/1D	Cogeneration Plant	NW	NW	-	NW	NW	-	NW	NW	-
5	923/2A	ETP	BDL	NW	-	BDL	NW	-	BDL	NW	-
6	925/1	Hostel	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
7	922/2	LSTC- Vagaimara thoppu	NC	BDL	-	NC	BDL	-	NC	BDL	-
8	938/1	SLF- 1	BDL	NW	-	BDL	NW	-	BDL	NW	-
9	938/2	SLF- 2	NW	BDL	-	NW	BDL	-	NW	BDL	-
10	938/2	SLF- 3	NW	NW	-	NW	NW	-	NW	NW	-
11	939/1A1	Bamboo garden	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
12	939/1A2	Coconut farm	BDL	NC	-	BDL	NC	-	BDL	NC	-
13	932	Coconut farm	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
14	943	Coconut farm	BDL	NC	-	BDL	NC	-	BDL	NC	-
15	932	Coconut farm	BDL	NW	-	BDL	NW	-	BDL	NW	-
16	877/2B	Hospital medu	NW	NW	-	NW	NW	-	NW	NW	-
17	879/2	Hospital medu	NW	NC	-	NW	NC	-	NW	NC	-
18	141/2A	KVK	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
19	884/2	Kandi thottam	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
20	891/2B1	Kandi thottam	NC	NC	-	NC	NC	-	NC	NC	-
21	891/2B1	Kandi thottam	BDL	NC	-	BDL	NC	-	BDL	NC	-
22	850	Coconut Field	BDL	NC	-	BDL	NC	-	BDL	NC	-

23	779	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-
24	778/2C	Coconut Field	NC	NC	-	NC	NC	-	NC	NC	-
25	962	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-
		Mean	-	-	-	-	-	-	-	-	-

*NW–No Water *BDL – Below Detectable Limit

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Table 8 f. Pb and Cr content of the piezo well samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	Pb (ppm)			Cr (ppm)		
			Sep., 2022 & Dec.,2022	March.,2023 & June., 2023	Mean	Sep., 2022 & Dec., 2022	March., 2023 & June., 2023	Mean
1	426/1B	Near to Raw water Tank	NC	NW	-	NC	NW	-
2	415/3A	Opposite to Lorry Yard	0.03	NW	**0.03**	BDL	NW	-
3	418	Old time office	NC	NW	-	NC	NW	-
4	426/1D	Cogeneration Plant	NW	NW	-	NW	NW	-
5	923/2A	ETP	0.09	NW	**0.09**	BDL	NW	-
6	925/1	Hostel	0.14	0.20	**0.17**	BDL	BDL	-
7	922/2	LSTC- Vagaimara thoppu	NC	0.55	**0.55**	NC	BDL	-
8	938/1	SLF- 1	0.23	NW	**0.23**	BDL	NW	-
9	938/2	SLF- 2	NW	0.03	**0.03**	NW	BDL	-
10	938/2	SLF- 3	NW	NW	-	NW	NW	-
11	939/1A1	Bamboo garden	0.09	0.10	**0.095**	BDL	BDL	-
12	939/1A2	Coconut farm	0.13	NC	**0.13**	BDL	NC	-
13	932	Coconut farm	0.26	0.28	**0.27**	BDL	BDL	-
14	943	Coconut farm	0.31	NC	**0.31**	BDL	NC	-
15	932	Coconut farm	0.25	NW	**0.25**	BDL	NW	-
16	877/2B	Hospital medu	NW	NW	-	NW	NW	-
17	879/2	Hospital medu	NW	NC	-	NW	NC	-
18	141/2A	KVK	0.16	BDL	**0.16**	BDL	BDL	-
19	884/2	Kandi thottam	0.11	0.09	**0.1**	BDL	BDL	-
20	891/2B1	Kandi thottam	NC	NC	-	NC	NC	-
21	891/2B1	Kandi thottam	0.08	NC	**0.08**	BDL	NC	-
22	850	Coconut Field	0.12	NC	**0.12**	BDL	NC	-

23	779	Eucalyptus field	NW	NW	-	NW	NW	-
24	778/2C	Coconut Field	NC	NC	-	NC	NC	-
25	962	Eucalyptus field	NW	NW	-	NW	NW	-
		Mean	**0.15**	**0.21**	-	-		-

*NW–No Water *BDL – Below Detectable Limit

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Ground water quality

The mean pH of the ground water samples were 7.74 in September, 2022, 7.75 in December, 2022 and whereas 7.71 during March, 2023 and 7.75 during June, 2023.The mean EC of the samples were 1.35 dSm^{-1} in September, 2022, 1.38 dSm^{-1}, 1.30 dSm^{-1} and 1.31 dSm^{-1} during December, 2022, March 2023 and June 2023, respectively. Based on the above results of September 2022, December, 2022, March, 2023, and June, 2023, chance for alkalinity hazard (SAR < 5) is less. All the water samples were found to have low Soluble Sodium Percentage (<60%). Variations in ground water EC may be caused by the monsoon failure and drought conditions prevailed in these region. On analyzing the heavy metal contentsof the water samples, heavy metals such as Ni, As, Cd and Cr were below detectable limits, while the lead (Pb) content ranged from 0.07 to 1.09 ppm in September, 2022, 0.05 to 1.21 ppm, 0.02 to 0.61 ppm and from 0.08 to 0.98 ppm during December, 2022, March 2023 andJune 2023, respectively. Apart from the bench mark sites, samples were also collected from piezo meters and piezo well. All quality parameters of the piezo meters and piezo well water samples were under the permissible limit.

Soil quality

The mean pH of the soil samples were 7.55 in September, 2022, 7.56 in December, 2022, 7.66 in March, 2023 and 7.66 in June, 2023 samples. The mean EC of the soil samples were 0.64 dSm^{-1} in September, 2022, 0.66 dSm^{-1} in December, 2022, 0.64 dSm^{-1} in March, 2023 and 0.63 dSm^{-1} in June, 2023. The organic content of the soil ranged from low to medium status. Most of the soil samples have very low organic carbon content (<0.5). The available nitrogen content of the samples found to be very low (<280 kg ha^{-1}). The potassium status of the most of the soil samples found to be medium range (< 280 kg ha^{-1}).

In order to evaluate the different methods of irrigation (drip and flood irrigation) using treated effluent and well water on crop production and soil fertility, a field experiment was initiated with Ragi (Finger millet) test crop. The details of the experiment are given below.

Activity III: Field Experiment : " To evaluate the impact of ITC Kovai paper board mill treated effluent along with sludge on soil health and crop productivity"

As a crop rotation a field experiment was initiated with Ragi (*Eleusine coracana*) as test crop, in order to evaluate the different methods of irrigation (drip and flood irrigation) using treated effluent and borewell water along with the application of ETP secondary clarifier

sludge and ETP sludge vermicompost on crop production and soil fertility through organic matter build up in the soil. The details of the experiment are given below.

EXPERIMENTAL DETAILS

1	Crop	:	Ragi (*Eleusine coracana)* ATL 1
2	Spacing	:	22.5x10 cm
3	Date of sowing	:	20.05.2022
4	Design	:	Split-split plot design
5	Factors	:	3
6	Treatments	:	8
7	Replications	:	4
8	No. of plots	:	32
9	Area	:	0.2 acres
10	Plot size	:	4x4 m
11	Location	:	ITC PSPD field

Treatments comprised of three main factors with two levels in each factor viz.,

Treatments		
Factor 1	:	**Source of irrigation**
I_1	:	Bore well water
I_2	:	Treated paper board mill treated effluent
Factor 2		**Method of irrigation**
M_1	:	Drip irrigation
M_2	:	Flood irrigation
Factor 3	:	**Sludge Application**
S_1	:	ETP sludge compost @5 tha^{-1}
S_2	:	Phosphorous enriched ETP sludge compost @5 tha^{-1}

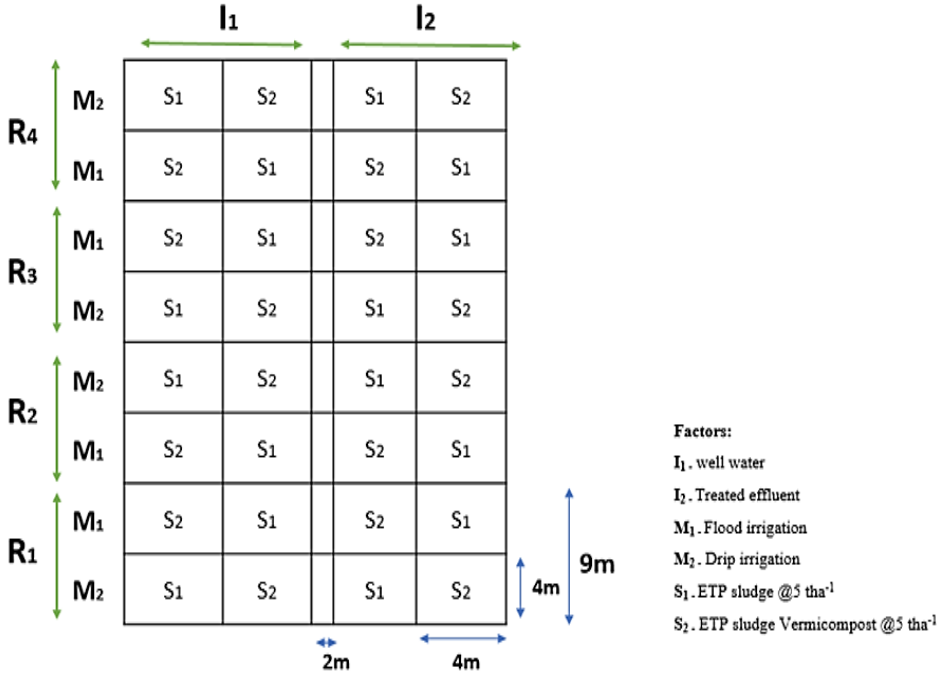
Treatment combinations		
T_1	$I_1M_1S_1$	Soil application of ETP sludge @5 tha^{-1} along with well water through flood irrigation
T_2	$I_1M_1S_2$	Soil application of ETP sludge vermicompost @5 tha^{-1} along with well water through flood irrigation
T_3	$I_1M_2S_1$	Soil application of ETP sludge @5 tha^{-1} along with well water through drip

		irrigation
T_4	$I_1M_2S_2$	Soil application of ETP sludge vermicompost @5 tha^{-1} along with well water through drip irrigation
T_5	$I_2M_1S_1$	Soil application of ETP sludge @5 tha^{-1} along with treated effluent through flood irrigation
T_6	$I_2M_1S_2$	Soil application of ETP sludge vermicompost @5 tha^{-1} along with treated effluent through flood irrigation
T_7	$I_2M_2S_1$	Soil application of ETP sludge @5 tha^{-1} along with treated effluent through drip irrigation
T_8	$I_2M_2S_2$	Soil application of ETP sludge vermicompost @5 tha^{-1} along with treated effluent through drip irrigation

Field layout:

The field layout was prepared by the statistical split plot design with 3 main factors, (source of irrigation, method of irrigation and ETP sludge compost application) and 4 replications. The ploughed field were split into 2 main plots, i.e., Bore well water irrigation and treated effluent irrigation plots which is further divided into many subplots. Totally 32 subplots were laid. The distance between the two main plots and the sub plots are 2m and the distance between the sub-sub plots is 1m.

Fig.1. Experimental field layout



Characterization of soil

Soil samples were collected from the experimental field before transplanting of the crops. The collected soil samples were analyzed for its chemical properties and results are presented in the table 9.

Table 9. Characteristics of soil samples collected from the experimental field

Parameters	Unit	Initial Soil Sample	Irrigation water Samples					
			Treated Effluent			Well Water		
			Drip Irrigation	Flood Irrigation	Mean	Drip Irrigation	Flood Irrigation	Mean
pH	-	7.25	7.21	7.66	**7.37**	7.81	7.55	**7.68**
EC	dSm^{-1}	1.01	0.98	0.98	**0.99**	0.96	0.98	**0.97**
OC	Per cent	0.89	1.02	1.09	**1.00**	0.88	0.89	**0.885**
Available N	kg ha^{-1}	198.27	208	219	**208.42**	184	194	**189**
Available P	kg ha^{-1}	24.08	22.09	26.75	**24.31**	18.32	21.52	**19.92**
Available K	kg ha^{-1}	321.82	389	411	**373.94**	372	385	**378.5**
Exchangeable Ca	cmol (p^{+}) kg^{-1}	0.25	0.51	0.57	**0.44**	0.59	0.59	**0.59**
Exchangeable Mg	cmol (p^{+}) kg^{-1}	0.39	0.25	0.38	**0.34**	0.32	0.44	**0.38**
Exchangeable Na	cmol (p^{+}) kg^{-1}	1.11	0.89	1.21	**1.07**	0.92	1.25	**1.085**
Exchangeable K	cmol (p^{+}) kg^{-1}	0.81	0.79	0.89	**0.83**	0.81	0.99	**0.9**

Table 10. Initial characteristics of the paperboard mill ETP sludge compost:

S.No.	Parameters	Units	ETP sludge compost	'P' enriched ETP sludge compost
1	pH	-	7.05	5.50
2	EC	dsm^{-1}	2.60	3.67
3	Organic carbon	Per cent	3.12	3.91
4	Total nitrogen	Per cent	1.08	1.09
5	Total phosphorus	Per cent	0.49	1.47
6	Total potassium	Per cent	0.71	0.75
7	C:N ratio	-	2.8 :1	3.5 :1

The ETP sludge compost and 'P' enriched ETP sludge compost recorded pH of 7.05 and 5.50 respectively with an EC of 2.60 and 3.67 dSm^{-1}, respectively. The organic carbon content of ETP sludge compost and 'P' enriched ETP sludge compost were3.12 and 3.91 percent, respectively. The nutrient content of the ETP sludge compost recorded the values of 1.08, 0.49 and 0.71 per cent of N, P and K ant the Phosphorus enriched compost with nutrient content of 1.09, 1.47 and 0.75 per cent.

Field preparation

The selected field was ploughed initially to pulverize the soil. The field layout was prepared by the statistical split-split plot design with 3 main factors (source of irrigation, method of irrigation and ETP sludge application) and 4 replications. The ploughed field were split into 2 main plots i.e., well water irrigation and treated effluent irrigation plots which is further divided into many subplots. Totally 32 subplots were laid. The distance between the two main plots and the sub plots are 2m and the distance between the sub-sub plots is 1m.

Nursery field preparation for Ragi

The raised beds were prepared in the plots with 2x1 meter. Seeds were directly sown on the nursery at the rate of 1.5 kg/5 cents by line sowing. Seedlings were collected on the 30th day after sowing for planting in the main field at ITC Ltd, PSPD, Unit – Kovai at Thekkampatty.

Transplanting of Ragi seedlings

The raised beds were prepared in the plots of 4x4 meter size. Two seedlings per hill at a depth of 3 cm with the spacing of 22.5x10 cm.

Fertilizer application for Ragi (*Eleusine coracana)*

The recommended dose of fertilizers for ragi 60:30:30 (kg/ha) kg NPK per hectare (as per the package of practices mentioned in Crop Production Guide, 2012). Full dose of phosphorus and potassium and 25 percent of nitrogen were given basally with DAP and MOP. Raw ETP sludge and composted sludge were applied to the plots as amendment. Hand weeding was done 3-4 times during the crop growth.

Effect of treated effluent on of Ragi growth

Effect of treated effluent on growth attributes of Ragi under flood and drip irrigations were studied and the results are shown in Table 11.

Table 11. Effect of ETP sludge and treated effluent irrigation on growth of Ragi - (ATL 1) at 30 DAT

Treatment Details	Plant Height (cm)	No. of Tillers / plant
T_1 - $I_1M_1S_1$	83.8	8
T_2 - $I_1M_1S_2$	85.2	7
T_3 - $I_1M_2S_1$	85.3	6
T_4 - $I_1M_2S_2$	85.2	8
T_5 - $I_2M_1S_1$	86.2	7
T_6 - $I_2M_1S_2$	84.7	8
T_7 - $I_2M_2S_1$	85.6	7
T_8 -$I_2M_2S_2$	88.2	9
Mean	**85.5**	**7.5**

Plant height had significant difference between the treatments. The plant height in the treatments followed the order of T_8> T_5>T_7>T_3>T_2, T_4> T_6>T_1. It was found that plant height of 88.2 cm and No. of tillers/plant was 9. It was observed higher in T8 (Soil application of ETP sludge vermicompost @ 5 tha^{-1} along with treated effluent through drip irrigation) compared to the control.

Table 12. Effect of ETP sludge and treated effluent irrigation on growth of Ragi (ATL 1) at 60 DAT

Treatment Details	Plant Height (cm)	No. of Tillers / plant
T_1 - $I_1M_1S_1$	95.6	10
T_2 - $I_1M_1S_2$	93.5	9
T_3 - $I_1M_2S_1$	92.8	9
T_4 - $I_1M_2S_2$	91.6	11
T_5 - $I_2M_1S_1$	93.2	10
T_6 - $I_2M_1S_2$	91.5	9
T_7 - $I_2M_2S_1$	92.0	10
T_8 -$I_2M_2S_2$	96.4	12
Mean	**93.3**	**10.0**

Table 13. Effect of ETP sludge and treated effluent irrigation on growth of Ragi (ATL 1) at 90 DAT

Treatment Details	Plant Height (cm)	No. of Tillers / plant
T_1 - $I_1M_1S_1$	110.6	12
T_2 - $I_1M_1S_2$	108.9	11
T_3 - $I_1M_2S_1$	106.4	10
T_4 - $I_1M_2S_2$	105.7	13
T_5 - $I_2M_1S_1$	111.2	12
T_6 - $I_2M_1S_2$	109.4	11
T_7 - $I_2M_2S_1$	112.3	13
T_8 -$I_2M_2S_2$	114.8	14
Mean	**109.9**	**12.0**

Plant height had significant difference between the treatments. The plant height in the treatments followed the order of T_8> T_1>T_2>T_5>T_3>T_7>T_4> T_6 (60 days) and T_8> T_7>T_5>T_1>T_6>T_2> T_3>T_4 (90 days). It was found that plant height 96.4 cm (60 days), 114.8 cm (90 days) and No. of tillers/plant 12 (60 days), 14 (90 days) was observed higher in T8 (Soil application of ETP sludge vermicompost @ 5 tha^{-1} along with treated effluent through drip irrigation) compared to the control.

Yield

Field trial experiment to assess the impact of treated paper mill effluent on Ragi crop with var ATL1 was completed. It was found that T_8 (Soil application of ETP sludge vermicompost @ 5 tha^{-1} along with treated effluent through drip irrigation) shows higher grain yield of 2907 Kg/ha^{-1}as compare to other treatment.

Table 14. Grain Yield (Kg/ha)

Treatments	R_1	R_2	R_3	R_4	Mean
T_1: $I_1M_1S_1$	2597	2546	2561	2568	**2558**
T_2: $I_1M_1S_2$	2889	2669	2826	2795	**2763**
T_3: $I_1M_2S_1$	2531	2746	2592	2623	**2654**
T_4: $I_1M_2S_2$	2888	2928	2788	2868	**2861**
T_5: $I_2M_1S_1$	2688	2917	2753	2786	**2819**
T_6: $I_2M_1S_2$	2759	2604	2542	2635	**2594**
T_7: $I_2M_2S_1$	2631	2580	2757	2656	**2664**
T_8: $I_2M_2S_2$	3033	2812	2970	2938	**2907**

Plate 1 - Nursery field View of Ragi at TNAU, Coimbatore



Nursery field preparation



Raised bed preparation



Sowing of Ragi ATL1 variety seeds



Irrigation of Ragi nursery field



Ragi ATL1 Nursery field (7 DAS)



Pulling out of Ragi ATL1 seedlings

Plate 2 - Field View of Ragi at at ITC-PSPD, Thekkampatty



Main field preparation



Transplanting of Ragi ATL1 seedlings



Ragi ATL1 crop (7 DAT)



Ragi ATL1 crop (30 DAT)



Ragi ATL1 crop (45 DAT)



Ragi ATL1 crop (60 DAT)

Plate 3 - Field View of Ragi at at ITC-PSPD, Thekkampatty





Ragi ATL1 crop (90 DAT)





Ragi ATL1 field covered by green net for Avian pest management

Conclusion:

For monitoring the quality of treated ITC paperboard effluent used for irrigation, ground water and soil samples were collected at three months interval from the benchmark sites in and around the premises of ITC factory during July, 2022 to June, 2023 and analyzed for its physic-chemical characterization.

- From the analyses, it is concluded that, the treated ITC paperboard treated effluent is suitable for the irrigation since the vital quality parameters such as pH, EC, BOD, TDS and other parameters are within the prescribed limits of the Central Pollution Control Board norms.
- In order to assess the long-term impact of treated effluent irrigation on ground water quality, 30 bench mark sites were selected in and around factory premises, ground water samples were collected at periodical intervals and analyzed. The water level of the piezo well sampling sites are ranges between 4 to 7 meters. All the groundwater quality parameters are within the permissible limits. The average SAR value was found to be less than 5. It indicates that the ground water quality was not deteriorated due to use of treated effluent irrigation.
- Based on the analytical results of collected soil samples, it is revealed that the soil quality was not deteriorated in all the benchmark sites.
- The physico-chemical analyses of the water samples from the piezo meter were observed within the prescribed limits of the Central Pollution Control Board norms.
- Field experiment with Ragi ATL – 1 variety as test crop for crop rotation was initiated and it has been observed that the application of ETP sludge vermicompost @ 5t ha^{-1} along with treated effluent through drip irrigation recorded significantly better growth and yield (2907 kg/ha) compared to other treatments.

However, continuous monitoring is essential to assess the long-term effect of paper board mill treated effluent irrigation on soil health and crop productivity.

Signature of Co-PI

Signature of PI / Professor and Head
Department of Environmental Sciences

PROFESSOR AND HEAD
Dept. of Environmental Sciences
Tamil Nadu Agricultural University
Coimbatore - 641 003.

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

From

Dr. A. Manisekar, M.Sc., M.Phil., Ph.D.,
Deputy Chief Scientific Officer,
Advanced Environmental Laboratory
Tamilnadu Pollution Control Board
No.5, Ramasamy Nagar, Kavundampalayam
Coimbatore – 641 030.
Email – aelcbe@tnpcb.gov.in.

To

M/s. ITC Limited.,
Paper Boards & Specialty Papers Division,
Unit : Kovai – Power Plant,
Vivekanandapuram (Post),
Thekkampatty (Village),
Coimbatore – 641 113.

Lr.No.TNPC Bd/AD(L)/AEL-CBE/Air Survey/F.M.1/23 – 24, Dated 02.11.2023.

Sir,

Sub: Furnishing of Report of Analysis of Ambient Air Quality / Stack Monitoring / Ambient Noise Level Survey – Reg.

Ref: 1. This office Letter No.TNPC Bd/AD (Lab)/AEL/CBE/Air survey/F.M.1/23 – 24, dated 04.09.2023.
2. Your E-Mail Dated 31.10.2023.
3. Cash Receipt No. 627 dated 01.11.2023 for Rs.1,44,450/-

*****

I am sending herewith the Report of Analysis of Ambient Air Quality / Stack Monitoring / Ambient Noise Level Survey conducted in the vicinity of your industry M/s. ITC Limited., Paper Boards & Specialty Papers Division, Unit : Kovai - Power Plant on 26.10.2023 and 27.10.2023 (24 hrs Survey) with invoice for a sum of Rs. 1,44,450/- (Rupees one lakh forty four thousand four hundred and fifty only) towards the above survey / analysis charges, and the same has been adjusted with the advance fees received vide reference (3) cited.

Kindly acknowledge the receipt of the report without fail.

2/11/23

Deputy Chief Scientific Officer,
AEL – TNPCB – CBE.

Encl: As above.

Copy to:-

1. The District Environmental Engineer, TNPCB, Coimbatore (North) for favour of kind information please.
2. Copy to file.

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

TEST REPORT

ULR-TC702523000000874P

24 Hrs Average Values

Report No.70/AEL – CBE/ AAQS/2023 – 2024, Dated 02.11.2023.

1. Name of the Industry : M/s. ITC Limited., Paper Boards & Specialty Papers Division, Unit : Kovai - Power Plant,
2. Address of the Industry : Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
3. Date of Survey : 26.10.2023 & 27.10.2023.
4. Duration of Survey : 24 Hours
5. Category : Red/Large
6. Test Started on : 02.11.2023.
7. Test Completed on : 02.11.2023.
8. Matrix : Ambient Air Quality

Meteorological Conditions

Ambient Temperature (^{0}C)	Min	Max	Relative Humidity (%)	Min	Max
	27.4	35.0		53.0	88.0
Weather Condition	Clear Sky		Rain Fall (mm)	--	
Predominant Wind Direction	North East → South West		Mean Wind Speed (km/hr)	--	

Ambient Air Quality Survey Results

Sl. No	Location	Direction *	Distance (m) *	Height Form GL(m)	Pollutants Concentration (microgram / m^3) 24 Hrs Average		
					PM_{10}	SO_2	NO_2
1	On top of Scaffolding near Raw water pump.	North	200	3.0	**55.0**	**7.0**	**16.0**
2	On top of Scaffolding at North East corner opposite to Fire hydrant pump house.	North East	200	3.0	**41.0**	**8.0**	**16.0**
3	On top of Scaffolding at South East corner of the unit.	South East	200	3.0	**68.0**	**8.0**	**14.0**
4	On top of Scaffolding near R & D.Lab.	South West	350	3.0	**72.0**	**11.0**	**19.0**
5	On top of Scaffolding near D.M. Plant Lab.	North West	200	3.0	**80.0**	**10.0**	**17.0**
6	On top of Scaffolding at North West corner near ETP area.	North West	350	3.0	**53.0**	**8.0**	**15.0**

Note:- * With respect to major emission sources.
The analytical results are restricted to the sampling period of 24 hrs.

Test Performed	Test Method
PM_{10}	IS 5182: (Part 23) – 2006
SO_2	Modified West – Gaeke / IS 5182: (Part 2) – 2001 RA: 2012
NO_2	Jacobs – Hochheiser / IS 5182: (Part 6) – 2006 RA: 2012

-- End of Report –

28/11/23
J.E.S

3/11/23
Deputy Chief Scientific Officer,
AEL – TNPCB – CBE.

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

AMBIENT AIR QUALITY SURVEY

Schematic Diagram Showing Location of Sampling | **24 Hrs Average Values**

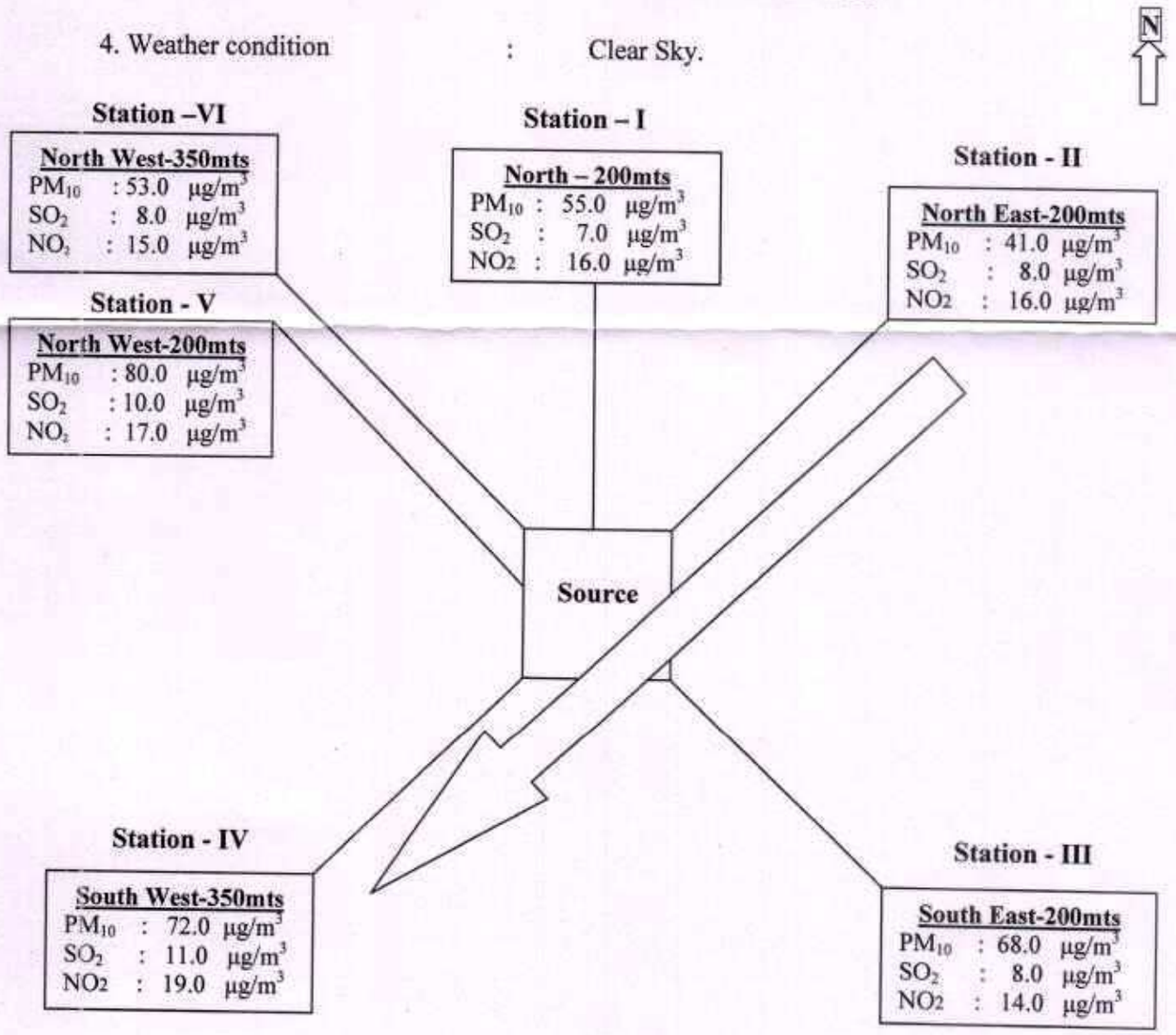
Report No.70/AEL – CBE/AAQ/SM/2023 – 2024, Dated 02.11.2023.

1. Name and Address of the Industry : M/s. ITC Limited.,
Paper Boards & Specialty Papers Division,
Unit : Kovai - Power Plant,
Vivekanandapuram (Post), Thekkampatty (Village),
Coimbatore – 641 113.

2. Date of Survey : 26.10.2023 & 27.10.2023.

3. Predominant wind direction : North East → South West

4. Weather condition : Clear Sky.



Note:- All the values are expressed in µg/m^3 and restricted to the sampling period of 24 hours.

08/11/23
J.E.S

27/11/23
Deputy Chief Scientific Officer,
AEL – TNPCB – CBE.

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

TEST REPORT

ULR-TC702523000000874P

Report No.70/AEL – CBE/ SM/2023 – 2024, Dated 02.11.2023.

1. Name of the Industry	:	M/s. ITC Limited., Paper Boards & Specialty Papers Division, Unit : Kovai - Power Plant.
2. Address of the Industry	:	Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
3. Date of Survey	:	26.10.2023.
4. Test Started on	:	02.11.2023.
5. Test Completed on	:	02.11.2023.
6. Matrix	:	Stack Emission
7. Type of Industry	:	Power Plant, Duplex Board, Art Board and Cromo Board Manufacturing.

Stack Monitoring Survey Results

Sl. No.	Stack attached to	Stack Temp ^{o}C	Velocity in (m/ sec)	Discharge rate in Nm^3/Hour	Pollutants (mg / Nm^3)		
					PM	So_2	No_x
1.	Captive Power Plant Boiler (60 TPH) (After Electro Static Precipitator) [Fuel: Saw dust, Imported Coal, Wood Chips]	120	6.64	32,014	22.0	17.07	34.83

Note:-

Test Performed	Test Method
Particulate Matter	IS 11255: (Part 1) – 1985 (RA: 2003)

-- End of Report –

8/11/23
J.E.S

8/11/23
Deputy Chief Scientific Officer,
AEL – TNPCB – CBE.

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

STACK DETAILS

Report No. 70/AEL – CBE/SM/2023 – 2024, Dated 02.11.2023.

1. Name and Address of the Industry: M/s. ITC Limited.,
Paper Boards & Specialty Papers Division,
Unit : Kovai - Power Plant,
Vivekanandapuram (Post), Thekkampatty (Village),
Coimbatore – 641 113.

2. Date of Survey : 26.10.2023.

Sl.No	Particulars	1
1.	Stack attached to	Captive Power Plant Boiler
2.	Details of process stack	Steam & Power Generation
3.	Height from G Level in (m)	84.0
4.	Diameter in (m)	1.5
5.	Port hole height from Ground Level or bends or ducts in (m)	42.0
6.	Fuel Used (with % Sulphur content)	Saw dust, Imported Coal, Wood Chips.
7.	Fuel Consumption rate per day (mention units)	Saw dust – 62 MT Imported Coal – 236 MT
8.	Stack Capacity	60 TPH Make: Thermax, Type: Water tube.
9.	APC Measures provided	Electro Static Precipitator
10.	APC functional status	Working
11.	Ambient temp in ^{o}K	304
12.	Temp of flue gas in ^{o}K	393
13.	Velocity of flue gas in m/sec	6.64
14.	Volume of flue gas sampled in m^3	1.012
15.	Gaseous Discharge rate per Nm^3/Hour	32,014

J.E.S

Deputy Chief Scientific Officer,
AEL – TNPCB – CBE.

TAMILNADU POLLUTION CONTROL BOARD

Advanced Environmental Laboratory, Coimbatore – 641 030.

AMBIENT/SOURCE NOISE LEVEL SURVEY - Report of Analysis

ULR-TC702523000000874P

Report No. 70/AEL – CBE/ NLS/2023 – 2024, Dated 02.11.2023.

1.	Name of the Industry	M/s.ITC Limited., Paper Boards & Specialty Papers Division, Unit : Kovai - Power Plant,
2.	Address of the Industry	Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
3.	Date of Survey	26.10.2023

Category	Red/Large	**Land use Classification**	--
Type of Survey	Ambient	**Time of Survey**	Day
Meteorological conditions		CALM	
Matrix		Sound Level	

Logging Parameters

Instrument Used	Larson & Davis		Serial No		824 A 2030
Logging Interval	10 Minutes each point		**Measuring Range**		50-110 dB(A)
Weighting	" A '	**Peak Weighting**	"C"	**Time Weighting**	FAST
Sound Incidence		RANDOM	**Time in hrs**		16.30 Hrs to 18.00 Hrs

Report of Noise Level Monitoring

Sl No	Location	Distance (M)	Direction	Sound Level – dB(A)					
	At Ambient:			L_{eq}	L_{90}	L_{50}	L_{10}	Min	Max
1.	Near Raw Water Pump House.	200	North	**51.8**	50.4	50.7	53.9	49.9	59.3
2.	Near North East corner opposite to Fire Hydrant Pump House.	200	North East	**52.6**	52.1	52.4	53.1	53.5	58.2
3.	At South East corner of the unit.	200	South East	**53.9**	52.8	53.5	54.8	51.7	58.9
4	Near R & D Lab.	350	South West	**49.0**	48.1	48.6	49.5	47.7	58.8
5	Near D.M. Plant.	200	North West	**54.0**	53.8	53.1	54.1	50.9	58.2

Note: L90 Value refers to background noise: L50 Value refers to mean noise.L10 value refers to nuisance or annoyance level :Leq value is the average energy for the measured period.

-- End of Report --

2/11/23

J.E.S

2/11/23

Deputy Chief Scientific Officer,
AEL – TNPCB – CBE.

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

GENERAL PARTICULARS

Report No. 70/AEL – CBE/AAQ/SM/2023 – 24, Dated 02.11.2023.

Name and Address of the Industry : M/s. ITC Limited.,
Paper Boards & Specialty Papers Division,
Unit : Kovai - Power Plant,
Vivekanandapuram (Post), Thekkampatty (Village),
Coimbatore – 641 113.

Date of Survey : 26.10.2023 & 27.10.2023.

Sl. No	Head of Particulars	Particulars
1.	Process Description	Power Plant, Duplex Board, Art Board and Cromo Board Manufacturing.
2.	Emission Sources	Boiler.
3.	Fugitive Emission Sources	Vehicle Movements were observed.
4.	Raw Material Consumptions	1. 26.10.2023 - Recycled waste paper – 362.704 Tons 2. 27.10.2023 - Recycled waste paper – 325.851 Tons
5.	Production Capacity as per Air Consent order No. & Date	1. Duplex Board, Art Board and Cromo Board } – 120000 Tons/Annum. As per Air Consent order No. 2205241935587 Dated 18.07.2022. 2. Power Plant – 8 MWHR As per Air Consent order No. 2205241846701 Dated 29.08.2022.
6.	Production on the day of Survey	1. 26.10.2023 – 368.5 Tons 2. 27.10.2023 – 328.8 Tons
7.	Air Consent Order No. Validity upto 31st March 2025 & 31st March 2027.	1. Air Consent order No. 2205241935587 Dated 18.07.2022 Validity upto 31.03.2025. 2. Air Consent order No. 2205241846701 Dated 29.08.2022 Validity upto 31.03.2027.
8.	Details of APC measures	Electro Static Precipitator
9.	Functional Status of APC measures	Working
10.	Field Observations	--

28/11/23
J.E.S

28/11/23
Deputy Chief Scientific Officer,
AEL – TNPCB – CBE.

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

INFERENCE REPORT NO. 70/ AEL – CBE/ A.A.Q.S./ S.M. Dated 02.11.2023.

1. Name of Industry : M/s. ITC Limited.,
   Paper Boards & Specialty Papers Division,
   Unit : Kovai - Power Plant,
   Vivekanandapuram (Post), Thekkampatty (Village),
   Coimbatore – 641 113.
2. Pollution Category : Red/Large
3. Date of A.A.Q. Survey : 26.10.2023 & 27.10.2023 [24hrs Survey]
4. Predominant Wind Direction : North East → South West
5. Weather condition : Clear Sky

STATUS OF POLLUTANTS LEVEL

I. AMBIENT AIR QUALITY:-

1. Total No. of A.A.Q. stations monitored : 6
2. No. of A.A.Q. stations in which Pollutants
   Level exceeded the Boards standards (PM_{10}) : NIL

Maximum and minimum values of 24 Hours Average values parameter wise

Sl. No	POLLUTANT	Values in microgram/m^3		BOARD's STANDARD (As per consent order)
		Maximum	Minimum	
1.	Respirable Suspended particulate Matter: PM_{10}	80.0	41.0	100
2.	GASEOUS POLLUTANTS:-			
	(i) SO_2	11.0	7.0	80
	(ii) NO_2	19.0	14.0	80

II. STACK MONITORING:-

1. Total No. of Stacks Monitored : 1
2. No. of Stacks in which Pollutants level Exceeded the Boards standards : NIL

8/11/23
J.E.S

8/11/23
Deputy Chief Scientific Officer,
AEL – TNPCB – CBE.

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

BILL

Report No.70/AEL – CBE/AAQ/SM/2023 – 2024, Dated 02.11.2023.

Bill No.	70/2023 – 2024
Date	02.11.2023.

To

M/s. ITC Limited.,

Paper Boards & Specialty Papers Division,

Unit : Kovai - Power Plant,

Vivekanandapuram (Post),

Thekkampatty (Village),

Coimbatore – 641 113.

Ref: 1. Bd's Memo No.TNPCB/DD(L)/02031/2019 Dated 08.09.2021. [G.O (2D) No.13 dated: 31.08.2021] **(REVISED ANALYTICAL CHARGES)**

2. This office Letter No.TNPC Bd/AD (Lab)/AEL/CBE/Air survey/F.M.1/23 – 24, dated 04.09.2023.

3. Your E-Mail Dated 31.10.2023.

4. Cash Receipt No. 627 dated 01.11.2023 for Rs.1,44,450/-

******

Sl. No.	Description	Rate (Rs)	No. of Stations/Stacks	Amount (Rs)
1.	**SAMPLING CHARGES:**			
	(i). Ambient Air Quality Monitoring	3,500.00	18 (6×3)	63,000.00
	(ii). Source Emission Monitoring (PM, SO_2 NO_2 etc.,)	13,100.00	1	13,100.00
2.	**ANALYTICAL CHARGES:**			
	(i). Ambient Air Samples PM_{10}, SO_2, NO_2 (each Rs.1,050/-)…..	3,150.00	18 (6×3)	56,700.00
	(ii). Source Emission Samples PM, SO_2, NO_2 (each Rs.1,050/-)…..	3,150.00	1	3,150.00
3.	**NOISE LEVEL MONITORING CHARGES:** (i). For first 5 stations	7,000.00	-	7,000.00
4.	**TRANSPORATION CHARGES:**	-	-	1,500.00
	Total			**1,44,450.00**
	Less: Advance – (Vide Ref. No.4)			1,44,450.00
	Balance to Pay			NIL

8/11/23
J.E.S

9/11/23
Deputy Chief Scientific Officer,
AEL – TNPCB – CBE.

ENVIRONMENTAL BASELINE DATA GENERATION



Submitted to

ITC LIMITED – PSPD, UNIT : KOVAI
Thekkampatti Village
Coimbatore – 641 113

Prepared By

VIMTA LABS LIMITED
142, IDA, Phase-II
Cherlapally, Hyderabad – 500 051

(QCI/NABL Accredited and ISO 17025 Certified Laboratory, Recognized by MoEF, New Delhi)
www.vimta.com

DECEMBER 2023

1.0 INTRODUCTION

M/s. ITC Limited - PSPD acquired the Paperboard facility at Coimbatore from BILT Industrial Packaging Company in August 2004. The Mill is located at Thekkampatti Village, Near Mettupalayam in Coimbatore Dist of Tamil Nadu. The commercial production under ITC management began on 29th August 2004.

The Mill at present has a single board machine with a capacity of 10,000 TPM. The main product is Coated Duplex Boards Greyback made with 100% recycled fibre. Eco Naturo and Eco Naturo-HS are the two grades of Coated Duplex Grey Back board made from this unit. For almost the first time in India, a customer has the option to buy a higher bulk and stiffness of Greyback Board (GD2 grade) for his carton requirements. The unit has made rapid strides in becoming a world-class producer and has achieved ISO 9001, ISO 14001 and OHSAS 18001 certifications. The product range, true to ITC's innovative streak, has been enlarged by developing cone boards for textiles cones and greyboards for book binding boards.

2.0 OBJECTIVE OF THE STUDY

To comply with the corporate policy of development in tune with Environment and to comply with the statutory requirements, ITC Limited-PSPD, entrusted the job of Ambient Air Quality monitoring (on continuous basis) and Source emission monitoring in and around plant Site to *VIMTA Labs Limited, Coimbatore*.

The data generated during the month of **DECEMBER 2023** is presented in the following section.

3.0 AMBIENT AIR QUALITY

To assess the effect of Boiler in the Paper industry on the ambient air, Ambient Air Quality Monitoring (AAQM) stations were set up at *five* locations with due consideration to the Meteorological conditions of the factory area. **Table-3.1** gives the details of monitoring station and their distances with reference to the source.

3.1 Frequency of Monitoring

The following frequency has been adopted for sampling:

- Ambient Air Quality monitoring has been carried out with a frequency of two days per week at five locations.

VIMTA LABS LIMITED HYDERABAD-51

TABLE –3.1
AMBIENT AIR QUALITY MONITORING LOCATIONS

Code	Name of the Station
AAQ1	On top of Raw Water Pump House (North East direction of the plant Site)
AAQ2	Near Rainwater Harvesting Pond (East direction of the plant Site)
AAQ3	Near Fuel Yard (South East direction of the plant Site)
AAQ4	Near Guest House South West direction of the plant Site)
AAQ5	Near ETP-Treated Water Tank (North West direction of the plant Site)

3.2 Parameters

The baseline data of air environment is generated for the following parameters:

- Particulate Matter (Size less than 10 µm) or PM_{10};
- Particulate Matter (Size less than 2.5 µm) or $PM_{2.5}$;
- Sulphur Dioxide (SO_2);
- Oxides of Nitrogen (NO_x);
- Ozone (O_3);
- Lead (Pb);
- Carbon Monoxide (CO);
- Ammonia (NH_3);
- Benzene (C_6H_6);
- Benzo (a) Pyrene [Particulate Phase only] ;
- Arsenic (As); and
- Nickel (Ni);

3.3 Duration of Sampling

The sampling duration for Particulate Matter (Size less than 10 µm) or PM_{10}, Particulate Matter (Size less than 2.5 µm) or $PM_{2.5}$, SO_2, NO_x, Lead, Ammonia, Benzene, Benzo (a) Pyrene, Arsenic and Nickel is twenty four hourly continuous samples per day and CO & Ozone is sampled for 8 hours.

3.4 Method of Analysis

The air samples are analyzed as per standard methods specified by Central Pollution Control Board (CPCB), IS: 5184 and American Public Health Organization (APHA).

VIMTA LABS LIMITED HYDERABAD-51

3.4.1 Selection of Instruments for Air Quality Sampling

Respirable Dust Samplers APM-451 of Envirotech instruments are used for monitoring Particulate Matter (Size less than 10 µm) or PM_{10}, Arsenic, Nickel, Benzo (a) Pyrene, Lead and gaseous pollutants like SO_2, NO_x, Ozone and Ammonia.

The Fine Dust Sampler PEM – ADS 2.5µ/10µ (Ver.1.1) of Polltech Instrument are used for Particulate Matter (Size less than 2.5 µm) or $PM_{2.5}$, Benzene and Carbon monoxide Glass tubes were deployed for collection of grab samples of Carbon monoxide and Benzene.

3.4.2 Sampling and Analytical Techniques

1] Particulate Matter (Size less than 10 µm and 2.5 µm) SO_2 and NO_x

Particulate Matter (Size less than 10µm) or PM_{10} present in ambient air is sucked at a Flow Rate (1.0 to 1.4) through the cyclone. Coarse and non-respirable dust is separated from the air stream by centrifugal forces acting on the solid particles i.e. greater than 10µm. The fine dust (<10 microns) forming the respirable fraction of the Particulate Matter passes the cyclone and is retained by the filter paper.

Particulate Matter (Size less than 2.5µm) or $PM_{2.5}$ present in ambient air is sucked at a constant Flow Rate through the Sampling inlet which separates particles larger than 10µ and allow the smaller Particles to enter an internal particle size separator (US EPA WING Impactor) the PM2.5 size range is collected on a PTFE Filter over specified sampling period of 24 hours.

PM 10 µm and PM 2.5 µm have been estimated by gravimetric method. Modified West and Gaeke method (IS-5182 Part-II, 1969) has been adopted for estimation of SO_2. Jacobs-Hochheiser method (IS-5182 Part-IV, 1975) has been adopted for the estimation of NO_x.

2] Carbon Monoxide

Glass tubes have been used to collect the grab samples of carbon monoxide. The CO levels were analyzed through Gas Chromatography Method as per IS 5182 (Part-X): 1999.

3] Lead, Arsenic, Nickel and Benzo (a) Pyrene

Filter paper Particulate Matter (Size less than 10µm) are used to estimate the lead, Arsenic, Nickel and Benzo (a) Pyrene level. Filter paper is digested and analyzed for Lead, Arsenic and Nickel as per the method "As per IS 5182 (Part 22): 2004 / ASTM D 4185-90 Method – 3.4 using ICP-AES" using Atomic Absorption Spectrometer (AAS). Benzo (a) Pyrene is analyzed using GC- MS/MS Quattro micro mass as per USEPA Method TO 13A.

VIMTA LABS LIMITED HYDERABAD-51

4] Benzene

Glass tubes have been used to collect the grab samples of Benzene. The Benzene levels were analyzed Using GC-MS (Agilent, 5975 inert MSD) with Headspace technique as per USEPA Method TO 17

5] Ozone (O_3) and Ammonia

A tapping is provided on the suction side of the blower to provide suction for sampling air through a set of impingers. Samples of gases are drawn at a flow rate of 0.5 liters per minute (lpm).Ozone is sampled for 8 hours the sample is analyzed By Midget Impinger Alkaline 1% KI, Colorimetric method as per IS:5182 (Part-IX) and Ammonia is analyzed By Indophenol Blue Method as per APHA-401

Calibration:

Calibration charts have been prepared for all gaseous pollutants. The calibration is carried out whenever new absorbing solutions are prepared.

3.4.3 Presentation of Primary Data

The survey results for the study period are presented in detail in **Annexure- I.**

Various statistical parameters like 98th percentile, average, maximum and minimum values have been computed from the observed raw data for all the AAQ monitoring stations. The summary of these results for all the locations is presented in **Table-3.3.** These are compared with the standards prescribed by Central Pollution Control Board (CPCB) for "Rural, Residential and other areas.

VIMTA LABS LIMITED HYDERABAD-51

TABLE-3.3

SUMMARY OF AMBIENT AIR QUALITY RESULTS

All the values are expressed in µg/m³

Parameters		AAQ-1	AAQ-2	AAQ-3	AAQ-4	AAQ-5	Std#
PM_{10}	Maximum	54.7	52.0	58.0	45.0	58.4	100
	Minimum	48.6	45.9	46.7	35.2	50.7	
	Average	51.9	49.4	52.3	38.7	54.6	
	98%tile	54.5	51.6	57.5	41.9	57.1	
SO_2	Maximum	13.2	12.5	14.7	9.9	16.7	80
	Minimum	11.3	9.6	10.9	7.4	12.0	
	Average	12.2	10.9	12.6	8.9	14.0	
	98%tile	13.2	11.7	14.5	9.7	15.4	
NO_x	Maximum	17.9	15.4	19.5	14.2	20.4	80
	Minimum	14.9	12.6	14.2	11.0	16.4	
	Average	16.1	14.1	16.2	12.9	18.3	
	98%tile	17.8	15.2	19.1	13.9	19.3	
CO	Maximum	346	338	341	321	345	2.0 mg/m³
	Minimum	309	300	302	284	321	
	Average	327	316	326	305	334	
	98%tile	344	336	341	321	344	
$PM_{2.5}$	Value	17.0	16.5	17.9	12.8	18.3	60
Ozone	Value	9.4	7.8	9.6	7.2	10.7	100
Lead	Value	0.020	BDL	0.021	BDL	0.021	1.0
Ammonia	Value	BDL	BDL	BDL	BDL	BDL	400
Benzene	Value	N.D.	N.D.	N.D.	N.D.	N.D.	5.0
Benzo (a) Pyrene	Value	N.D.	N.D.	N.D.	N.D.	N.D.	1.0 ng/m³
Arsenic	Value	BDL	BDL	BDL	BDL	BDL	6.0 ng/m³
Nickel	Value	BDL	BDL	BDL	BDL	BDL	20.0 ng/m³

#National Ambient Air Quality Standards prescribed by Ministry of Environment and Forests, Government of India vide Gazette Notification G.S.R. 826(E) dated 18.11.2009.
N.D. – Not Detected, BDL-Below Detectable Limit.

VIMTA LABS LIMITED HYDERABAD-51

3.5 SOURCE EMISSION MONITORING

The values of Particulate matter, SO_2, NO_x and CO, Hg levels monitored at the boiler stack and for other stacks like DG Set (250 KVA) and Fire Water Pump House-Diesel Engine, Dust Extraction System -1 (Coal / Bio Fuel Transfer point)& Dust Extraction System -2 (Coal / Bio Fuel Bunker) the values of Particulate matter, SO_2, NO_x and CO levels only monitored by using our stack monitoring kit (*Code No. 104, 01987321 with 01991967*) is given below. The stack monitoring results shows that all the values are within the limits prescribed by TNPCB and MoEF&CC. The results are shown in **Table 4.1, 4.2 & 4.3**

TABLE – 4.1
SOURCE EMISSION MONITORING

Parameters	Unit	Results	Method of Testing
Stack Attached to		**Cogen Boiler - 60 TPH (Chimney TOP)**	-
Capacity	MW	8.0	-
Stack Height	m	84.0	-
Stack Diameter at exit point	m	1.5	-
Stack Diameter at Sampling point	m	3.5	-
Duct Area	m^2	9.616	-
Stack Temperature	°C	127.1	USEPA1,2,3 & 4
Flue Gas Velocity	m/s	5.8	USEPA1,2,3 & 4
Volumetric Flow Rate	Nm^3/hr	1,38,549.9	USEPA1,2,3 & 4
Emission Rate			
Particulate Matter	mg/Nm^3	19.9	USEPA 5
Sulphur Dioxide (SO_2)	mg/Nm^3	BDL	USEPA 6
Oxides of Nitrogen (NO_x)	mg/Nm^3	110.2	USEPA 7
Carbon Monoxide (CO)	mg/Nm^3	17.0	Flue Gas Analyzer
Mercury (Hg)	mg/Nm^3	0.003	USEPA 29

Instrument Used	Stack Monitoring Kit	Flue Gas Analyzer
Instrument	SL. NO. 104-DTB-2018	SL. NO. 319713
Date of Calibration	2023.04.20	2023.11.14
Next Calibration Due	2024.04.19	2024.11.13

VIMTA LABS LIMITED HYDERABAD-51

TABLE – 4.2
SOURCE EMISSION MONITORING

Parameters	Unit	Results		
Stack Attached to		DG Set (250KVA) (Near Board Machine)	DG Set (250KVA) (Near Boiler)	Fire Water Pump House Diesel Engine
Stack Height	m	24.0	8.2	7.6
Stack Diameter	m	0.25	0.15	0.125
Cross Sectional Area	m^2	0.0491	0.0177	0.0123
Stack Temperature	°C	129.0	132.0	164.0
Flue Gas Velocity	m/s	11.2	11.5	11.0
Gas Discharge	Nm^3/hr	1,350.7	497.3	305.1
Emission Rate				
Particulate Matter*	mg/Nm^3	16.5	14.8	20.8
Sulphur Dioxide	mg/Nm^3	15.0	11.7	17.4
Oxides of Nitrogen (NO_x)	mg/Nm^3	20.8	16.1	21.2
Carbon Monoxide	mg/Nm^3	10.2	7.9	12.7

**TNPCB Standard for Particulate Matter is 150.0 mg/Nm³*

TABLE – 4.3
SOURCE EMISSION MONITORING

Parameters	Unit	Results	
Stack Attached to		Dust Extraction System - 1 (Coal / Bio Fuel Transfer point)	Dust Extraction System - 2 (Coal / Bio Fuel Bunker)
Stack Height	m	9.9	9.9
Stack Diameter	m	0.65	0.65
Cross Sectional Area	m^2	0.3317	0.3317
Stack Temperature	°C	42.0	38.0
Flue Gas Velocity	m/s	8.1	8.5
Gas Discharge	Nm^3/hr	8,446.2	8,855.9
Emission Rate			
Particulate Matter*	mg/Nm^3	18.6	21.2
Sulphur Dioxide	mg/Nm^3	-	-
Oxides of Nitrogen	mg/Nm^3	-	-
Carbon Monoxide	mg/Nm^3	-	-

VIMTA LABS LIMITED HYDERABAD-51

	Environmental Baseline Data Generation - **DECEMBER 2023**

Instrument Used	Stack Monitoring Kit	Flue Gas Analyzer
Instrument	SL. NO. 104-DTB-2018	SL. NO. 319713
Date of Calibration	2023.04.20	2023.11.14
Next Calibration Due	2024.04.19	2024.11.13

VIMTA LABS LIMITED HYDERABAD-ST

Dr. Subba Reddy Mallampatti
Manager - Environment

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ANNEXURE – I
AMBIENT AIR QUALITY MONITORING RESULTS

All units are in µg/m³

Location : On top of Raw Water Pump House (AAQ 1)

Date	PM_{10}	SO_2	NO_x	CO		
				I	II	III
04-12-23	48.6	11.5	14.9	309	311	314
05-12-23	51.3	12	15.3	315	320	319
08-12-23	54.7	13.2	17.9	336	330	342
09-12-23	52.8	12.6	16	331	339	346
11-12-23	50.4	11.3	15.5	322	320	317
12-12-23	51.9	12	16.3	330	327	334
20-12-23	52.4	12.2	16	325	320	326
21-12-23	53.8	13	17.3	336	330	341
27-12-23	50.6	11.5	14.9	319	322	324
28-12-23	52.7	12.8	16.8	330	335	328
Maximum	**54.7**	**13.2**	**17.9**	**346**		
Minimum	**48.6**	**11.3**	**14.9**	**309**		
Average	**51.9**	**12.2**	**16.1**	**327**		
98 %tile	**54.5**	**13.2**	**17.8**	**344**		

All units are in µg/m³

Location : Near Rainwater Harvesting Pond (AAQ 2)

Date	PM_{10}	SO_2	NO_x	CO		
				I	II	III
01-12-23	50.5	11.0	15.2	320	326	322
02-12-23	47.3	10.4	14.1	312	304	315
06-12-23	45.9	9.6	13.0	300	303	311
07-12-23	48.2	10.8	14.5	315	310	318
13-12-23	50.9	11.6	14.9	322	329	325
14-12-23	52.0	10.5	13.4	335	338	330
18-12-23	48.7	11.3	14.7	311	320	318
19-12-23	50.2	12.5	15.4	308	312	315
25-12-23	51.5	11.1	13.5	315	319	309
26-12-23	49.0	10.4	12.6	308	302	300
Maximum	**52.0**	**12.5**	**15.4**	**338**		
Minimum	**45.9**	**9.6**	**12.6**	**300**		
Average	**49.4**	**10.9**	**14.1**	**316**		
98 %tile	**51.6**	**11.7**	**15.2**	**336**		

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ANNEXURE – I
AMBIENT AIR QUALITY MONITORING RESULTS

All units are in µg/m³

Location : Near Fuel Yard (AAQ 3)

Date	PM_{10}	SO_2	NO_x	CO		
				I	II	III
01-12-23	46.7	10.9	14.2	302	310	304
02-12-23	50.1	12.8	16.0	315	327	322
06-12-23	51.3	12.1	15.9	328	330	325
07-12-23	49.5	11.6	15.0	319	322	327
11-12-23	52.5	12.5	15.3	321	329	322
12-12-23	55.0	13.4	16.1	330	338	332
18-12-23	50.9	12.8	16.8	327	325	330
19-12-23	55.3	14.7	19.5	331	336	341
25-12-23	53.9	12.0	15.9	325	320	327
26-12-23	58.0	13.5	17.2	337	341	333
Maximum	**58.0**	**14.7**	**19.5**	**341**		
Minimum	**46.7**	**10.9**	**14.2**	**302**		
Average	**52.3**	**12.6**	**16.2**	**326**		
98 %tile	**57.5**	**14.5**	**19.1**	**341**		

All units are in µg/m³

Location : Near Guest House (AAQ 4)

Date	PM_{10}	SO_2	NO_x	CO		
				I	II	III
01-12-23	35.2	7.4	11.9	288	299	284
02-12-23	38.4	8.9	13.4	300	294	290
06-12-23	36.7	8.0	12.1	292	295	297
07-12-23	39.5	9.6	13.0	303	307	300
13-12-23	37.0	8.2	13.8	308	315	305
14-12-23	40.1	9.9	14.2	312	320	316
18-12-23	37.6	9.7	13.9	321	317	321
19-12-23	36.0	9.2	13.1	310	315	308
25-12-23	41.5	8.9	11.0	300	296	303
26-12-23	45.0	9.3	12.3	314	310	317
Maximum	**45.0**	**9.9**	**14.2**	**321**		
Minimum	**35.2**	**7.4**	**11.0**	**284**		
Average	**38.7**	**8.9**	**12.9**	**305**		
98 %tile	**41.9**	**9.7**	**13.9**	**321**		

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ANNEXURE – I
AMBIENT AIR QUALITY MONITORING RESULTS

All units are in $\mu g/m^3$

Location : Near ETP-Treated Water Tank (AAQ 5)

Date	PM_{10}	SO_2	NO_X	CO		
				I	II	III
04-12-23	53.5	12.6	16.4	325	329	331
05-12-23	55.0	13.9	18.1	330	341	336
08-12-23	50.7	12.0	17.2	321	330	327
09-12-23	54.2	13.2	17.9	329	337	331
11-12-23	53.4	13.7	18.3	337	331	340
12-12-23	56.9	14.5	19.0	342	335	338
20-12-23	56.0	15.3	18.6	338	330	343
21-12-23	58.4	16.7	20.4	345	340	336
27-12-23	55.0	15.1	19.2	340	337	342
28-12-23	52.8	13.4	17.8	329	335	325
Maximum	**58.4**	**16.7**	**20.4**	**345**		
Minimum	**50.7**	**12.0**	**16.4**	**321**		
Average	**54.6**	**14.0**	**18.3**	**334**		
98 %tile	**57.1**	**15.4**	**19.3**	**344**		

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Schedule of Monitoring for the Month of December 2023

S. NO.	LOCATION	I WEEK		II WEEK		III WEEK		IV WEEK		V WEEK	
AAQ Monitoring											
1	Near Raw Water Pump House	04-12-23	05-12-23	08-12-23	09-12-23	11-12-23	12-12-23	20-12-23	21-12-23	27-12-23	28-12-23
2	Near Rain Water Harvesting Pond	01-12-23	02-12-23	06-12-23	07-12-23	13-12-23	14-12-23	18-12-23	19-12-23	25-12-23	26-12-23
3	Near Fuel Yard	01-12-23	02-12-23	06-12-23	07-12-23	11-12-23	12-12-23	18-12-23	19-12-23	25-12-23	26-12-23
4	Near Guest House	01-12-23	02-12-23	06-12-23	07-12-23	13-12-23	14-12-23	18-12-23	19-12-23	25-12-23	26-12-23
5	Near ETP Treated Water Tank	04-12-23	05-12-23	08-12-23	09-12-23	11-12-23	12-12-23	20-12-23	21-12-23	27-12-23	28-12-23
Stack Monitoring											
1	Dust Extraction System -2 (Coal / Bio Fuel Bunker)	16-12-23 & 20-12-23									
2	Power Plant Boiler stack										
3	DG Set (250 KVA) – (Near Board Machine)										
4	Fire Water Pump House Diesel Engine										
5	Coal / Bio Fuel Transfer point										
6	DG Set (250 KVA) – (Near Boiler)										

VIMTA LABS LIMITED HYDERABAD-51

Leachate collection & disposal System



Drain towards inlet sump



Level Controller Panel of Sump

Leachate collection & disposal System

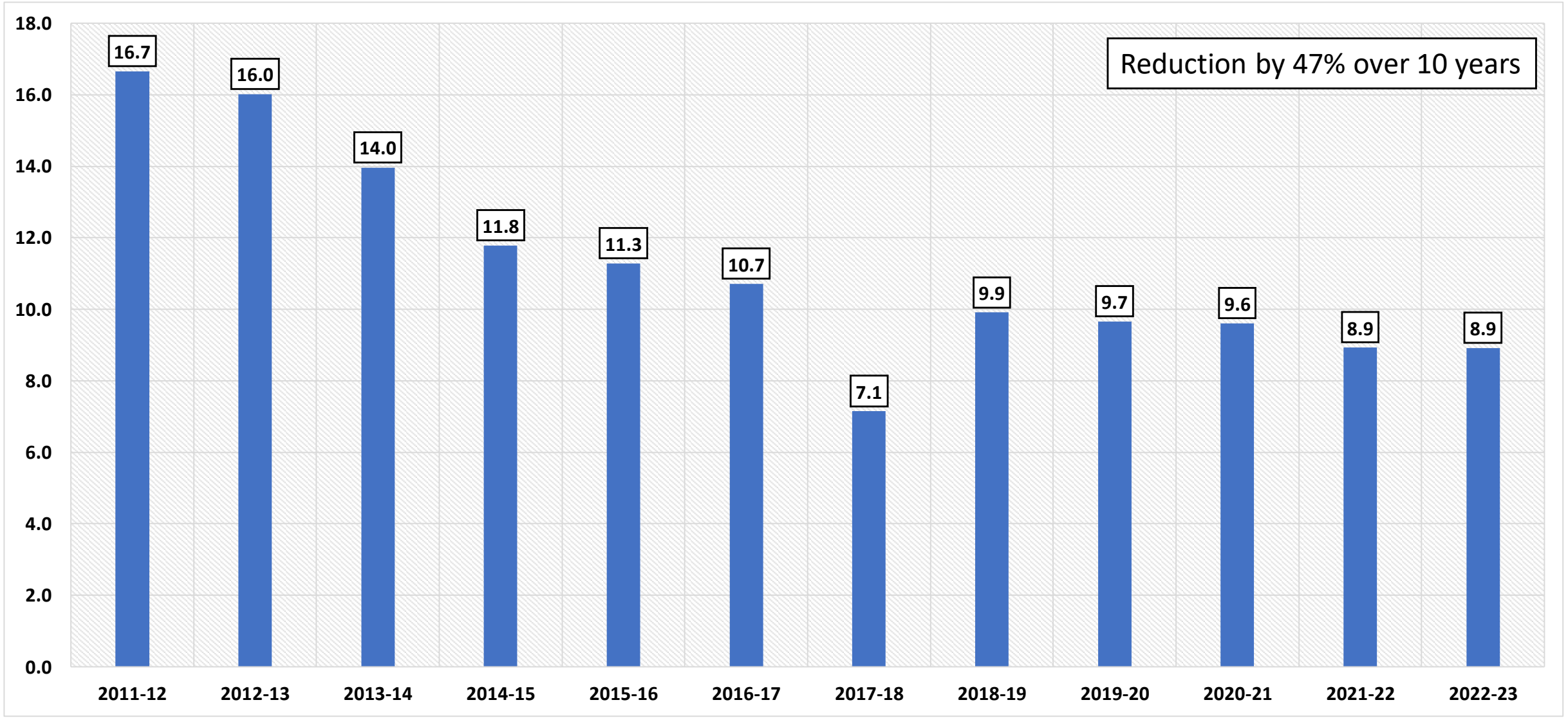


Piping from Sump Pump to ETP



Piping to ETP inlet main trench

Specific water consumption of Unit Kovai
(KL per MT of Saleable Production)



Dalmia cement
FUTURE TODAY

Ref No.: 130223120001467
Date: 06.01.2024

Certificate of Co-processing

This is certify that we have taken receipt of the following quantities of combustible fraction of PROCESS WASTE,PLASTIC waste sent by **ITC LIMITED** for Co-processing in our Cement factory for the month **DEC-2023.**

The Waste supplied would be safely and completely disposed in accordance with the provisions of applicable laws.

We certify that the following mentioned quantity has not been accounted for / billed to any other entity.

Waste Name: PROCESS WASTE,PLASTIC
Quantity : 600.740 MT

The annexure of this certificate will also include below details:

Supply Date	Vehicle No.	Challan No.	Source City	Source State	Supplied Qty	Received Qty
01.12.2023	TN52M1411	323	COIMBATORE	TAMIL NADU	27.750	27.360
05.12.2023	TN52F9561	324	COIMBATORE	TAMIL NADU	28.500	28.980
07.12.2023	TN28AQ5250	325	COIMBATORE	TAMIL NADU	23.700	23.100
07.12.2023	TN52K9297	326	COIMBATORE	TAMIL NADU	24.690	23.660
07.12.2023	TN31BH3606	327	COIMBATORE	TAMIL NADU	29.590	28.440
09.12.2023	TN52F9561	328	COIMBATORE	TAMIL NADU	31.010	28.860
10.12.2023	TN31BC6187	329	COIMBATORE	TAMIL NADU	32.570	30.340
10.12.2023	TN88E3345	330	COIMBATORE	TAMIL NADU	28.460	27.320
13.12.2023	TN19BU4334	331	COIMBATORE	TAMIL NADU	26.850	25.980
20.12.2023	TN45BM0077	332	COIMBATORE	TAMIL NADU	19.370	18.640
21.12.2023	TN28AH0354	333	COIMBATORE	TAMIL NADU	18.320	17.660
22.12.2023	TN52M3375	334	COIMBATORE	TAMIL NADU	26.260	25.200
25.12.2023	TN77D7999	337	COIMBATORE	TAMIL NADU	24.340	22.820
22.12.2023	TN34V4142	335	COIMBATORE	TAMIL NADU	25.230	23.440
24.12.2023	TN52B9757	338	COIMBATORE	TAMIL NADU	18.940	17.800
25.12.2023	TN82A9571	336	COIMBATORE	TAMIL NADU	23.120	21.840
28.12.2023	TN29AS5995	339	COIMBATORE	TAMIL NADU	23.550	22.480
28.12.2023	TN74BB9860	341	COIMBATORE	TAMIL NADU	18.180	17.740
28.12.2023	TN87C5578	340	COIMBATORE	TAMIL NADU	21.330	20.760
28.12.2023	TN28AP9869	343	COIMBATORE	TAMIL NADU	24.990	24.080
29.12.2023	TN52F9561	342	COIMBATORE	TAMIL NADU	25.220	24.500
29.12.2023	TN34Q5377	344	COIMBATORE	TAMIL NADU	23.480	23.020
31.12.2023	TN28BD1523	345	COIMBATORE	TAMIL NADU	27.840	25.680
Total Qty					**573.290**	**549.700**

For Dalmia Cement Bharat Ltd	
06/01/24	06/01/2024
First Signatory	Approving Signatory

Dalmia cement
FUTURE TODAY

181

Ref No.: 130223120001467
Date: 06.01.2024

Supply Date	Vehicle No.	Challan No.	Source City	Source State	Supplied Qty	Received Qty
31.12.2023	TN77L9456	346	COIMBATORE	TAMIL NADU	26.600	25.940
31.12.2023	TN52H9366	347	COIMBATORE	TAMIL NADU	25.500	25.100
Total Qty					**625.390**	**600.740**

For Dalmia Cement Bharat Ltd	
06/01/24	08/01/2024
First Signatory	**Approving Signatory**

DALMIA CEMENT (BHARAT) LIMITED
DCBL FACTORY ARIYALUR, SF-630 THAMARAIKULAM VILLAGE, ARIYALUR, , Tamil Nadu-621705, India, www.dalmiacement.com, CIN: U65191TN1996PLC035963
Registered Office: Dalmia Cement (Bharat) Limited, Dalmiapuram,Dist:Thiruchirappalli, , Tiruchirapalli, Tamil Nadu-621651, India

ANNEXURE R7

ITC Limited
PAPERBOARDS & SPECIALTY PAPERS DIVISION
Unit : Kovai
Vivekanandapuram (PO), Thekkampatty (Village)
Coimbatore - 641 113, Tamilnadu, India.
Tel(O) : 91-4254- 271234 / 28430
Fax : 91-4254-284304
www.itcpspd.com

Enduring Value



12/06/2024

The District Environmental Engineer,
Tamil Nadu Pollution Control Board,
No-5, Ramasamy Nagar,
Kavundampalayam,
Coimbatore – 641 025

Dear Sir,

Sub: Extraction and disposal of plastics by Zigma Global Environ Solutions Private Limited from our site at Thekkampatty Village

As you are aware that we had engaged one Zigma Global Environ Solutions Private Limited ("Zigma") for extraction, segregation and disposal of plastics which were found embedded in our aforesaid unit's premises leftover by the erstwhile owner of the unit viz., BILT Industrial Packaging Company Limited. Zigma had started their works in February 2023 and we have regularly been updating your good office on the progress of such works.

We are now pleased to inform the Board that Zigma has completed the aforesaid works in May 2024,by excavating about 3.03 hectares of land and processed 2.25 Lakh MT of soil at the aforesaid Unit, extracting plastics there from and disposing about 17902 MT of plastics, in aggregate. These plastics were sent to various Cement plants. Copies of Delivery Challan towards disposal of such plastics to cement plants are enclosed herewith for your kind reference. At the locations that were excavated, we have been planting trees after refilling earth in order to maintain greenery.

This is for your information and necessary record.

Thanking you,

Yours faithfully,
For ITC Limited – PSPD, Unit: Kovai.

S. Venkatrao
Unit Head

Encl: 1. Summary of soil excavation & plastic disposal details.
2. Copies of Delivery Challan towards plastic disposal

Copy: The Joint Chief Environmental Engineer (M), Coimbatore.

Summary of the Soil Excavated & Plastic Disposal status

Summary of the soil excavated & plastic disposed details		
Month	Soil excavated for segregation (MT)	Disposed Plastic waste to Cement Plants (MT)
Feb-23	2,562	0
Mar-23	9,222	187
Apr-23	15,179	1,572
May-23	12,342	2,073
Jun-23	17,565	1,072
Jul-23	36,058	2,534
Aug-23	24,573	2,378
Sep-23	33,323	1,841
Oct-23	26,277	2,977
Nov-23	13,780	676
Dec-23	19,115	505
Jan-24	13,755	446
Feb-24	1,249	31
Mar-24	0	150
Apr-24	0	889
May-24	0	571
Total	**225,000**	**17,902**

Summary of plastic disposed to Cement Industries			
S/L No	Name of the Cement plant	Location	Quantity of Plastics disposed (MT)
1	Dalmia Cement (B) Ltd (Unit: Ariyalur)	Ariyalur	3410
2	Dalmia Cement (B) Ltd (Unit: Dalmiapuram)	Dalmiapuram	874
3	JSW Cement Limited	Nandyal	10621
4	M/S Jindal Urban Waste Management (Guntur) Limited	Guntur	737
5	Ultratech Cement Limited (Unit: Reddipalayam)	Reddipalayam	14
6	Zuari Cement Limited (Unit: Yerraguntla)	Yerraguntla	2224
7	Chettinad Cement Corporation Private Limited (Unit: Ariyalur)	Ariyalur	21
Total			**17,902**

ANNEXURE R8

TAMILNADU POLLUTION CONTROL BOARD,
ADVANCED ENVIRONMENTAL LABORATORY,
COIMBATORE – 641 030.

TC-12371

REPORT OF ANALYSIS

ULR-TC123712400001474P

Report No : **2127.**

Analysis starting Date : 10.12.2024.

Code No & Point of Collection

1.DEECBN241055 – ETP Outlet [Treated]

Report Date : **30.12.2024.**

Analysis Completion date : 30.12.2024.

Date of Collection : 10.12.2024.

Date of Receipt : 10.12.2024.

Sample Condition : Sealed

Sample Quantity : 2.5 Litres

Sample Collected and Requested by : Er. K. Ganesan, AEE., O/o.The District Env.Engineer, No.5, Ramasamy Nagar, Kavundampalayam (Post), Coimbatore – 641 030.

Sl. No	Parameters	Test Method	Unit	Sample-1 DEECBN241055
1	pH @ 25° C	APHA 24th Edition - 4500 H+	- - -	**8.10**
2	Total Suspended Solids	APHA 24th Edition - 2540 D	mg/l	**12**
3	Total Dissolved Solids	APHA 24th Edition – 2540 C	mg/l	**1694**
4	Chlorides as Cl	APHA 24th Edition – 4500 Cl B	mg/l	**510**
5	Sulphate as SO_4	APHA 24th Edition – 4500 SO4 E	mg/l	**238**
6	BOD for 3 days @ 27^0C	IS 3025 (Part 44)	mg/l	**6**
7	COD	IS 3025 (Part 58)	mg/l	**40**
8	Ammonical Nitrogen	APHA 24th Edition – 4500 NH3	mg/l	**1.68**
9	Total Kjeldahl Nitrogen	APHA 24th Edition – 4500 Norg B	mg/l	**4.48**
10	Sulphide	APHA 24th Edition-4500 S2 F	mg/l	**<1**
11	Phenolic Compounds	APHA 24th Edition-5530 C	mg/l	**<0.01**
12	% Sodium	TNPCB/AEL/CBE/SOP/18, Issue No.01, Date. 20/08/2018	%	**39**

Remarks: < - Indicates less than minimum detectable limit.

-- End of Report --

E.S 20/01/25

20/01/25

[Dr. A. MANISEKAR]
Authorised Signatory,
Deputy Chief Scientific Officer.

The test result furnished relate to the sample received. The test report shall not be reproduced anywhere except in full without the written approval of Laboratory

ANNEXURE R9

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

From

Dr. A. Manisekar, M.Sc., M.Phil., Ph.D.,
Deputy Chief Scientific Officer,
Advanced Environmental Laboratory
Tamilnadu Pollution Control Board
No.5, Ramasamy Nagar, Kavundampalayam
Coimbatore – 641 030.
Email – aelcbe@tnpcb.gov.in.

To

M/s. ITC Limited.,
Paper Boards & Specialty Papers Division,
Unit : Kovai – Power Plant,
Vivekanandapuram (Post),
Thekkampatty (Village),
Coimbatore – 641 113.

Lr.No.TNPC Bd/DCSO/AEL-CBE/Air Survey/F.M.1/24 – 25, Dated 11.11.2024.

Sir,

Sub: Furnishing of Report of Analysis of Ambient Air Quality / Stack Monitoring / Ambient Noise Level Survey – Reg.

Ref: 1. This office Letter No.TNPC Bd/DCSO/AEL-CBE/Air survey/F.M.1/ 24 – 25, dated 16.05.2024 & 11.11.2024.
2. Your E-Mail Dated 05.11.2024.
3. Cash Receipt No. 381 dated 12.07.2024 for Rs.1,44,450/-
4. Cash Receipt No. 625 dated 28.11.2024 for Rs.15,620/-

*****

I am sending herewith the Report of Analysis of Ambient Air Quality / Stack Monitoring / Ambient Noise Level Survey conducted in the vicinity of your industry M/s. ITC Limited., Paper Boards & Specialty Papers Division, Unit : Kovai - Power Plant on 25.10.2024 and 26.10.2024 (24 hrs Survey) with invoice for a sum of Rs. 1,60,070/- (Rupees one lakh sixty thousand and seventy only) towards the above survey / analysis charges, and the same has been adjusted with the advance fees received vide reference (3) & (4) cited.

Kindly acknowledge the receipt of the report without fail.

12/12/24

Deputy Chief Scientific Officer,
AEL – TNPCB – CBE.

11/12/24

Encl: As above.

Copy to:-

1. The District Environmental Engineer, TNPCB, Coimbatore (North) for favour of kind information please.
2. File.

TAMILNADU POLLUTION CONTROL BOARD,
ADVANCED ENVIRONMENTAL LABORATORY,
COIMBATORE – 641 030.

NABL – TC-12371

TEST REPORT

ULR-TC123712400001292P

24 Hrs Average Values

Report No.70/AEL – CBE/ AAQS/2024 – 2025, Dated 11.11.2024.

1. Name of the Industry	:	M/s. ITC Limited., Paper Boards & Specialty Papers Division, Unit : Kovai - Power Plant,
2. Address of the Industry	:	Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
3. Date of Survey	:	25.10.2024 & 26.10.2024.
4. Duration of Survey	:	24 Hours
5. Category	:	Red/Large
6. Test Started on	:	29.10.2024.
7. Test Completed on	:	29.10.2024.
8. Matrix	:	Ambient Air Quality

Meteorological Conditions

Ambient Temperature (^{0} C)	Min	Max	Relative Humidity (%)	Min	Max
	25.6	33.9		62.0	92.0
Weather Condition	Partially Cloudy		Rain Fall (mm)	--	
Predominant Wind Direction	North East → South West		Mean Wind Speed (km/hr)	--	

Ambient Air Quality Survey Results

Sl. No	Location	Direction *	Distance (m) *	Height Form GL(m)	Pollutants Concentration (microgram / m^3) 24 Hrs Average		
					PM_{10}	SO_2	NO_2
1	On top of Scaffolding near Raw water sump.	North	200	2.0	**67.0**	**6.0**	**17.0**
2	On top of Scaffolding at North East corner opposite to Fire hydrant pump house.	North East	200	2.0	**48.0**	**7.0**	**15.0**
3	On top of Scaffolding at South East corner of the unit.	South East	200	2.0	**62.0**	**10.0**	**19.0**
4	On top of Scaffolding near R & D.Lab.	South West	350	2.0	**76.0**	**12.0**	**20.0**
5	On top of Scaffolding near D.M. Plant Lab.	North West	200	2.0	**66.0**	**9.0**	**18.0**
6	On top of Scaffolding at North West corner near ETP area.	North West	350	3.0	**57.0**	**10.0**	**20.0**

Note:- * With respect to major emission sources.
The analytical results are restricted to the sampling period of 24 hrs.

Test Performed	Test Method
PM_{10}	IS 5182: (Part 23) – 2006
SO_2	Modified West – Gaeke / IS 5182: (Part 2) – 2001 RA: 2012
NO_2	Jacobs – Hochheiser / IS 5182: (Part 6) – 2006 RA: 2012

-- End of Report --

11/12/24
J.E.S

12/12/24
[Dr. A. MANISEKAR]
Authorised Signatory
[Deputy Chief Scientific Officer]

TAMILNADU POLLUTION CONTROL BOARD,
ADVANCED ENVIRONMENTAL LABORATORY,
COIMBATORE – 641 030.

NABL – TC-12371

AMBIENT AIR QUALITY SURVEY

Schematic Diagram Showing Location of Sampling | **24 Hrs Average Values**

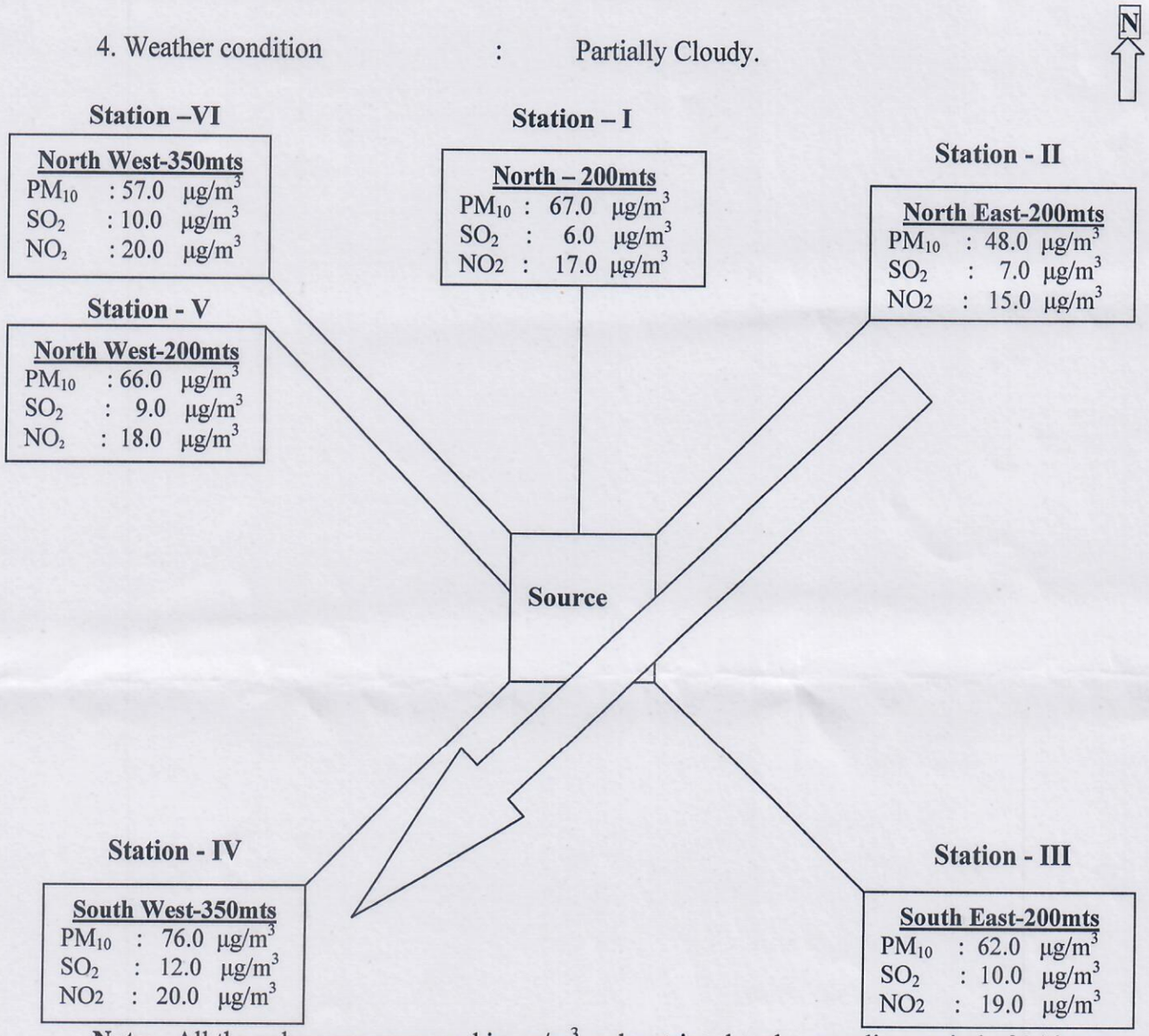
Report No.70/AEL – CBE/AAQ/SM/2024 – 2025, Dated 11.11.2024.

1. Name and Address of the Industry : M/s. ITC Limited.,
Paper Boards & Specialty Papers Division,
Unit : Kovai - Power Plant,
Vivekanandapuram (Post), Thekkampatty (Village),
Coimbatore – 641 113.

2. Date of Survey : 25.10.2024 & 26.10.2024.

3. Predominant wind direction : North East → South West.

4. Weather condition : Partially Cloudy.



Note:- All the values are expressed in µg/m^3 and restricted to the sampling period of 24 hours.

-- End of Report --

11/12/24
J.E.S

12/11/24
[Dr. A. MANISEKAR]
Authorised Signatory
[Deputy Chief Scientific Officer]

TAMILNADU POLLUTION CONTROL BOARD,
ADVANCED ENVIRONMENTAL LABORATORY,
COIMBATORE – 641 030.

NABL – TC-12371

TEST REPORT

ULR-TC123712400001292P

Report No.70/AEL – CBE/ SM/2024 – 2025, Dated 11.11.2024.

1. Name of the Industry	:	M/s. ITC Limited., Paper Boards & Specialty Papers Division, Unit : Kovai - Power Plant.
2. Address of the Industry	:	Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
3. Date of Survey	:	26.10.2024.
4. Test Started on	:	29.10.2024.
5. Test Completed on	:	29.10.2024.
6. Matrix	:	Stack Emission
7. Type of Industry	:	Power Plant for power generation & Duplex Board, Art Board and Cromo Board Manufacturing.

Stack Monitoring Survey Results

Sl. No.	Stack attached to	Stack Temp ^0C	Velocity in (m/ sec)	Discharge rate in Nm^3/Hour	Pollutants (mg / Nm^3)
					PM
1.	Captive Power Plant Boiler (60 TPH) (After Electro Static Precipitator) [Fuel: Saw dust, Imported Coal, Wood Chips, Unburnt Raw Lignite & Chemical Sludge.]	120	6.37	30,713	24.0

Test Performed	Test Method
Particulate Matter	IS 11255: (Part 1) – 1985 (RA: 2003)

-- End of Report --

11/12/24
J.E.S

11/12/24
[Dr. A. MANISEKAR]
Authorised Signatory
[Deputy Chief Scientific Officer]

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

TEST REPORT

Report No.70/AEL – CBE/ SM/2024 – 2025, Dated 11.11.2024.

1. Name of the Industry : M/s. ITC Limited., Paper Boards & Specialty Papers Division, Unit : Kovai - Power Plant.
2. Address of the Industry : Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
3. Date of Survey : 26.10.2024.
4. Test Started on : 29.10.2024.
5. Test Completed on : 29.10.2024.
6. Matrix : Stack Emission
7. Type of Industry : Power Plant for power generation & Duplex Board, Art Board and Cromo Board Manufacturing.

Stack Monitoring Survey Results

Sl. No.	Stack attached to	Stack Temp ^0C	Velocity in (m/ sec)	Discharge rate in Nm^3/Hour	Pollutants (mg / Nm^3)	
					So_2	No_x
1.	Captive Power Plant Boiler (60 TPH) (After Electro Static Precipitator) [Fuel: Saw dust, Imported Coal, Wood Chips, Unburnt Raw Lignite & Chemical Sludge.]	120	6.37	30,713	14.93	72.21

-- End of Report --

11/12/24

J. E.S

Deputy Chief Scientific Officer,
AEL – TNPCB – CBE.

TAMILNADU POLLUTION CONTROL BOARD,
ADVANCED ENVIRONMENTAL LABORATORY,
COIMBATORE – 641 030.

NABL – TC-12371

STACK DETAILS

Report No. 70/AEL – CBE/SM/2024 – 2025, Dated 11.11.2024.

1. Name and Address of the Industry: M/s. ITC Limited.,
Paper Boards & Specialty Papers Division,
Unit : Kovai - Power Plant,
Vivekanandapuram (Post), Thekkampatty (Village),
Coimbatore – 641 113.

2. Date of Survey : 26.10.2024.

Sl.No	Particulars	1
1.	Stack attached to	Captive Power Plant Boiler
2.	Details of process stack	Steam & Power Generation
3.	Height from G Level in (m)	84.0
4.	Diameter in (m)	1.5
5.	Port hole height from Ground Level or bends or ducts in (m)	42.0
6.	Fuel Used (with % Sulphur content)	Saw dust, Imported Coal, Wood Chips, Unburnt Raw Lignite & Chemical Sludge.
7.	Fuel Consumption rate per day (mention units)	**Description** / **25.10.2024** / **26.10.2024** Saw Dust / 99 MT / 89 MT Imported Coal / 216 MT / 190 MT Wood Chips / 24 MT / 24 MT Unburnt Raw Lignite / - / 32 MT Chemical Sludge (Bio Sludge) / 10 MT / 10 MT
8.	Stack Capacity	60 TPH Make: Thermax, Type: Water tube.
9.	APC Measures provided	Electro Static Precipitator
10.	APC functional status	Working
11.	Ambient temp in ^{o}K	304
12.	Temp of flue gas in ^{o}K	393
13.	Velocity of flue gas in m/sec	6.37
14.	Volume of flue gas sampled in m^3	1.008
15.	Gaseous Discharge rate per Nm^3/Hour	30,713

-- End of Report --

11/12/24

J.E.S

[Dr. A. MANISEKAR]
Authorised Signatory
[Deputy Chief Scientific Officer]

TAMILNADU POLLUTION CONTROL BOARD,
ADVANCED ENVIRONMENTAL LABORATORY,
COIMBATORE – 641 030.

NABL – TC-12371

AMBIENT/SOURCE NOISE LEVEL SURVEY - Report of Analysis

ULR-TC123712400001292P

Report No. 70/AEL – CBE/ NLS/2024 – 2025, Dated 11.11.2024.

1.	Name of the Industry	M/s. ITC Limited., Paper Boards & Specialty Papers Division, Unit : Kovai - Power Plant,
2.	Address of the Industry	Vivekanandapuram (Post), Thekkampatty (Village), Coimbatore – 641 113.
3.	Date of Survey	26.10.2024

Category	Red/Large	**Land use Classification**	--
Type of Survey	Ambient	**Time of Survey**	Day
Meteorological conditions		CALM	
Matrix		Sound Level	

Logging Parameters

Instrument Used	Larson & Davis		Serial No		824 A 2030
Logging Interval	10 Minutes each point		**Measuring Range**		50-110 dB(A)
Weighting	" A '	**Peak Weighting**	"C"	**Time Weighting**	FAST
Sound Incidence	RANDOM		**Time in hrs**		12.30 to 14.00 Hrs

Report of Noise Level Monitoring

Sl No	Location **At Ambient:**	Distance (M)	Direction	Sound Level – dB(A)					
				L_{eq}	L_{90}	L_{50}	L_{10}	Min	Max
1.	Near Raw Water Pump House.	200	North	**51.5**	50.2	50.8	53.1	49.4	61.9
2.	Near North East corner opposite to Fire Hydrant Pump House.	200	North East	**49.0**	48.1	48.2	50.4	47.6	59.8
3.	At South East corner of the unit.	200	South East	**47.5**	46.4	46.7	47.8	46.2	51.9
4	Near R & D Lab.	350	South West	**50.2**	49.0	49.6	51.5	48.3	60.6
5	Near Solar Panel Yard.	200	North West	**50.7**	50.4	50.6	51.1	49.9	53.5

Note: L90 Value refers to background noise: L50 Value refers to mean noise.L10 value refers to nuisance or annoyance level: Leq value is the average energy for the measured period.

-- End of Report --

11/12/24
J.E.S

11/12/24
[Dr. A. MANISEKAR]
Authorised Signatory
[Deputy Chief Scientific Officer]

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

GENERAL PARTICULARS

Report No. 70/AEL – CBE/AAQ/SM/2024 – 25, Dated 11.11.2024.

Name and Address of the Industry : M/s. ITC Limited.,
Paper Boards & Specialty Papers Division,
Unit : Kovai - Power Plant,
Vivekanandapuram (Post), Thekkampatty (Village),
Coimbatore – 641 113.

Date of Survey : 25.10.2024 & 26.10.2024.

Sl. No	Head of Particulars	Particulars
1.	Process Description	Power Plant for power generation & Duplex Board, Art Board and Cromo Board Manufacturing.
2.	Emission Sources	Boiler.
3.	Fugitive Emission Sources	Vehicle Movements were observed.
4.	Raw Material Consumptions	1. 25.10.2024 - Recycled waste paper – 275.79 Tons 2. 26.10.2024 - Recycled waste paper – 450.35 Tons
5.	Production Capacity as per Air Consent order No. & Date	1. Duplex Board, Art Board and Cromo Board } – 120000 Tons/Annum. As per Air Consent order No. 2205241935587 Dated 18.07.2022. 2. Power Plant – 8 MWHR As per Air Consent order No. 2205241846701 Dated 29.08.2022.
6.	Production on the day of Survey	1.25.10.2024– 369.400 Tons &Power Generated – 1,29,594 KWH 2.26.10.2024– 377.600 Tons &Power Generated – 1,25,531 KWH
7.	Air Consent Order No. Validity upto 31st March 2025 & 31st March 2027.	1. Air Consent order No. 2205241935587 Dated 18.07.2022 Validity upto 31.03.2025. 2. Air Consent order No. 2205241846701 Dated 29.08.2022 Validity upto 31.03.2027.
8.	Details of APC measures	Electro Static Precipitator
9.	Functional Status of APC measures	Working
10.	Field Observations	--

11/12/24
J. E.S

12/12/2024
Deputy Chief Scientific Officer,
AEL – TNPCB – CBE.

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

INFERENCE REPORT NO. 70/AEL – CBE/ A.A.Q.S./S.M. Dated 11.11.2024.

1. Name of Industry : M/s. ITC Limited.,
   Paper Boards & Specialty Papers Division,
   Unit : Kovai - Power Plant,
   Vivekanandapuram (Post), Thekkampatty (Village),
   Coimbatore – 641 113.
2. Pollution Category : Red/Large
3. Date of A.A.Q. Survey : 25.10.2024 & 26.10.2024 [24hrs Survey]
4. Predominant Wind Direction : North East → South West.
5. Weather condition : Partially Cloudy.

STATUS OF POLLUTANTS LEVEL

I. AMBIENT AIR QUALITY:-

1. Total No. of A.A.Q. stations monitored : 6
2. No. of A.A.Q. stations in which Pollutants
   Level exceeded the Boards standards (PM_{10}) : NIL

Maximum and minimum values of 24 Hours Average values parameter wise

Sl. No	POLLUTANT	Values in microgram/m^3		BOARD's STANDARD (As per consent order)
		Maximum	Minimum	
1.	Respirable Suspended particulate Matter: PM_{10}	76.0	48.0	100
2.	GASEOUS POLLUTANTS:-			
	(i) SO_2	12.0	6.0	80
	(ii) NO_2	20.0	15.0	80

II. STACK MONITORING:-

1. Total No. of Stacks Monitored : 1
2. No. of Stacks in which Pollutants level Exceeded the Boards standards : NIL

11/12/24
J. E.S

12/12/2024
Deputy Chief Scientific Officer,
AEL – TNPCB – CBE.

TAMILNADU POLLUTION CONTROL BOARD
Advanced Environmental Laboratory, Coimbatore – 641 030.

BILL

Report No.70/AEL – CBE/AAQ/SM/2024 – 2025, Dated 11.11.2024.

Bill No.	70/2024 – 2025
Date	11.11.2024.

To

M/s. ITC Limited.,

Paper Boards & Specialty Papers Division,

Unit : Kovai - Power Plant,

Vivekanandapuram (Post),

Thekkampatty (Village),

Coimbatore – 641 113.

Ref: 1. Bd's Memo No. TNPCB/DD(L)/02031/2019 Dated 30.08.2024. [G.O.(2D) No.76 dated: 21.08.2024] **(REVISED ANALYTICAL CHARGES)**

2. This office Letter No.TNPC Bd/DCSO/AEL-CBE/Air survey/F.M.1/ 24 – 25, dated 16.05.2024 & 11.11.2024.

3. Your E-Mail Dated 05.11.2024.

4. Cash Receipt No. 381 dated 12.07.2024 for Rs.1,44,450/-

5. Cash Receipt No. 625 dated 28.11.2024 for Rs.15,620/-

******

Sl. No.	Description	Rate (Rs)	No. of Stations/Stacks	Amount (Rs)
1.	**SAMPLING CHARGES:**			
	(i). Ambient Air Quality Monitoring	3,500.00	18 **(6×3)**	63,000.00
	(ii). Source Emission Monitoring (PM, SO_2 NO_2, etc.,)	17,800.00	1	17,800.00
2.	**ANALYTICAL CHARGES:**			
	(i). Ambient Air Samples PM_{10}, SO_2, NO_2 (Rs. 1,120 + 1,120 + 1,450)	3,690.00	18 **(6×3)**	66,420.00
	(ii). Source Emission Samples PM, SO_2, NO_2 (each Rs.1,450/-)	4,350.00	1	4,350.00
3.	**NOISE LEVEL MONITORING CHARGES:** (i). For first 5 stations	7,000.00	-	7,000.00
4.	**TRANSPORATION CHARGES:**	-	-	1,500.00
Total				**1,60,070.00**
Less: Advance – (Vide Ref. No. 4 & 5)				1,60,070.00
Balance to Pay				NIL

11/12/24
J. E.S

12/12/24
Deputy Chief Scientific Officer,
AEL – TNPCB – CBE.

ANNEXURE R10

Enviro Solutions & Labs

A5, Cheran Nagar, Off. Mettupalayam Road,
Kavundampalayam, GN Mills (Post), Coimbatore - 641 029. Tamilnadu.
: info@envislab.com : www.envislab.com : 0422 4200600

NABL Accredited Lab

TEST REPORT

Issued To

M/s. ITC Limited (PSPD), Unit: Kovai
Vivekananda Puram, Thekkampatti, Mettupalayam,
Coimbatore Dist. – 641 113.

Report No. : **ESL/2502/W/0916**
Report Date : 10.02.2025
Sample Code : ESL2501570

SAMPLE DETAILS			
Nature of Sample	Waste Water	Sample Description	ETP Outlet Water
Sample Collected By	Enviro Solutions & Labs	Sample Condition	Good
Sampling Procedure	ESL/QSP/07	Sample Location	ETP
Sample Collected On	31.01.2025	Sample Received On	01.02.2025
Analysis Started On	01.02.2025	Analysis Completed On	10.02.2025

S. No	Parameters	Units	Test Method	Results	Limits *
1	pH at 25 °C	-	IS 3025 (part -11)-2022	7.93	5.5-9.0
2	Colour	Hazen	IS 3025(Part-4)-2021	80	-
3	Total Dissolved Solids	mg/l	IS 3025 (part -16)-2023	1395	2100
4	Total Suspended Solids	mg/l	IS 3025 (part -17)-2022	23.0	200
5	Biochemical Oxygen Demand at 27° C for 3 days	mg/l	IS:3025(Part-44)-2023	16	100
6	Chemical Oxygen Demand	mg/l	IS 3025(part -58)-2023	98	-
7	Oil & Grease	mg/l	IS 3025(Part-39)-2021	BQL (LOQ:4.0)	10
8	Chloride as Cl	mg/l	IS 3025 (Part- 32)-1988 (RA:2019)	307	600
9	Sulphate as SO4	mg/l	IS 3025(Part24/Sec-1)-2022	253	1000
10	Temperature	°C	IS 3025 (Part 9)-1983 RA-2017	27.3	-
11	Sulphide as S^{2-}	mg/l	IS 3025 (Part 29) -1986 RA-2019	BQL(LOQ:0.1)	2
12	Percent Sodium as Na	mg/l	IS 3025 (Part 45)-1993 RA-2019	0.0105	-
13	Total Residual Chlorine	mg/l	IS 3025(Part 26)-2021	BQL(LOQ:0.2)	-
14	Fluoride as F	mg/l	IS 3025 (Part 60) -2008 RA-2019	BQL(LOQ:0.1)	2
15	Ammonical Nitrogen as N	mg/l	IS 3025(Part 34)-2023	1.12	-
16	Phenolic Compounds as Phenol	mg/l	IS 3025 (Part 43) 1992 RA-2019	BQL(LOQ:0.001)	5
17	Nickel as Ni	mg/l	IS 3025 (Part 54) 2003 RA-2019	BQL(LOQ:0.02)	3
18	Cadmium as Cd	mg/l	IS 3025 (Part 41) 1992 RA-2019	BQL(LOQ:0.02)	1

Note: BQL-Below Quantification Limit, LOQ – Limit of Quantification.
* As per TNPCB Standards- On land for irrigation

Contd....

Enviro Solutions & Labs ENVISLAB Coimbatore

- The test results relate only to the items tested during the specified time
- The test report shall not be reproduced in full or part without the written approval of ENVISLAB
- The test items will not be retained more than 15 days from the date of issue of the test report unless specifically requested

ENVISLAB

Enviro Solutions & Labs

A5, Cheran Nagar, Off. Mettupalayam Road,
Kavundampalayam, GN Mills (Post), Coimbatore - 641 029. Tamilnadu.
: info@envislab.com : www.envislab.com : 0422 4200600

NABL
Accredited Lab

TEST REPORT

Issued To

M/s. ITC Limited (PSPD), Unit: Kovai
Vivekananda Puram, Thekkampatti, Mettupalayam,
Coimbatore Dist. – 641 113.

Report No. : **ESL/2502/W/0916**
Report Date : 10.02.2025
Sample Code : ESL2501570

SAMPLE DETAILS			
Nature of Sample	Waste Water	Sample Description	ETP Outlet Water
Sample Collected By	Enviro Solutions & Labs	Sample Condition	Good
Sampling Procedure	ESL/QSP/07	Sample Location	ETP
Sample Collected On	31.01.2025	Sample Received On	01.02.2025
Analysis Started On	01.02.2025	Analysis Completed On	10.02.2025

S. No	Parameters	Units	Test Method	Results	Limits *
19	Lead as Pb	mg/l	IS:3025 (Part 47)-1994 RA-2019	BQL(LOQ:0.05)	1.0
20	Copper as Cu	mg/l	IS 3025 (Part 42) 1992 RA-2019	BQL(LOQ:0.01)	3
21	Zinc as Zn	mg/l	IS:3025 (Part:49)-1994 RA-2019	0.02	1.5
22	Total Chromium as Cr	mg/l	IS 3025 (Part 52) -2003 RA-2019	BQL(LOQ:0.05)	2
23	Arsenic as As	µg/l	IS:3025 (Part:37)-1988 RA-2019	BQL(LOQ:4.0)	0.2
24	Cyanide as CN	mg/l	IS 3025 (Part 27) 1986 RA-2019	BQL(LOQ:0.02)	0.2
25	Selenium as Se	µg/l	IS 3025 (Part 56) 2003 RA-2019	BQL(LOQ:1.0)	0.05
26	Mercury as Hg	µg/l	IS:3025 (Part 48)-1994 RA-2019	BQL(LOQ:1.0)	0.01
27	Free Ammonia as NH_3	mg/l	IS 3025(Part 34)-2023	0.4	-
28	Total Kjeldahl Nitrogen as N	mg/l	IS 3025(Part 34)-2023	14.2	-
29	Dissolved Phosphate as P	mg/l	IS 3025 (Part 31/Sec-1):2022	BQL(LOQ:0.2)	-
30	Hexavalent Chromium as Cr^{6+}	mg/l	IS 3025 (Part 52) -2003 RA-2019	BQL(LOQ:0.2)	1
31	Boron as B	mg/l	IS 3025 (Part 57): 2021	BQL(LOQ:0.2)	2
32	Residual Sodium Carbonate	mg/l	IS 11624 : 2019	2.0	5
33	Particle Size of TSS	-	IS Sieve 850 Micron	Pass 850 Micron IS Sieve	-
34	Alpha Emitters #	µCi/ml	IS14194(part2):2013[cl.6.3] (RA:2018)	BDL	Max- 10^{-7} µCi/ml
35	Beta Emitters #	µCi/ml	IS14194(part1):2020 [cl.6.2]	BDL	Max-10^{-6} µCi/ml

Note: BQL-Below Quantification Limit, BDL –Below Detectable Limit, Ci – Curie.
Out Sourced from NABL Authorized Lab. * As per TNPCB Standards- On land for irrigation

*****End of Report*****

V. Saravanakumar
Sr. Manager - Labs
Authorised Signatory

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- The test results relate only to the items tested during the specified time
- The test report shall not be reproduced in full or part without the written approval of ENVISLAB
- The test items will not be retained more than 15 days from the date of issue of the test report unless specifically requested

MONTHLY ENVIRONMENTAL MONITORING REPORT

February 2025



Project Proponent

ITC Limited

M/s. ITC Limited – PSPD,
Unit: Kovai
Thekkampatti Village
Coimbatore

Laboratory

ENVISLAB

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Enviro Solutions & Labs ENVISLAB Coimbatore

1.0 Introduction

M/s. ITC Limited - PSPD acquired the Paperboard facility at Coimbatore from BILT Industrial Packaging Company in August 2004. The Mill is located at Thekkampatti Village, Near Mettupalayam in Coimbatore Dist. of Tamil Nadu. The commercial production under ITC management began on 29th August 2004.

The Mill at present has a single board machine with a capacity of 1,20,000 TPM. The main product is Coated Duplex Boards Greyback made with 100% recycled fibre. Eco Naturo and Eco Naturo-HS are the two grades of Coated Duplex Grey Back board made from this unit. For almost the first time in India, a customer has the option to buy a higher bulk and stiffness of Greyback Board (GD2 grade) for his carton requirements. The unit has made rapid strides in becoming a world-class producer and has achieved ISO 9001, ISO 14001, ISO 45001 & ISO 50001certifications. The product range, true to ITC's innovative streak, has been enlarged by developing cone boards for textiles cones and grey boards for book binding boards.

ITC Limited availed the services of M/s. Enviro Solutions & Labs, Coimbatore which is an ISO 9001:2008 certified and accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL).

Environmental Monitoring is carried out to determine of various attributes viz., Air quality in Plant. This study would help to undertake corrective mitigation measures for protection of the environment on account of any change in deviation of attributes due to activities of the Plant.

The attributes like ambient air quality, source emission monitoring have been carried out at different locations of the Plant site on the Regular basis and this report represents the details of the study conducted during February 2025.

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2.0 Ambient Air Quality

The prime objective of ambient air quality monitoring is to evaluate the air quality of the proposed project area during construction phase. This will also be useful for assessing the conformity to standards of the ambient air quality. This section describes the selection of sampling locations, methodology adopted for sampling, analytical techniques, frequency of sampling and monitoring results.

2.1 Selection of Sampling Locations

The ambient air quality locations have been selected based on the wind direction as per the windrose diagram published by nearest IMD station, Coimbatore Airport. Ambient Air Quality Monitoring (AAQM) stations were set up at Five (5) locations across the Plant. The Ambient Air Quality monitoring locations are given in the **Table - 1.**

TABLE - 1: Details of Ambient Air Quality Monitoring Locations

Code	Location	Direction of the Location
AAQ1	On top of Raw Water Pump House	North East direction of the plant Site
AAQ2	Near Rainwater Harvesting Pond	East direction of the plant Site
AAQ3	Near Fuel Yard	South East direction of the plant Site
AAQ4	Near Guest House	South West direction of the plant Site
AAQ5	Near ETP-Treated Water Tank	North West direction of the plant Site

2.2 Frequency and Parameters for Sampling

Ambient air quality monitoring was carried out at each location weekly twice for 52 weeks on continuous basis. The data of air environment was generated for the parameters namely Particulate Matter size less than 10 µm (PM10), Particulate Matter size less than 2.5 µm (PM2.5), Sulphur dioxide (SO2), Oxides of Nitrogen (NOx), Ammonia (NH3), Ozone (O3), Carbon Monoxide (CO), Lead (Pb), Ammonia (NH3), Benzene (C6H6), Benzo (a) Pyrene (BaP), Arsenic (As) and Nickel (Ni) as per NAAQ standards.

2.3 Sampling and Analytical Techniques

The sampling and analytical techniques used for the monitoring of Ambient Air quality is given in **Table – 2.**

TABLE - 2: Techniques Used for Ambient Air Quality Monitoring

S. No.	Parameter	Technical Protocol	Detectable Limit
1	Particulate Matter (PM_{10})	IS 5182 Pt.23 : 2006 (Reaff. 2017)	5.0 µg / m^3
2	Particulate Matter ($PM_{2.5}$)	IS 5182 Pt.24 : 2019	5.0 µg / m^3
3	Sulphur Dioxide (SO_2)	IS 5182: Part 2:2001 (Reaff. 2017)	5.0 µg / m^3
4	Nitrogen Dioxide (NO_2)	IS 5182: Part 6:2006 (Reaff. 2017)	5.0 µg / m^3
5	Carbon Monoxide (CO)	IS 5182:Part 10 :1999 (Reaff. 2014)	0.1 mg / m^3
6	Ozone (O_3)	IS : 5182 (Part 09):1974	5.0 µg / m^3
7	Lead (Pb)	IS 5182 P 22	0.1 µg / m^3
8	Ammonia (NH_3)	ESL/SOP/001	5.0 µg / m^3
9	Benzene (C_6H_6)	IS 5182: Pt 22: 2004	0.01 µg / m^3
10	Benzo (a) Pyrene (BaP)	IS 5182: Pt 22: 2004	0.1 ng / m^3
11	Arsenic (As);	IS 5182: Pt 22: 2004	1.0 ng / m^3
12	Nickel (Ni):	IS 5182: Pt 22: 2004	1.0 ng / m^3

2.4 Presentation of Results

The Air Quality Monitoring results of Five locations are presented in below Table 3.1 to 3.5 and the Summary of the same is given in Table 3.6. The results are compared with the NAAQ standards.

TABLE-3.1: Ambient Air Quality Monitoring Results

AAQ 1: On Top of Raw Water Pump House				
Date of Monitoring	**PM 10 µg/m^3**	**SO_2 µg/m^3**	**NO_2 µg/m^3**	**CO mg/m^3**
10.02.2025	52.8	5.9	13.5	0.16
11.02.2025	53.1	5.2	12.8	0.14
13.02.2025	52.7	6.1	14.0	0.11
14.02.2025	53.0	5.5	12.7	0.15
18.02.2025	52.8	5.3	13.5	0.18
19.02.2025	53.2	5.9	12.3	0.16
24.02.2025	51.5	5.7	13.2	0.13
25.02.2025	52.3	6.0	14.2	0.15
Min	**51.5**	**5.2**	**14.0**	**0.11**
Max	**53.2**	**6.1**	**14.2**	**0.18**
Mean	**52.7**	**5.7**	**13.3**	**0.15**
98%ile	**53.2**	**6.1**	**14.2**	**0.18**
CPCB Limits	**100**	**80**	**80**	**2**

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TABLE-3.2: Ambient Air Quality Monitoring Results

AAQ 2: Near Rainwater Harvesting Pond				
Date of Monitoring	PM 10 µg/m³	SO_2 µg/m³	NO_2 µg/m³	CO mg/m³
10.02.2025	53.7	6.3	13.8	0.14
11.02.2025	50.5	5.4	13.1	0.15
13.02.2025	53.6	5.5	13.5	0.14
14.02.2025	50.3	6.1	13.1	0.16
18.02.2025	52.8	6.4	12.7	0.15
19.02.2025	51.9	6.2	12.9	0.14
24.02.2025	53.3	5.7	12.6	0.16
25.02.2025	53.0	6.0	13.2	0.13
Min	**50.3**	**5.4**	**12.6**	**0.13**
Max	**53.7**	**6.4**	**13.8**	**0.16**
Mean	**52.4**	**6.0**	**13.1**	**0.15**
98%ile	**53.7**	**6.4**	**13.8**	**0.16**
CPCB Limits	**100**	**80**	**80**	**2**

TABLE-3.3: Ambient Air Quality Monitoring Results

AAQ 3: Near Fuel Yard				
Date of Monitoring	PM 10 µg/m³	SO_2 µg/m³	NO_2 µg/m³	CO mg/m³
10.02.2025	57.9	5.9	15.6	0.16
11.02.2025	55.4	6.2	15.3	0.19
13.02.2025	56.5	5.6	15.0	0.17
14.02.2025	58.1	6.6	16.2	0.15
18.02.2025	58.4	6.0	14.9	0.23
19.02.2025	58.7	6.4	15.8	0.15
24.02.2025	57.3	5.5	16.2	0.18
25.02.2025	56.9	5.7	15.9	0.21
Min	**55.4**	**5.5**	**14.9**	**0.15**
Max	**58.7**	**6.6**	**16.2**	**0.23**
Mean	**57.4**	**6.0**	**15.6**	**0.18**
98%ile	**58.7**	**6.6**	**16.2**	**0.23**
CPCB Limits	100	80	80	2

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TABLE-3.4: Ambient Air Quality Monitoring Results

AAQ 4: Near Guest House				
Date of Monitoring	PM 10 µg/m³	SO_2 µg/m³	NO_2 µg/m³	CO mg/m³
10.02.2025	44.1	5.1	14.5	0.13
11.02.2025	42.6	5.6	14.2	0.15
13.02.2025	45.8	6	14.4	0.11
14.02.2025	45.9	5.7	13.9	0.16
18.02.2025	43.5	5.5	12.4	0.14
19.02.2025	41.6	6.2	14.6	0.12
24.02.2025	45.9	5.7	13.5	0.16
25.02.2025	45.4	5.9	14.7	0.15
Min	**41.6**	**5.1**	**12.4**	**0.11**
Max	**45.9**	**6.2**	**14.7**	**0.16**
Mean	**44.4**	**5.7**	**14.0**	**0.14**
98%ile	**45.9**	**6.2**	**14.7**	**0.16**
CPCB Limits	100	80	80	2

TABLE-3.5: Ambient Air Quality Monitoring Results

AAQ 5: Near ETP-Treated Water Tank				
Date of Monitoring	PM 10 µg/m³	SO_2 µg/m³	NO_2 µg/m³	CO mg/m³
10.02.2025	51.7	6.0	14.5	0.16
11.02.2025	53.4	5.7	13.9	0.15
13.02.2025	52.9	5.4	14.2	0.13
14.02.2025	53.1	6.0	13.2	0.16
18.02.2025	52.9	6.2	13.5	0.17
19.02.2025	53.8	5.9	14.1	0.15
24.02.2025	51.4	6.3	13.9	0.16
25.02.2025	51.8	5.4	14.4	0.15
Min	**51.4**	**5.4**	**13.2**	**0.13**
Max	**53.8**	**6.3**	**14.5**	**0.17**
Mean	**52.6**	**5.9**	**14.0**	**0.15**
98%ile	**53.7**	**6.3**	**14.5**	**0.17**
CPCB Limits	100	80	80	2

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TABLE-3.6: Summary of Ambient Air Quality Results

Parameters		AAQ-1	AAQ-2	AAQ-3	AAQ-4	AAQ-5	Std#
PM10 µg/m³	Minimum	51.5	50.3	55.4	41.6	51.4	100
	Maximum	53.2	53.7	58.7	45.9	53.8	
	Average	52.7	52.4	57.4	44.4	52.6	
	98%tile	53.2	53.7	58.7	45.9	53.7	
SO2 µg/m³	Minimum	5.2	5.4	5.5	5.1	5.4	80
	Maximum	6.1	6.4	6.6	6.2	6.3	
	Average	5.7	6.0	6.0	5.7	5.9	
	98%tile	6.1	6.4	6.6	6.2	6.3	
NOX µg/m³	Minimum	14.0	12.6	14.9	12.4	13.2	80
	Maximum	14.2	13.8	16.2	14.7	14.5	
	Average	13.3	13.1	15.6	14.0	14.0	
	98%tile	14.2	13.8	16.2	14.7	14.5	
CO mg/m³	Minimum	0.11	0.13	0.15	0.11	0.13	2
	Maximum	0.18	0.16	0.23	0.16	0.17	
	Average	0.15	0.15	0.18	0.14	0.15	
	98%tile	0.18	0.16	0.23	0.16	0.17	
PM2.5 µg/m³	Value	23.4	22.9	26.2	20.2	24.0	60
Ozone µg/m³	Value	BQL (LOQ:5.0)	BQL (LOQ:5.0)	BQL (LOQ:5.0)	BQL (LOQ:5.0)	BQL (LOQ:5.0)	100
Lead µg/m³	Value	BQL (LOQ:1.0)	BQL (LOQ:1.0)	BQL (LOQ:1.0)	BQL (LOQ:1.0)	BQL (LOQ:1.0)	1.0
Ammonia µg/m³	Value	BQL (LOQ:5.0)	BQL (LOQ:5.0)	BQL (LOQ:5.0)	BQL (LOQ:5.0)	BQL (LOQ:5.0)	400
Benzene µg/m³	Value	BQL (LOQ:0.5)	BQL (LOQ:0.5)	BQL (LOQ:0.5)	BQL (LOQ:0.5)	BQL (LOQ:0.5)	5.0
Benzo (a) Pyrene ng/m3	Value	BQL (LOQ:0.5)	BQL (LOQ:0.5)	BQL (LOQ:0.5)	BQL (LOQ:0.5)	BQL (LOQ:0.5)	1.0
Arsenic ng/m3	Value	BQL (LOQ:1.0)	BQL (LOQ:1.0)	BQL (LOQ:1.0)	BQL (LOQ:1.0)	BQL (LOQ:1.0)	6.0
Nickel ng/m3	Value	BQL (LOQ:2.5)	BQL (LOQ:2.5)	BQL (LOQ:2.5)	BQL (LOQ:2.5)	BQL (LOQ:2.5)	20.0

Note: BQL-Below Quantification Limit, LOQ – Limit of Quantification

2.5 Observations

PM_{10}: The maximum and minimum concentrations for PM_{10} were recorded as 58.7 µg/m³ and 41.6 µg/m³ respectively. The maximum concentration was recorded at the Near Fuel Yard and the minimum concentration was recorded at Near Guest House.

SO_2: The maximum and minimum concentrations for SO_2 were recorded as 6.6 µg/m³ and 5.1 µg/m³ respectively. The maximum concentration was recorded at Near Fuel Yard and the minimum concentration was recorded at Near ETP.

NO_x: The maximum and minimum NO_x concentrations were recorded as 16.2 µg/m³ and 12.4 µg/m³ respectively. The maximum concentration was recorded at Near Fuel Yard and the minimum concentration was recorded at Near ETP.

All other parameters like Ammonia, Ozone, Lead, Arsenic, Nickel, Benzene, Benzo(a)pyrene are found below detectable Limits.

The overall concentrations of PM_{10}, $PM_{2.5}$, SO_2, NOx was observed to be well within the National Ambient Air Quality Standards (NAAQS) prescribed by Central Pollution Control Board (CPCB).

2.6. Instrument Calibration Details

Instrument Used	Instrument SL. Number	Date of Calibration	Next Calibration Due
PM10 & PM 2.5 Sampler	COMBO-23D02	15.07.2024	15.07.2025
PM10 & PM 2.5 Sampler	ESL/CHL/INS/CSM/001	15.07.2024	15.07.2025
PM10 Sampler	355 D-2023	15.07.2024	15.07.2025
PM10 Sampler	RDS-23A-01	15.07.2024	15.07.2025
PM10 Sampler	111D-2023	15.07.2024	15.07.2025

3.0 Source Emission Monitoring

Source Emission Monitoring has been conducted in the Boiler, DG Sets, Fire Water Pump house and Dust Extraction systems to assess the Emission levels. The main objective of Source Emission monitoring is to establish the Emission levels and assess the impact of the Air Pollution Control Devices (APCD's)

3.1 Methodology for Monitoring

The Stack Kit was used for measuring the Source Emission. The Sampling was conducted as per IS 11255 methods to measure the Particulate matter. The Gaseous emissions are measured by Flue Gas analyzer.

3.2 Details of Stacks

The Details of the Stacks are listed in below Table 4 and Emission Results are given in Table 5.1 to 5.4.

TABLE-4: Details of the Emission Sources

S. No	Name of Stack	Height of the Stack from ground level in Meters
1	Boiler	84
2	DG set 250 KVA (Near Board Machine)	24
3	DG set 250 KVA (Near Boiler)	8.2
4	Fire Water pump House Diesel Engine	7.6
5	Dust Extraction System-1 Coal/Bio Fuel Transfer Point	9.9
6	Dust Extraction System-2 Coal/Bio Fuel Bunker	9.9

TABLE-5.1: Source Emission Results – Boiler

S. No	STACK DETAILS	UOM	Cogen Boiler 60 TPH	Standards
1	Stack Height	Meter	84.0	--
2	Stack Diameter at Exit Point	Meter	1.5	--
3	Stack Diameter at Sampling Point	Meter	3.5	--
4	Cross Sectional Area	Sq. Meter	9.616	--
5	Velocity of Flue Gas	M/sec	6.2	--
6	Gas Discharge	Nm^3/hr	155490	--
7	Stack Gas Temperature	°C	126	--
8	Ambient Gas Temperature	°C	35	--
Emission Results				
1	Particulate Matter	Mg/Nm3	26.8	**50**
2	Sulphur Dioxide	Mg/Nm3	29.4	**600**
3	Oxides of Nitrogen	Mg/Nm3	142.8	**450**
4	Mercury	Mg/Nm3	BQL (LOQ:0.003)	**0.03**
5	Carbon Monoxide (CO)	Mg/Nm3	30	--

Note: BQL-Below Quantification Limit, LOQ – Limit of Quantification

TABLE-5.2: Source Emission Results – DG sets

S. No	STACK DETAILS	UOM	DG set 250 KVA (Near Board Machine)	DG set 250 KVA (Near Boiler)	Standards
1	Stack Height	Meter	24	8.2	--
2	Stack Diameter	Meter	0.25	0.15	--
3	Cross Sectional Area	Sq. Meter	0.0491	0.0177	--
4	Velocity of Flue Gas	M/sec	10.8	10.4	--
5	Gas Discharge	Nm^3/hr	1347	476	--
6	Stack Gas Temperature	°C	141	134	--
7	Ambient Gas Temperature	°C	35	35	--
Emission Results					
1	Particulate Matter	g/kw-hr	0.0536	0.0498	≤0.20
2	Sulphur Dioxide	Mg/Nm3	12.4	10.6	--
3	Oxides of Nitrogen	g/kw-hr	0.3866	0.3201	--
4	Carbon Monoxide (CO)	g/kw-hr	0.403	0.441	≤3.5

*As per the Emission standard for diesel generator set up to 800KW (Power Category from 75 KW to 800 KW) in the Gazette of India vide number S.O 844(E) dated 19th November 1986 and subsequent amendment rule vide GSR 771(E) dated 11th December 2013

TABLE-5.3: Source Emission Results – Diesel Engine

S. No	STACK DETAILS	UOM	Fire Water Pump House Diesel Engine	Standards
1	Stack Height	Meter	7.6	--
2	Stack Diameter	Meter	0.125	--
3	Cross Sectional Area	Sq. Meter	0.0123	--
4	Velocity of Flue Gas	M/sec	17.3	--
5	Gas Discharge	Nm^3/hr	471	--
6	Stack Gas Temperature	°C	202	--
7	Ambient Gas Temperature	°C	35	--
Emission Results				
1	Particulate Matter	Mg/Nm3	32.8	150
2	Sulphur Dioxide	Mg/Nm3	16.3	--
3	Oxides of Nitrogen	Mg/Nm3	45.0	--



TABLE-5.4: Source Emission Results – Dust Extraction Systems

S. No	STACK DETAILS	UOM	Dust Extraction System-1 (Coal / Bio Fuel Transfer Point)	Dust Extraction System-2 (Coal / Bio Fuel Bunker)	Standards
1	Stack Height	Meter	9.9	9.9	--
2	Stack Diameter	Meter	0.65	0.65	--
3	Cross Sectional Area	Sq. Meter	0.3317	0.3317	--
4	Velocity of Flue Gas	M/sec	5.9	6.3	--
5	Gas Discharge	Nm^3/hr	6659	7064	--
6	Stack Gas Temperature	°C	36	38	--
7	Ambient Gas Temperature	°C	35	35	--
Emission Results					
1	Particulate Matter	Mg/Nm3	28.2	25.0	**150**
2	Sulphur Dioxide	Mg/Nm3	--	--	--
3	Oxides of Nitrogen	Mg/Nm3	--	--	--

3.3. Instrument Calibration Details

Instrument Used	Instrument SL. Number	Date of Calibration	Next Calibration Due
Stack Kit	113 D 2024	06.04.2024	05.04.2025
Flue Gas Analyzer	044114624	15.07.2024	14.07.2025

Authorised Signatory
T. Ram Ganesan
Technical Manager

V. Saravanakumar
Sr. Manager - Labs
Authorised Signatory

Enviro Solutions & Labs ENVISLAB Coimbatore

Monitoring Schedule for the Month of February 2025

S. No	Location	Ist Week		IInd Week		IIIrd Week		IVth Week	
	AAQ Stations								
1	AAQ1- On top of Raw Water Pump House	10.02.25	11.02.25	13.02.25	14.02.25	18.02.25	19.02.25	24.02.25	25.02.25
2	AAQ2- Near Rainwater Harvesting Pond	10.02.25	11.02.25	13.02.25	14.02.25	18.02.25	19.02.25	24.02.25	25.02.25
3	AAQ3- Near Fuel Yard	10.02.25	11.02.25	13.02.25	14.02.25	18.02.25	19.02.25	24.02.25	25.02.25
4	AAQ4- Near Guest House	10.02.25	11.02.25	13.02.25	14.02.25	18.02.25	19.02.25	24.02.25	25.02.25
5	AAQ5 -Near ETP-Treated Water Tank	10.02.25	11.02.25	13.02.25	14.02.25	18.02.25	19.02.25	24.02.25	25.02.25
	Stack Monitoring								
1	Power Plant Boiler Stack	24.02.2025 & 28.02.2025							
2	DG set 250 KVA (Near Board Machine)								
3	DG set 250 KVA (Near Boiler)								
4	Fire Water Pump House Diesel Engine								
5	Dust Extraction System-1 Coal/Bio Fuel Transfer Point								
6	Dust Extraction System-2 Coal/Bio Fuel Bunker								

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ANNEXURE R11

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TNAU - ITC Ltd., (PSPD UNIT), KOVAI - COLLABORATIVE RESEARCH PROJECT

ANNUAL PROGRESS REPORT

(JULY, 2023 – JUNE, 2024)

"STUDIES ON THE IMPACT OF ITC KOVAI PAPER BOARD MILL TREATED EFFLUENT ALONG WITH SLUDGE ON SOIL HEALTH AND CROP PRODUCTIVITY"



TEAM

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TAMIL NADU AGRICULTURAL UNIVERSITY

COIMBATORE – 641 003

2024

ANNUAL PROGRESS REPORT (JULY, 2023 – JUNE, 2024)

1. Project Title : **"Studies on the impact of ITC kovai paper board mill treated effluent along with sludge on soil health and crop productivity"**

2. Name of the Project Leader(s) and Designation : **PI: Dr. P. Devagi**
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3. Project duration : 3 Years (2023-2026)

4. Objectives :

1. Characterization of raw and treated effluent from Effluent Treatment Plant (ETP) of ITC Paper Board mill, Thekkampatty
2. Continuous monitoring of soil and ground water qualities in and around the premises of ITC factory (Bench Mark sites)
3. Piezometers and lysimeter studies in the areas irrigated with ITC paper board treated effluent for agriculture purpose
4. Evaluating different methods of irrigation by using treated effluent for different crops
5. ETP Sludge management for effective usage

Activity I: Characterization of ITC Ltd., (PSPD), effluent for physico-chemical properties at periodical intervals

The raw and treated effluent samples were collected once in three months during the sampling period up to June, 2024 from ITC Ltd., PSPD and they were analyzed for its physical and chemical properties. At quarterly intervals samples were collected during September, 2023, December, 2023, March, 2024 and June, 2024. Samples collected were analyzed as per the standard analytical methods and the results are presented in Table 1.

Table 1. Characteristics of the Raw and Treated Effluent of ITC

Parameters	Unit	Values									
		Raw Effluent					Treated Effluent				
		Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
pH	-	7.72	7.76	7.62	7.71	**7.70**	7.56	7.58	7.54	7.59	**7.57**
EC	dS m^{-1}	1.92	1.86	1.95	2.02	**1.94**	1.58	1.61	1.75	1.80	**1.69**
TDS	mg L^{-1}	1278.5	1359.72	1256	1295	**1297.31**	960.43	925.51	1075	1062	**1005.74**
TSS	mg L^{-1}	942	952	944	971	**952.25**	78.5	79.2	81.47	84.25	**80.86**
DO	mg L^{-1}	3.46	3.58	3.42	3.51	**3.49**	5.51	5.35	5.41	5.57	**5.46**
BOD	mg L^{-1}	163.22	161.16	164.18	162.57	**162.78**	25.03	24.43	25.14	24.65	**24.81**
COD	mg L^{-1}	475.62	482.57	481.51	480.24	**479.99**	94.36	104.33	95.75	98.49	**98.23**
Nitrogen	mg L^{-1}	36.14	35.62	30.24	32.51	**33.63**	17.54	18.51	15.4	18.5	**17.49**
Phosphorus	mg L^{-1}	2.26	2.49	2.17	2.22	**2.29**	1.23	1.17	1.21	1.27	**1.22**
Potassium	mg L^{-1}	30.56	34.82	31.51	32.48	**32.34**	22.16	25.22	24.45	26.28	**24.53**
Calcium	mg L^{-1}	271.36	268.31	270.84	268.5	**269.75**	208.15	219.62	212.52	221.91	**215.55**
Magnesium	mg L^{-1}	52.07	51.84	49.42	50.24	**50.89**	31.58	35.82	46.75	45.65	**39.95**
Sodium	mg L^{-1}	247.23	242.60	241.25	248.25	**244.83**	138.96	141.62	151.67	155.45	**146.93**
Bicarbonate	mg L^{-1}	327.18	316.72	381.52	379.26	**351.17**	119.42	122.58	119.4	124.5	**121.48**
Chloride	mg L^{-1}	267.63	274.53	264.21	259.27	**266.41**	197.55	191.87	201.61	198.44	**197.37**
Sulphate	mg L^{-1}	222.34	216.89	219.74	224.21	**220.80**	127.15	121.16	132.11	131.35	**127.94**

Characteristics of the raw effluent

Based on the results obtained, the pH of the raw effluent was 7.72 in September, 2023, 7.76 in December, 2023, 7.62 in March, 2024 and 7.71 in June, 2024 which tends to be neutral with an EC of 1.92 dSm^{-1} in September, 2023, 1.86 dSm^{-1} in December, 2023, 1.95 dSm^{-1} in March, 2024 and 2.02 dSm^{-1} in June, 2024. TDS range was reported as 1278 mg L^{1}, 1359 mgL^{-1}, 1256 mg L^{-1} and 1295 mg L^{-1} in September, 2023, December,2023 March, 2024 and June, 2024 , respectively. As far as TSS is concerned, the values were 942 mg L^{-1} in September, 2023,952 mg L^{-1} in December, 2023, 944 mg L^{-1} in March, 2024 and 971 mg L^{-1} in June, 2024, respectively. The values of 3.46 mg L^{-1}, 3.58 mg L^{-1}, 3.42 mg L^{-1} and 3.51 mg L^{-1} were recorded for DO in September, 2023, December, 2023 and March, 2024 and June, 2024, respectively. Similarly, the values of 163.22 mg L^{-1}, 161.16 mg L^{-1}, 164.18 mg $L^{-1}$and 162.57 mg L^{-1} were recorded for BOD in September, 2023, December, 2023, March, 2024 and June, 2024,respectively.

While comparing with the COD of September, 2023 which was found to be 475.62 mg L^{-1}, the COD values recorded during December, 2023, March, 2024 and June, 2024 were 482.57, 481.51, and 480.24 mg L^{-1}, respectively. The values of nitrogen were foundto be 36.14 mg L^{-1} in September, 2023 and 35.62 mg L^{-1} in December, 2023, 30.24 mg L^{-1} in March, 2024 and 32.51 mg L^{-1} in June, 2024. Phosphorus content in the effluent was found to be 2.26 mg L^{-1} in September, 2023, 2.49 mg L^{-1} in December, 2023, 2.17 mg L^{-1} in March, 2024 and 2.22 mg L^{-1} in June, 2024. In the effluent, potassium was recorded to be 30.56 mg L^{-1} in September, 2023, 34.82 mg L^{-1} in December, 2023, 31.51 mg L^{-1} in March, 2024 and 32.48 mgL^{-1} in June, 2024. The calcium was found to be 271.36 mg L^{-1} in September, 2023, 268.31 mg L^{-1} in December, 2023, 270.84 mg L^{-1} in March, 2024 and 268.5 mg L^{-1} in June, 2024.In the effluent, 52.07 mg L^{-1} of Magnesium in September, 2023, 51.84 mg L^{-1} in December, 2023, 49.42 mg L^{-1} in March, 2024 and 50.24mg L^{-1} in June, 2024 and the values of 247.23 mg L^{-1} in September, 2023, 242.60 mg L^{-1} in December, 2023, 241.25 mg L^{-1} in March, 2024 and showed an increase of 248.25 mg L^{-1} in June, 2024 was found to be the sodium content of the effluent. Bicarbonate, it was found to be 327.18 mg L^{-1} in September, 2023 which decreased to 316.72 mg L^{-1} in December, 2023, then showed a increase to 381.52 mg L^{-1} in March, 2024 and 379.26 mg L^{-1} in June, 2024. Chloride content was found to be 267.63 mg L^{-1} in September, 2023 which stepped up 274.53 mg L^{-1} in December, 2023, decreased to 264.21 mg L^{-1} in the month of March, 2024 and 259.27 mg L^{-1} in June, 2024. Sulphate content was found to be 222.34 mg L^{-1} in September, 2023 which stepped down to 216.89 mg L^{-1} in December, 2023, increased to 219.74 mgL^{-1} in the month of March, 2024 and 224.21 mg L^{-1} in June, 2024.

Characteristics of the treated effluent

Based on the results obtained the pH value of treated effluent during September, 2023 was found to be 7.56, pH values recorded during December, 2023, March, 2024 and June, 2024 were 7.58, 7.54, and 7.59, respectively. The treated effluent tends to be neutral with an EC of 1.58 dSm^{-1} in September, 2023, 1.61 dSm^{-1} in December, 2023, 1.75 dSm^{-1} in March, 2024 and 1.80 dSm^{-1} in June, 2024. TDS range was reported as 960 mg L^{-1}, 925 mg L^{-1}, 1075 mg L^{-1} and 1062 mg L^{-1} in September, 2023, December, 2023 March, 2024 and June, 2024, respectively. As far as TSS is concerned, the values were 78.5 mg L^{-1} in September, 2023, 79.2 mg L^{-1} in December, 2023, 81.47 mg L^{-1} in March, 2024 and 84.25 mg L^{-1} in June, 2024, respectively. The DO values of 5.51 mg L^{-1}, 5.35 mg L^{-1}, 5.41 mg L^{-1} and 5.57 mg L^{-1} were recorded during September, 2023, December, 2023 and March, 2024 , and June, 2024, respectively. Similarly, the values of 25.03 mg L^{-1}, 24.43 mg L^{-1}, 25.14 mg L^{-1} and 24.65 mg L^{-1} were recorded for BOD during September, 2023, December, 2023, March, 2024 and June, 2024, respectively.

While comparing with the COD of September, 2023 which was found to be 94.36 mg L^{-1}, the COD values recorded during December, 2023, March, 2024 and June, 2024 were 104.33, 95.75, and 98.49 mg L^{-1}, respectively. The values of nitrogen were found to be 17.54 mg L^{-1} in September, 2023 and 18.51 mg L^{-1} in December, 2023, 15.4 mg L^{-1} in March, 2024 and 18.5 mg L^{-1} in June, 2024. Phosphorus content in the treated effluent was found to be 1.23 mg L^{-1} in September, 2023, 1.17 mg L^{-1} in December, 2023, 1.21 mg L^{-1} in March, 2024and 1.27 mg L^{-1} in June, 2024. In the treated effluent, potassium was recorded to be 22.16 mg L^{-1} in September, 2023, 25.22 mg L^{-1} in December, 2023, 24.45 mg L^{-1} in March, 2024 and 26.28 mg L^{-1} in June, 2024. The calcium was found to be 208.15 mg L^{-1} in September, 2023, 219.62 mg L^{-1} in December, 2023, 212.52 mg L^{-1} in March, 2024 and 221.91 mg L^{-1} in June, 2024. In the treated effluent, 31.58 mg $L^{-1}$of Magnesium in September, 2023, 35.82 mg L^{-1} in December, 2023, 46.75 mg L^{-1} in March, 2024 and 45.65 mg L^{-1} in June, 2024 and the values of 138.96 mg L^{-1} in September, 2023, 141.62 mg L^{-1} in December, 2023, 151.67 mg L^{-1} in March, 2024 andshowed an increase of 155.45 mg L^{-1} in June, 2024 was found to be the sodium content of the treated effluent. Bicarbonate, it was found to be 119.42 mg L^{-1} in September, 2023 which increased to 122.58 mg L^{-1} in December, 2023, thenshowed a decrease to 119.4 mg L^{-1} in March, 2024 and 124.5 mg L^{-1} in June, 2024.

Chloride content was found to be 197.55 mg L^{-1} in September, 2023 which stepped down to 191.87 mg L^{-1} in December, 2023, increased to 201.61 mg L^{-1} in the month of March, 2024 and 198.44 mgL^{-1} in June, 2024. Sulphate content was found to be 127.15 mg L^{-1} in September, 2023 which stepped up 121.16 mg L^{-1} in December, 2023, increased to 132.11 mg L^{-1} in the month of March, 2024 and 131.35 mg L^{-1} in June, 2024.

Activity II: Monitoring soil and groundwater quality in and around the premises of the ITC factory

1. The soil and water samples were collected from the bench mark sites (Table 2) (in and around factory Premises) during the sampling duration from September, 2023 to November, 2023, December, 2023 to February, 2024, March, 2024 to May, 2024 and June, 2024 to August, 2024. The analyzed data are presented in the tables 3 to 12.
2. Piezometers were installed at different locations of factory premises for assessing the groundwater quality. But there was no water in the piezometers during the period of study.

Table 2.a. Bench mark sites for continuous monitoring of soil and groundwater quality in ITC factory Premises

Sl. No	SF No.	Village	Block	Locations	Type
1	938/1	KEM	B	SLF-1	Piezo well
2	938/2	KEM	B	SLF-2	Piezo well
3	938/2	KEM	B	SLF-3	Piezo well
4	940	KEM	B	Coconut garden - 8	Piezo well
5	943	KEM	B	Coconut garden - 9a	Piezo meter
6	940	KEM	B	Coconut garden - 9b	Piezo meter
7	936	KEM	B	Iyer thottam- TNAU Trail Plot	Piezo meter
8	936	KEM	B	Casurina field	Piezo meter
9	415	TKP	A	Admin Block	Piezo meter
10	411	TKP	A	Old Boiler	Piezo meter
11	426/1B	TKP	A	Factory Block A	Piezo well
12	415/3A	TKP	A	Admn Block office	Piezo well
13	418	TKP	A	Old time office	Piezo well
14	426/1D	TKP	A	Back side of Raw water tank- Cogeneration plant	Piezo well
15	923/2A	KEM	B	Factory Block B- ETP	Piezo well
16	925/1	KEM	B	Factory Block B- Hostel	Piezo well
17	922/2	KEM	B	LSTC- Vagaimara thoppu	Piezo well
18	938/1	KEM	B	SLF	Piezo well
19	938/2	KEM	B	SLF	Piezo well
20	938/2	KEM	B	SLF	Piezo well
21	939/1A1	KEM	B	Bamboo garden	Piezo well
22	939/1A2	KEM	B	Coconut garden	Piezo well
23	932	KEM	B	Coconut garden	Piezo well
24	940	KEM	B	Coconut garden	Piezo well
25	877/2B	KEM	C-2	Block C-2 (Hospital medu)	Piezo well
26	879/2	KEM	C-1	Block C-1 (Hospital medu)	Piezo well
27	141/2A	KEM	D	KVK	Piezo well
28	893	KEM	E	Pichankadu	Piezo well
29	850	KEM	F	Mysore G. Thottam	Piezo well
30	779	KEM	G	KLR	Piezo well
31	962	KEM	G	KLR- Eucalyptus field	Piezo well

*411 - Open well closed due to erection of solar plant

26	881	Open Well	NatarajGounder	Kemmarampalayam

Table 2.b. Bench mark sites for continuous monitoring of soil and groundwater quality in ITC factory Premises

Sample	SF	Type of well	Owner's name	Village
1	426	Test bore Well	Block A (Near coal Godown)	Thekkampatty
2	923	Test bore Well	Block B (ETP)	Kemmarampalayam
3	925	Test bore Well	Block B (Canteen)	Kemmarampalayam
4	942	Test bore Well	Block B (Field - 9)	Kemmarampalayam
5	932	Test bore Well	Block B (Field - 8)	Kemmarampalayam
6	411	Open Well	Block A (Closed)	Thekkampatty
7	923	Open Well	Block B (ETP)	Kemmarampalayam
8	922	Open Well	Block B (Canteen)	Kemmarampalayam
9	884	Open Well	Block E (Kandithoppu)	Kemmarampalayam
10	893	Open Well	Block E (Pichankadu)	Kemmarampalayam
11	851	Open Well	Block F (Mysore G. Thottam)	Kemmarampalayam
12	850	Bore Well	Block F (Mysore G. Thottam)	Kemmarampalayam
13	778	Bore Well	Block G (KLR)	Kemmarampalayam
14	779	Open Well	Block G (KLR)	Kemmarampalayam
15	962	Bore Well	Block G (KLR- Eucalyptus)	Kemmarampalayam
16	141	Bore Well	Block D (KVK)	Kemmarampalayam
17	416	Open Well	Nachimuthu	Thekkampatty
18	424	Open Well	Selvaraj	Thekkampatty
19	427	Open Well	Pettiyan (Servall)	Thekkampatty
20	-	Stream	Near Varatharajthottam	Thekkampatty
21	93	Open Well	Velumaniammal	Thekkampatty
22	414	Open Well	Batheri	Thekkampatty
23	916	Open Well	Kalikutty&Rajan	Kemmarampalayam
24	911	Open Well	Rangaraj	Kemmarampalayam
25	937	Open Well	Rangasamy	Kemmarampalayam
26	881	Open Well	NatarajGounder	Kemmarampalayam
27	876	Open Well	Subbaiyan	Kemmarampalayam
28	884	Open Well	Annamalai Gr, Thottam	Kemmarampalayam
29	131	Open Well	Somanur Gr, Thottam	Kemmarampalayam
30	-	River water	Control	-

Table 2.c. Geo co-ordinates of benchmark sites

S.No.	Sample Site	Co-ordinate
1	Coal Yard	11° 14' 46" N 76° 52' 42" E
2	Canteen	11° 14' 74" N 76° 52' 21" E
3	ETP	11° 14' 53" N 76° 52' 12" E
4	Block-D	11° 14' 17" N 76° 52' 48" E
5	Block-G	11° 14' 37" N 76° 52' 37" E
6	Block-F (850)	11° 14' 33" N 76° 50' 52" E
7	Block- F (851)	11° 14' 33" N 76° 50' 48" E
8	Annamalai gr thottam	11° 14' 22" N 76° 51' 37" E
9	Block-E (884)	11° 14' 25" N 76° 51' 30" E
10	Block-E (893)	11° 14' 25" N 76° 51' 29" E
11	Pettaiyan	11° 15' 01" N 76° 52' 43" E
12	Stream	11° 14' 41" N 76° 52' 44" E
13	Coconut garden 8	11° 14' 24" N 76° 52' 87" E
14	Coconut garden 9	11° 14' 30" N 76° 52' 09" E
15	Bamboo garden	11° 14' 34" N 76° 52' 19" E
16	SLF1	11° 14' 40" N 76° 52' 18" E
17	SLF3	11° 14' 30" N 76° 52' 14" E
18	Rangaraj	11° 14' 31" N 76° 52' 15" E
19	Kandasamy	11° 14' 36" N 76° 52' 17" E
20	Natraj gr thottam	11° 14' 52" N 76° 52' 37" E
21	Velumani Ammal Thoppu	11° 15' 01" N 76° 52' 30" E
22	Near Admin Block	11° 14' 65" N 76° 52' 38" E
23	Sambal Medu	11° 14' 40" N 76° 52' 29" E
24	Raw Water Borewell (Factory)	11° 14' 51" N 76° 52' 51" E
25	Somanur	11° 14' 26" N 76° 52' 16" E
26	Nachimuthu	11° 13' 26" N 76° 52' 13" E
27	TNAU Trail Plot	11° 14' 61" N 76° 52' 14" E
28	Casuarina field	11° 14' 66" N 76° 52' 21" E
29	Kalikuty and Rajan	11° 14' 40" N 76° 52' 13" E
30	Old time office	11° 14' 64" N 76° 52' 37" E

Table 3 a. pH, EC, TDS and Sodium content of the ground water samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	pH					EC(dS m^{-1})					TDS (mg L^{-1})					Sodium (mg L^{-1})				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	426	Factory (Block A)	NC	NC	7.15	7.12	**7.13**	NC	NC	1.32	1.32	**1.32**	NC	NC	875.2	863.1	**869.15**	NC	NC	85.5	86.2	**85.85**
2	923	Factory (Block B)	8.25	8.29	NW	NW	**8.27**	1.15	1.39	NW	NW	**1.27**	866	890.6	NW	NW	**878.30**	81.6	83.24	NW	NW	**82.42**
3	925	Factory (Block B)	7.05	7.17	7.38	7.25	**7.21**	2.82	2.93	2.34	2.35	**2.61**	835.4	863.4	872.4	871.4	**860.65**	116.6	117.84	116.4	118.5	**117.33**
4	942	Factory (Block B)	7.14	7.30	7.35	7.26	**7.26**	2.52	2.54	2.44	2.37	**2.46**	870.8	890.6	1665.2	1651.5	**1269.53**	72.8	72.58	74.5	72.5	**73.09**
5	932	Factory (Block B)	7.65	7.88	7.14	7.29	**7.49**	0.92	0.93	0.98	1.22	**1.01**	604.6	597.2	619.4	624.1	**611.33**	51.9	52.67	58.5	60.2	**55.81**
6	411	Block A (Closed)	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	-
7	923	Factory (Block B)	7.88	7.96	7.81	7.72	**7.84**	1.41	1.64	1.54	1.49	**1.52**	946.2	986.6	935.4	968.1	**959.07**	61.58	61.32	62.25	63.14	**62.07**
8	922	Factory (Block B)	7.64	7.98	7.58	7.63	**7.70**	1.29	1.53	1.22	1.26	**1.32**	888.6	916.2	911.5	964.5	**920.21**	83.9	82.79	82.26	81.5	**82.61**
9	884	Factory (Block E)	7.65	7.52	7.71	7.56	**7.61**	1.61	1.35	1.44	1.42	**1.45**	903.4	929	921.7	925.5	**919.9**	52.1	52.53	52.47	52.9	**52.21**
10	893	Factory (Block E)	7.70	7.85	7.75	7.82	**7.78**	0.78	0.92	0.95	1.11	**0.94**	562.2	588.8	581.5	578.5	**577.75**	48.7	50.21	52.8	51.4	**50.77**
11	851	Factory (Block F)	8.51	8.36	8.21	8.26	**8.33**	0.86	0.93	0.85	0.95	**0.90**	616.4	595.2	592.4	589.5	**598.37**	35.6	38.37	36.5	35.5	**36.49**
12	850	Factory (Block F)	8.22	8.50	8.42	8.47	**8.40**	0.79	0.98	1.07	1.05	**0.97**	636.6	615.4	618.2	620.5	**622.67**	61.3	66.21	66.4	68.4	**65.57**
13	778	Factory (Block G)	NC	NC	7.35	7.26	**7.30**	NC	NC	1.12	1.05	**1.08**	NC	NC	624.6	632.5	**628.55**	NC	NC	63.4	62.4	**62.9**
14	779	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-

15	962	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-
16	141	Factory (Block D)	8.26	8.22	NC	NC	**8.24**	0.59	0.96	NC	NC	**0.78**	566.6	551.4	NC	NC	**559**	102.7	105.28	NC	NC	**103.99**
17	416	Nachimuthu	7.37	7.83	7.22	7.75	**7.54**	2.47	2.83	1.42	1.46	**2.05**	909.8	885.2	741.5	735.6	**818.02**	71.8	73.06	76.5	75.2	**74.14**
18	424	Selvaraj	7.16	7.48	7.64	NC	**7.43**	2.27	2.62	2.36	NC	**2.42**	936.8	876.8	732.5	NC	**848.7**	55.1	60.26	64.3	NC	**59.89**
19	427	Pettiyan (Servall)	7.42	7.64	7.75	7.65	**7.61**	0.73	0.90	1.42	1.55	**1.15**	597.2	576	560.5	575.1	**577.2**	66.4	65.04	66.5	64.2	**65.53**
20	-	Stream near Varatharajthottam	7.54	7.81	7.82	7.75	**7.73**	0.61	0.85	0.96	0.94	**0.84**	516.4	544.5	573.5	585.4	**554.95**	81.2	83.52	81.6	79.5	**81.455**
21	93	Velumani ammal	NC	NC	NC	NC	-	NC	NC	NC	NC	-	NC	NC	NC	NC	-	NC	NC	NC	NC	-
22	414	Batheri	NC	NC	7.74	7.73	**7.73**	NC	NC	0.94	1.05	**1.00**	NC	NC	623.4	624.5	**623.95**	NC	NC	54.5	55.2	**54.85**
23	916	Kalikutty &Rajan	7.61	7.95	7.82	7.79	**7.79**	1.1	0.98	1.22	1.16	**1.12**	606	627.2	632.5	640.5	**626.55**	215.1	218.61	219.5	206.4	**214.90**
24	911	Rangaraj	7.85	7.68	7.65	7.71	**7.72**	0.16	0.16	1.54	1.56	**0.86**	74.8	102.4	142.5	79.8	**99.88**	174.2	178.23	175.6	179.5	**176.88**
25	937	Kandasamy	7.36	7.19	7.12	7.45	**7.28**	1.66	1.51	1.54	1.51	**1.56**	937.4	966.4	965.6	972.4	**960.45**	191.4	192.89	195.5	202.4	**195.55**
26	881	Natraj Gounder	7.66	7.83	7.65	7.72	**7.71**	1.62	1.93	1.65	1.42	**1.66**	978.8	935.2	947.5	932.5	**948.50**	36.5	37.64	38.5	39.5	**38.04**
27	876	Subbaiyan	NC	NC	7.85	NC	**7.85**	NC	NC	1.39	NC	**1.39**	NC	NC	873.5	NC	**873.50**	NC	NC	32.6	NC	**32.60**
28	884	Annamalai Gr, Thottam	7.17	7.39	7.65	7.75	**7.49**	1.53	1.26	1.32	1.21	**1.33**	785.2	806.4	761.5	765.4	**779.63**	46.2	48.39	41.5	44.2	**45.07**
29	131	Somanur Gr, Thottam	7.74	7.61	7.54	7.55	**7.61**	0.58	0.84	0.89	1.12	**0.86**	565.2	537.6	562.5	550.4	**553.93**	44.4	47.14	44.2	42.5	**44.56**
30	-	River water (Control)	8.22	8.15	7.35	7.46	**7.79**	0.54	0.70	0.89	0.83	**0.74**	475.6	448	621.4	629.9	**543.73**	125.5	129.49	121.5	15.4	**97.97**
		Mean	**7.68**	**7.80**	**7.61**	**7.63**	-	**1.27**	**1.39**	**1.37**	**1.34**	-	**712.7**	**715.0**	**748.2**	**744.6**	-	**85.30**	**87.15**	**81.80**	**79.85**	-

*NW - No Water * NC- Not collected

Table 3 b. Potassium, Calcium, Magnesium and Carbonate content of the ground water samples collected from the bench mark sites for continuous monitoring of ground water quality

	SF	Sample ID	Potassium (mg L^{-1})					Calcium (mg L^{-1})					Magnesium (mg L^{-1})					Carbonate (mg L^{-1})				
			Sep., 2023	Dec., 2023	March ,2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March ,2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March ,2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March ,2024	June., 2024	Mean
1	426	Factory (Block A)	NC	NC	2.2	2.5	**2.35**	NC	NC	92.31	89.55	**90.93**	NC	NC	55.3	57.4	**56.35**	NC	NC	275	284	**279.5**
2	923	Factory (Block B)	3.25	3.55	NW	NW	**3.40**	72.1	73.1	NW	NW	**72.60**	58.9	60.30	NW	NW	**59.6**	187	193	NW	NW	**190**
3	925	Factory (Block B)	2.18	2.28	1.91	2.24	**2.15**	72.8	74.23	72.02	75.24	**73.57**	61.5	64.61	62.5	64.6	**63.30**	160.5	175	189	175	**174.87**
4	942	Factory (Block B)	8.83	8.57	8.14	8.2	**8.44**	36.1	41.15	36.52	42.56	**39.08**	45.7	45.56	44.5	42.5	**44.56**	166	170	165	159	**165**
5	932	Factory (Block B)	5.5	5.46	5.2	5.1	**5.32**	162.8	161.34	162.57	162.5	**162.30**	83.5	81.32	82.4	85.9	**83.28**	226	217	220	219	**220.5**
6	411	Block A (Closed)	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	-
7	923	Factory (Block B)	3.86	3.96	4.1	3.5	**3.85**	51.8	52.74	51.5	52.4	**52.11**	15.6	16.69	14.5	13.8	**15.14**	12	12	11	13	**12**
8	922	Factory (Block B)	2.71	2.85	2.65	2.91	**2.78**	52.6	54.09	52.4	53.6	**53.17**	43.4	40.07	41.2	39.26	**40.98**	94	97	98	92	**95.25**
9	884	Factory (Block E)	3.77	3.96	3.92	3.77	**3.85**	34.4	37.19	39.5	38.5	**37.39**	17.3	15.48	16.5	19.21	**17.12**	29	31.5	24	27	**27.87**
10	893	Factory (Block E)	2.63	2.87	2.95	2.64	**2.77**	52.8	55.36	55.6	52.5	**54.06**	12.4	14.63	14.9	15.1	**14.25**	144	142	142.5	136.25	**141.18**
11	851	Factory (Block F)	3.24	4.19	4.12	3.93	**3.87**	123.5	122.68	126.5	124.5	**124.29**	17.1	17.85	15.4	16.2	**16.63**	175	177	175	171	**174.5**
12	850	Factory (Block F)	4.83	4.51	3.9	4.12	**4.34**	23.7	20.58	22.5	22.5	**22.32**	53.9	53.53	52.6	51.5	**52.88**	36	44	43	49	**43**
13	778	Factory (Block G)	NC	NC	4.43	4.42	**4.42**	NC	NC	52.5	55.5	**54**	NC	NC	22.5	25.4	**23.95**	NC	NC	35	36	**35.5**
14	779	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-
15	962	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-
16	141	Factory (Block D)	3.58	3.54	NC	NC	**3.56**	30.8	33.62	NC	NC	**32.21**	18.8	18.78	NC	NC	**18.79**	43	46.8	NC	NC	**44.9**

17	416	Nachimuthu	4.51	4.58	4.61	4.57	**4.56**	108.5	110.67	111.52	116.4	**111.77**	42.8	40.69	41.24	43.5	**42.05**	167	171.4	173	175	**171.6**
18	424	Selvaraj	2.62	2.86	2.55	NC	**2.67**	108.5	108.54	105.21	NC	**107.41**	92.2	90.2	93.15	NC	**91.85**	72	76.4	86	NC	**78.13**
19	427	Pettiyan (Servall)	2.87	2.80	2.74	2.81	**2.80**	153.8	150.26	147.52	140.4	**147.99**	13.3	12.51	11.5	12.4	**12.42**	65	72.8	63	65	**66.45**
20	-	Stream near Varatharaj thottam	3.64	3.43	3.23	3.17	**3.36**	80.6	82.75	84.5	82.5	**82.58**	54.4	57.23	56.5	57.8	**56.48**	31	35.4	38	42	**36.6**
21	93	Velumani ammal	NC	NC	NC	NC		NC	NC	NC	NC	-	NC	NC	NC	NC	-	NC	NC	NC	NC	-
22	414	Batheri	NC	NC	3.24	3.22	**3.23**	NC	NC	135.6	130.5	**133.05**	NC	NC	61.6	63.5	**62.55**	NC	NC	43	42	**42.5**
23	916	Kalikutty &Rajan	3.16	3.50	3.12	3.11	**3.22**	80.6	81.39	81.5	80.25	**80.93**	92.2	94.72	94.5	96.9	**94.58**	144	145	131	135	**118.75**
24	911	Rangaraj	1.75	1.87	1.72	1.69	**1.75**	116.4	115.61	116.2	121.5	**117.42**	53.6	52.59	59.3	58.5	**55.99**	95	103	97	100	**98.75**
25	937	Kandasamy	4.48	5.21	4.95	4.81	**4.86**	94.8	95.21	94.51	93.4	**94.48**	50.5	50.84	50.4	51.2	**50.73**	81	81	87	95	**86**
26	881	Natraj Gounder	6.47	6.14	6.22	6.29	**6.28**	82.1	81.26	85.4	81.2	**82.49**	42.6	41.21	42.8	41.5	**42.02**	115	123	125	116	**119.75**
27	876	Subbaiyan	NC	NC	5.59	NC	**5.59**	NC	NC	68.4	NC	**68.4**	NC	NC	59.3	NC	**59.3**	NC	NC	93	NC	**93**
28	884	Annamalai Gr, Thottam	9.68	9.34	8.84	8.89	**9.18**	127.2	130.97	127.9	130.1	**129.04**	50.1	53.26	53.3	52.5	**52.29**	40	46	48	56	**47.5**
29	131	SomanurGr, Thottam	7.82	7.83	7.32	7.59	**7.64**	90.0	92.42	93.5	91.5	**91.85**	21.5	23.81	21.4	23.4	**22.52**	54	62	57	58	**57.75**
30	-	Riverwater (Control)	5.36	5.41	5.88	5.96	**5.65**	61.5	64.61	62.4	61.5	**62.50**	43.2	41.42	41.5	46.5	**43.12**	40	43	46	49	**44.5**
		Mean	**4.40**	**4.49**	**4.31**	**4.34**	-	**82.61**	**83.63**	**86.59**	**86.30**	-	**44.75**	**44.88**	**46.20**	**44.48**	-	**98.93**	**102.92**	**102.69**	**104.28**	-

*NW - No Water * NC- Not collected

Table 3 c. Bicarbonate, Sulphate and Chloride content of the ground water samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No.	SF	Sample ID	Bicarbonate (mg L^{-1})					Sulphate (mg L^{-1})					Chloride (mg L^{-1})				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	426	Factory (Block A)	NC	NC	35	38	**36.5**	NC	NC	91.5	96.5	**94**	NC	NC	169.5	175.3	**172.4**
2	923	Factory (Block B)	26.1	27	NW	NW	**26.55**	92.4	94.67	NW	NW	**93.53**	140.8	143.64	NW	NW	**142.22**
3	925	Factory (Block B)	23.5	28	27	24	**25.62**	72.5	77.58	72.4	73.4	**73.97**	121.7	125.67	122.5	124.2	**123.51**
4	942	Factory (Block B)	73	77	85	78	**78.25**	25.0	29.21	22.9	23.5	**25.15**	116.0	119.51	120.6	114.61	**117.68**
5	932	Factory (Block B)	225	234	237	235	**232.75**	62.5	66.34	66.24	63.51	**64.64**	123.4	125.64	123.4	125.2	**124.41**
6	411	Block A	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	-
7	923	Factory (Block B)	148	157	156	153	**153.5**	55.8	57.94	55.54	53.61	**55.72**	168.0	171.24	173.5	171.5	**171.06**
8	922	Factory (Block B)	159	171	160	163	**163.25**	191.4	200.42	195.29	197.81	**196.23**	61.5	64.91	64.3	63.5	**63.55**
9	884	Factory (Block E)	132	136	141	145	**138.5**	122.4	124.76	125.32	127.21	**124.92**	116.5	116.61	116.2	118.9	**117.05**
10	893	Factory (Block E)	352	356	330	332	**342.5**	31.7	31.34	30.17	31.5	**31.17**	64.8	62.28	63.9	64.5	**63.87**
11	851	Factory (Block F)	291	295	294	290	**292.5**	70.5	73.26	70.25	71.33	**71.33**	97.4	97.54	98.5	97.5	**97.73**
12	850	Factory (Block F)	253	255	254	265	**256.75**	22.5	24.81	24.5	22.3	**23.52**	166.5	170.16	165.32	170.25	**168.05**
13	778	Factory (Block G)	NC	NC	243	254	**248.5**	NC	NC	22.4	29.5	**25.95**	NC	NC	55.3	54.5	**54.90**
14	779	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-
15	962	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-

16	141	Factory (Block D)	246	243	NC	NC	**244.5**	30.7	34.50	NC	NC	**32.6**	61.5	65.60	NC	NC	**63.55**
17	416	Nachimuthu	222	232	226	219	**224.75**	23.6	21.73	22.16	18.35	**21.46**	224.7	225.21	224.31	217.25	**222.86**
18	424	Selvaraj	167	174	175	NC	**172**	131.8	132.67	136.51	NC	**133.66**	224.4	223.57	230.21	NC	**226.06**
19	427	Pettiyan (Servall)	193	196.45	181	179	**187.36**	29.6	33.64	33.68	31.75	**32.16**	127.9	125.24	122.36	121.47	**124.24**
20	-	Stream near Varatharajthottam	410	418.14	417	422	**416.78**	41.9	44.25	42.36	42.51	**42.75**	323.0	322.65	326.3	321.3	**323.31**
21	93	Velumaniammal	NC	NC	NC	NC	-	NC	NC	NC	NC	-	NC	NC	NC	NC	-
22	414	Batheri	NC	NC	155	163	**159**	NC	NC	57.5	52.5	**55**	NC	NC	185.6	184.31	**184.955**
23	916	Kalikutty&Rajan	147	154	125	139	**141.25**	35.2	38.36	37.65	32.61	**35.95**	164.4	160.32	157.5	151.5	**158.43**
24	911	Rangaraj	435	449	445	427	**439**	56.5	57.62	52.6	55.3	**55.50**	140.0	144.29	135.28	136.55	**139.03**
25	937	Kandasamy	156	167	167	155	**161.25**	42.4	46.94	43.61	41.49	**43.61**	128.9	132.46	129.65	125.3	**129.07**
26	881	Natraj Gounder	218	232	215	214	**219.75**	134.3	138.31	139.81	137.21	**137.40**	390.2	387.62	392.34	390.52	**390.1**
27	876	Subbaiyan	NC	NC	185	NC	**185**	NC	NC	21.52	NC	**21.52**	NC	NC	342.56	NC	**342.56**
28	884	Annamalai Gr, Thottam	145	156	147	152	**150**	53.9	56.84	56.52	51.52	**54.69**	140.6	143.32	193.5	195.5	**168.23**
29	131	Somanur Gr, Thottam	283	275	269	275	**275.5**	80.8	85.34	83.26	84.5	**83.47**	96.7	95.26	95.56	94.5	**95.50**
30	-	River water (Control)	272	279	281	295	**281.75**	62.2	64.20	64.71	63.28	**63.59**	118.2	118.39	116.8	112.54	**116.48**
		Mean	**208.02**	**214.16**	**206.25**	**209.86**	-	**66.8**	**69.76**	**63.35**	**63.69**	-	**150.77**	**151.86**	**163.54**	**151.39**	-

*NW - No Water * NC- Not collected

Table 3 d. SAR, RSC and SSP content of the ground water samples collected from the bench mark sites for continuous monitoring of ground waterquality

S. No.	SF	Sample ID	SAR					RSC					SSP				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	426	Factory (Block A)	NC	NC	-	1.49	**1.49**	NC	NC	0.15	1.11	**0.63**	NC	NC	25.34	29.65	**27.49**
2	923	Factory (Block B)	1.69	1.91	-	-	**1.8**	-8.45	-8.65	-	-	**-8.55**	22.45	23.34	-	-	**22.89**
3	925	Factory (Block B)	2.45	2.41	1.94	2.21	**2.25**	-8.95	-9.12	-2.31	-2.61	**-5.74**	31.75	32.19	33.21	35.22	**33.09**
4	942	Factory (Block B)	1.97	1.94	1.63	1.58	**1.78**	-5.66	-5.92	1.29	1.09	**-2.3**	18.36	18.99	19.63	18.65	**18.90**
5	932	Factory (Block B)	0.86	1.82	0.76	0.72	**1.04**	-14.82	-15.98	-3.81	-4.39	**-9.75**	9.91	11.04	12.28	11.35	**11.14**
6	411	Block A	Closed	Closed	-	-	-	Closed	Closed	-	-	-	Closed	Closed	-	-	-
7	923	Factory (Block B)	1.98	2.91	1.55	1.52	**1.99**	-3.76	-3.01	-0.75	-0.79	**-2.07**	25.81	26.60	27.35	28.54	**27.07**
8	922	Factory (Block B)	2.14	2.25	1.72	1.68	**1.94**	-6.12	-7.18	-0.31	-0.12	**-3.43**	27.33	29.26	29.35	29.51	**28.86**
9	884	Factory (Block E)	1.58	1.99	1.25	1.26	**1.52**	-3.41	-3.24	-0.70	-0.81	**-2.04**	22.78	24.23	26.45	25.41	**24.71**
10	893	Factory (Block E)	1.42	1.55	1.21	1.22	**1.35**	-3.55	-3.99	6.39	6.23	**1.27**	22.42	24.15	26.31	28.32	**25.3**
11	851	Factory (Block F)	0.45	0.86	0.61	0.63	**0.63**	-7.53	-7.59	3.24	3.12	**-2.19**	13.62	12.41	13.15	15.61	**13.69**
12	850	Factory (Block F)	1.97	1.80	1.56	1.58	**1.72**	-5.61	-5.91	0.56	0.75	**-2.55**	23.51	23.07	24.32	25.23	**24.05**
13	778	Factory (Block G)	NC	NC	1.39	1.41	**1.4**	NC	NC	0.63	0.42	**0.52**	NC	NC	36.81	35.62	**36.21**
14	779	Factory (Block G)	NW	NW	-	-	-	NW	NW	-	-	-	NW	NW	-	-	-

15	962	Factory (Block G)	NW	NW	-	-	--	NW	NW	-	-	-	NW	NW	-	-	-
16	141	Factory (Block D)	3.46	3.61	-	-	**3.53**	-3.14	-3.16	-	-	**-3.15**	42.64	40.91	-	-	**41.75**
17	416	Nachimuthu	1.32	1.82	1.62	1.45	**1.55**	-8.72	-8.99	-8.42	-8.05	**-8.54**	18.54	18.99	17.35	18.35	**18.30**
18	424	Selvaraj	0.95	1.03	1.06	-	**1.01**	-11.89	-12.94	-	-	**-12.41**	12.78	14.22	15.6	-	**14.2**
19	427	Pettiyan (Servall)	1.56	1.37	1.21	1.27	**1.35**	-8.73	-8.56	-7.15	-6.55	**-7.74**	21.00	19.91	21.55	20.24	**20.67**
20	-	Stream near Varatharajthottam	1.80	1.55	1.57	1.71	**1.65**	-8.58	-8.95	-8.12	8.15	**-4.37**	23.99	23.72	23.64	22.51	**23.46**
21	93	Velumaniammal	NC	NC	-	-	-	NC	NC	-	-	-	NC	NC	-	-	-
22	414	Batheri	NC	NC	0.75	0.86	**0.80**	NC	NC	-7.59	-7.60	**-7.59**	NC	NC	16.12	18.61	**17.36**
23	916	Kalikutty&Rajan	3.57	3.89	3.23	3.15	**3.46**	-10.89	-11.96	-9.25	-9.51	**-10.45**	32.07	38.07	33.62	35.61	**34.84**
24	911	Rangaraj	3.22	3.44	3.45	3.41	**3.38**	-9.02	-10.16	-9.15	-9.65	**-9.49**	41.02	39.17	41.25	40.28	**40.43**
25	937	Kandasamy	3.58	3.95	3.64	3.82	**3.74**	-8.60	-9.00	-9.12	-7.18	**-8.47**	38.53	37.07	36.52	39.52	**37.91**
26	881	Natraj Gounder	0.67	0.85	0.65	0.75	**0.73**	-7.67	-7.50	-6.58	-6.58	**-7.08**	11.86	10.69	12.54	10.29	**11.34**
27	876	Subbaiyan	NC	NC	0.71	-	**0.71**	NC	NC	-	-	-	NC	NC	16.81	-	**16.81**
28	884	Annamalai Gr, Thottam	0.52	0.90	0.66	0.74	**0.70**	-10.58	-10.99	-9.15	-9.58	**-10.07**	9.62	9.37	10.26	11.36	**10.15**
29	131	Somanur Gr, Thottam	1.42	1.13	1.02	0.96	**1.13**	-6.30	-6.61	-6.14	-6.26	**-6.32**	12.47	12.43	14.56	13.69	**13.28**
30	-	River water(Control)	3.25	3.08	3.14	3.05	**3.13**	-6.50	-6.68	-6.35	-6.24	**-6.44**	30.02	31.66	31.15	33.21	**31.51**
		Mean	**1.90**	**2.09**	**1.57**	**1.65**	-	**-7.65**	**-8.00**	**-3.75**	**-2.95**	-	**23.29**	**23.70**	**23.54**	**24.85**	-

*NW - No Water * NC- Not collected

Table 3 e. Ni, As and Cd content of the ground water samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No	SF	Sample ID	Ni (ppm)					As (ppm)					Cd (ppm)				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	426	Factory (Block A)	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-
2	923	Factory (Block B)	BDL	BDL	NW	NW	-	BDL	BDL	NW	NW	-	BDL	BDL	NW	NW	-
3	925	Factory (Block B)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
4	942	Factory (Block B)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
5	932	Factory (Block B)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
6	411	Block A	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
7	923	Factory (Block B)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
8	922	Factory (Block B)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
9	884	Factory (Block E)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
10	893	Factory (Block E)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
11	851	Factory (Block F)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
12	850	Factory (Block F)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
13	778	Factory (Block G)	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-
14	779	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-
15	962	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-	NW	NW	NC	NC	-

16	141	Factory (Block D)	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
17	416	Nachimuthu	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
18	424	Selvaraj	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-
19	427	Pettiyan (Servall)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
20	-	Stream near Varatharajthottam	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
21	93	Velumaniammal	NC	NC	NC	NC	-	NC	NC	NC	NC	-	NC	NC	NC	NC	-
22	414	Batheri	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-
23	916	Kalikutty&Rajan	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
24	911	Rangaraj	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
25	937	Kandasamy	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
26	881	Natraj Gounder	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
27	876	Subbaiyan	NC	NC	BDL	NC	-	NC	NC	BDL	NC	-	NC	NC	BDL	NC	-
28	884	Annamalai Gr, Thottam	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
29	131	Somanur Gr, Thottam	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
30	-	River water (Control)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
		Mean	-	-	-	-		-	-	-	-	-	-	-	-	-	-

*NW - No Water *BDL – Below Detectable Limit * NC- Not collected

Table 3 f. Pb and Cr content of the ground water samples collected from the bench mark sites for continuous monitoring of ground water quality

S. No.	SF	Sample ID	Pb (ppm)					Cr (ppm)				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	426	Factory (Block A)	NC	NC	1.01	0.95	**0.98**	NC	NC	BDL	BDL	-
2	923	Factory (Block B)	0.23	0.57	NW	NW	**0.4**	BDL	BDL	NW	NW	-
3	925	Factory (Block B)	0.66	0.71	0.95	0.91	**0.8075**	BDL	BDL	BDL	BDL	-
4	942	Factory (Block B)	0.73	0.60	0.45	0.48	**0.565**	BDL	BDL	BDL	BDL	-
5	932	Factory (Block B)	1.29	1.31	0.95	0.92	**1.1175**	BDL	BDL	BDL	BDL	-
6	411	Block A	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	Closed
7	923	Factory (Block B)	0.42	0.68	0.41	0.48	**0.4975**	BDL	BDL	BDL	BDL	-
8	922	Factory (Block B)	0.61	0.56	0.65	0.68	**0.625**	BDL	BDL	BDL	BDL	-
9	884	Factory (Block E)	0.58	0.33	0.34	0.38	**0.4075**	BDL	BDL	BDL	BDL	-
10	893	Factory (Block E)	0.27	0.22	BDL	BDL	**0.245**	BDL	BDL	BDL	BDL	-
11	851	Factory (Block F)	0.5	0.15	0.06	0.07	**0.195**	BDL	BDL	BDL	BDL	-
12	850	Factory (Block F)	0.71	0.46	0.08	0.09	**0.335**	BDL	BDL	BDL	BDL	-
13	778	Factory (Block G)	NC	NC	0.04	0.06	**0.05**	NC	NC	BDL	BDL	-
14	779	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-
15	962	Factory (Block G)	NW	NW	NC	NC	-	NW	NW	NC	NC	-
16	141	Factory (Block D)	0.34	0.27	NC	NC	**0.31**	BDL	BDL	NC	NC	-
17	416	Nachimuthu	0.43	0.37	0.15	0.18	**0.28**	BDL	BDL	BDL	BDL	-
18	424	Selvaraj	0.30	0.52	0.22	NC	**0.35**	BDL	BDL	BDL	NC	-

19	427	Pettiyan (Servall)	0.53	0.37	0.52	0.66	**0.52**	BDL	BDL	BDL	BDL	-
20	-	Stream near Varatharajthottam	0.52	0.35	0.24	0.26	**0.34**	BDL	BDL	BDL	BDL	-
21	93	Velumaniammal	NC	NC	NC	NC	-	NC	NC	NC	NC	-
22	414	Batheri	NC	NC	0.32	0.27	**0.29**	NC	NC	BDL	BDL	-
23	916	Kalikutty&Rajan	0.61	0.48	0.35	0.32	**0.44**	BDL	BDL	BDL	BDL	-
24	911	Rangaraj	0.66	0.52	0.44	0.48	**0.52**	BDL	BDL	BDL	BDL	-
25	937	Kandasamy	0.43	0.39	0.12	0.25	**0.29**	BDL	BDL	BDL	BDL	-
26	881	Natraj Gounder	0.47	0.32	0.25	0.24	**0.32**	BDL	BDL	BDL	BDL	-
27	876	Subbaiyan	NC	NC	0.08	NC	**0.08**	NC	NC	BDL	NC	-
28	884	Annamalai Gr, Thottam	0.18	0.15	0.06	0.08	**0.11**	BDL	BDL	BDL	BDL	-
29	131	Somanur Gr, Thottam	0.15	0.28	0.12	0.15	**0.17**	BDL	BDL	BDL	BDL	-
30	-	River water (Control)	0.5	0.36	0.32	0.35	**0.38**	BDL	BDL	BDL	BDL	-
		Mean	**0.50**	**0.45**	**0.35**	**0.39**	-	-	-	-	-	-

*NW - No Water *BDL – Below Detectable Limit * NC- Not collected

Table 4 a. pH, EC, TDS and Sodium content of the bore well water samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	pH					EC (dSm^{-1})					TDS (mg L^{-1})					Sodium (mg L^{-1})				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	409/28	Backside of raw water unit	7.36	7.61	7.61	NC	**7.52**	0.32	0.45	0.35	NC	**0.37**	941.8	162	167	NC	**423.6**	10.35	15.58	12.36	NC	**12.76**
2	418	Old time office	7.68	7.83	7.63	7.72	**7.71**	1.58	1.55	1.47	1.44	**1.15**	885.2	865	865	879	**873.55**	127.50	129.25	124.61	121.35	**125.67**
3	415/3	Admin block office	7.28	7.35	7.27	7.22	**7.28**	1.32	1.38	1.29	1.25	**1.31**	718.8	756.2	772	781	**757**	87.65	87.94	84.6	86.8	**86.74**
4	939/17	Bamboo garden	7.60	7.94	7.93	NC	**7.82**	1.25	1.84	1.46	NC	**1.51**	1058	915.6	1024	NC	**999.2**	129.36	129.36	127.63	NC	**128.78**
5	940/2	Coconut garden	7.85	7.82	7.67	NC	**7.78**	1.92	1.73	1.67	NC	**1.77**	912.8	944.2	985	NC	**947.3**	135.25	131.67	131.69	NC	**132.87**
6	932	Coconut farm	7.86	7.63	7.55	NC	**7.68**	1.85	1.79	1.58	NC	**1.74**	958	982.6	926	NC	**955.53**	132.58	139.32	136.32	NC	**136.07**
		Mean	**7.60**	**7.69**	**7.61**	**7.47**	-	**1.33**	**1.67**	**1.33**	**1.34**	-	**912.3**	**770.9**	**789.33**	**830**	-	**103.77**	**105.52**	**102.86**	**104.07**	-

* NC- Not collected

Table 4b. Potassium, Calcium, Magnesium and Carbonate content of the bore well water samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	Potassium (mg L^{-1})					Calcium (mg L^{-1})					Magnesium (mg L^{-1})					Carbonate (mg L^{-1})				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	409/28	Backside of raw water unit	2.12	2.73	2.12	NC	**2.23**	33.25	35.64	32.36	NC	**33.75**	16.50	13.28	15.84	NC	**15.20**	14.55	16.28	16.76	NC	**15.89**
2	418	Old time office	7.21	7.59	7.59	7.65	**7.51**	54.32	56.42	51.26	54.65	**54.16**	35.26	36.61	34.65	35.52	**35.51**	27.36	27.58	28.65	26.58	**27.54**
3	415/3	Admin block office	3.35	3.25	3.12	3.18	**3.25**	88.65	87.39	87.14	85.69	**87.21**	37.65	38.98	32.36	32.75	**35.43**	24.35	26.92	28.62	24.53	**26.105**
4	939/17	Bamboo garden	1.50	3.36	2.25	NC	**2.37**	98.57	97.12	96.39	NC	**97.36**	36.85	37.15	38.54	NC	**37.51**	23.21	25.21	25.68	NC	**24.71**
5	940/2	Coconut garden	2.60	3.84	3.65	NC	**3.36**	123.01	123.38	122.39	NC	**122.92**	45.85	48.29	42.32	NC	**45.48**	35.87	36.73	31.15	NC	**34.58**
6	932	Coconut farm	8.55	7.91	7.89	NC	**8.11**	130.20	133.57	124.34	NC	**129.37**	51.30	54.20	49.62	NC	**51.70**	23.2	19.26	22.11	NC	**21.52**
		Mean	**4.22**	**4.78**	**4.43**	**5.41**	-	**88**	**88.92**	**85.64**	**70.17**	-	**37.23**	**38.08**	**35.55**	**34.13**	-	**24.75**	**25.33**	**25.49**	**25.55**	-

* NC- Not collected

Table 4c. Bicarbonate, Sulphate and Chloride content of the bore well water samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	Bicarbonate (mg L^{-1})					Sulphate (mg L^{-1})					Chloride (mg L^{-1})				
			Sep. 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	409/28	Backside of raw water unit	125.27	121.25	128.22	NC	**124.91**	6.65	13.33	11.56	NC	**10.51**	37.65	38.59	38.65	NC	**38.30**
2	418	Old time office	217.65	218.46	219.36	221.59	**219.27**	59.32	56.28	55.36	57.32	**57.07**	246.87	246.23	249.65	250.35	**248.28**
3	415/3	Admin block office	285.46	287.28	281.55	284.28	**284.64**	56.87	57.39	59.61	58.37	**58.06**	213.23	215.64	214.36	209.64	**213.22**
4	939/17	Bamboo garden	315.25	312.92	316.51	NC	**314.89**	123.23	122.56	120.71	NC	**122.17**	262.89	269.60	261.27	NC	**264.59**
5	940/2	Coconut garden	248.58	232.64	248.31	NC	**243.18**	157.35	155.72	149.76	NC	**154.28**	311.25	306.28	305.32	NC	**307.62**
6	932	Coconut farm	302.27	286.36	297.62	NC	**295.42**	196.89	197.31	195.52	NC	**196.57**	314.26	305.82	309.38	NC	**309.82**
		Mean	**249.08**	**243.15**	**248.59**	**252.93**	-	**100.05**	**100.43**	**98.75**	**57.84**	-	**231.02**	**230.36**	**229.77**	**229.99**	-

* NC- Not collected

Table 4 d. SAR, Calcium, RSC and SSP content of the bore well water samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	SAR					RSC					SSP				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	409/28	Backside of raw water unit	1.05	1.55	1.37	-	**1.32**	-1.30	-3.71	- 3.15	-	**-2.72**	17.36	11.80	16.37	-	**15.18**
2	418	Old time office	1.60	3.49	2.52	2.62	**2.56**	-1.4	-5.84	- 6.14	-7.17	**-5.14**	26.65	30.97	28.64	31.54	**29.45**
3	415/3	Admin block office	1.50	1.99	1.56	1.55	**1.65**	-2.5	-7.58	- 7.25	-6.52	**-5.96**	25.89	27.41	31.69	29.71	**28.68**
4	939/17	Bamboo garden	2.70	2.92	2.24	-	**2.62**	-3.9	-7.92	- 6.32	-	**-6.05**	40.20	36.41	39.26	-	**38.62**
5	940/2	Coconut garden	2.93	2.63	2.65	-	**2.74**	-5.8	-11.06	- 6.32	-	**-7.73**	38.65	30.16	37.29	-	**35.37**
6	932	Coconut farm	2.20	2.76	2.32	-	**2.43**	-6.42	-11.36	- 7.35	-	**-8.38**	34.55	24.27	29.35	-	**29.39**
		Mean	**2.00**	**2.56**	**2.11**	**2.09**	-	**-3.55**	**-7.91**	**-6.09**	**-6.85**	-	**30.55**	**26.84**	**30.43**	**30.63**	-

* NC- Not collected

Table 4 e. Ni, As and Cd content of the bore well water samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	Ni (ppm)					As (ppm)					Cd (ppm)				
			Sep., 2023	Dec., 2023	March., 2024	June. 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June. 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June. 2024	Mean
1	409/28	Backside of raw water unit	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-
2	418	Old time office	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
3	415/3	Admin block office	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
4	939/17	Bamboo garden	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-
5	940/2	Coconut garden	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-
6	932	Coconut farm	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-	BDL	BDL	BDL	NC	-
		Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* NC- Not collected *BDL – Below Detectable Limit

Table 4 f. Pb and Cr content of the bore well water samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	Pb (ppm)					Cr (ppm)				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	409/28	Backside of raw waterunit	0.09	0.16	0.10	NC	**0.12**	BDL	BDL	BDL	NC	-
2	418	Old time office	0.19	0.34	0.21	0.18	**0.23**	BDL	BDL	BDL	BDL	-
3	415/3	Admin block office	0.05	0.15	0.09	0.08	**0.09**	BDL	BDL	BDL	BDL	-
4	939/17	Bamboo garden	0.87	0.91	0.78	NC	**0.85**	BDL	BDL	BDL	NC	-
5	940/2	Coconut garden	0.07	0.26	BDL	NC	**0.17**	BDL	BDL	BDL	NC	-
6	932	Coconut farm	0.13	0.27	0.33	NC	**0.24**	BDL	BDL	BDL	NC	-
		Mean	**0.23**	**0.35**	**0.30**	**0.13**	-	-	-	-	-	-

*BDL – Below Detectable Limit * NC- Not collected

Table 5 a. pH, EC and OC content of the soil samples collected in ITC factory and surroundings area

Sample No.	SF	Sample ID	pH					EC (dSm^{-1})					OC(%)				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	426	Factory (Block A)	7.48	7.62	7.55	7.51	**7.59**	0.54	0.37	0.39	0.41	**0.35**	0.78	0.51	0.42	0.55	**0.50**
2	923	Factory (Block B)	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-
3	925	Factory (Block B)	7.54	7.43	NC	NC	**7.39**	0.71	0.51	NC	NC	**0.53**	0.54	0.34	NC	NC	**0.33**
4	942	Factory (Block B)	7.29	6.85	NC	NC	**6.87**	0.93	0.62	NC	NC	**0.65**	0.51	0.21	NC	NC	**0.24**
5	932	Factory (Block B)	7.92	7.68	NC	NC	**7.65**	0.78	0.62	NC	NC	**0.60**	0.76	0.64	NC	NC	**0.59**
6	411	Factory (Block A)	7.74	7.48	7.59	7.53	**7.44**	0.59	0.34	0.39	0.45	**0.34**	0.65	0.57	0.49	0.51	**0.53**
7	923	Factory (Block B)	7.66	7.52	7.57	7.58	**7.52**	0.96	0.73	0.85	0.87	**0.79**	0.75	0.58	0.56	0.50	**0.56**
8	922	Factory (Block B)	7.94	7.89	7.71	7.77	**7.81**	0.98	0.71	0.75	0.76	**0.73**	0.84	0.67	0.75	0.71	**0.71**
9	884	Factory (Block E)	7.71	7.56	7.59	7.76	**7.57**	0.48	0.33	0.39	0.29	**0.30**	0.54	0.34	0.33	0.34	**0.33**
10	893	Factory (Block E)	7.94	7.80	NC	NC	**7.77**	0.66	0.57	NC	NC	**0.48**	0.82	0.54	NC	NC	**0.60**
11	851	Factory (Block F)	7.82	7.69	7.68	7.75	**7.68**	0.54	0.35	0.49	0.45	**0.40**	0.79	0.62	0.59	0.58	**0.60**
12	850	Factory (Block F)	8.23	8.23	7.95	8.01	**8.03**	0.51	0.29	0.28	0.31	**0.29**	0.92	0.89	0.72	0.79	**0.83**
13	778	Factory (Block G)	7.81	7.72	7.56	7.62	**7.70**	0.62	0.34	0.52	0.45	**0.42**	0.70	0.54	0.52	0.55	**0.52**
14	779	Factory (Block G)	7.58	7.34	NC	NC	**7.36**	0.84	0.61	NC	NC	**0.66**	0.58	0.48	NC	NC	**0.40**
15	962	Factory (Block G)	6.64	6.89	NC	NC	**6.92**	0.52	0.71	NC	NC	**0.74**	0.81	0.64	NC	NC	**0.63**
16	141	Factory (Block D)	7.92	7.86	7.59	7.53	**7.80**	0.72	0.61	0.78	0.76	**0.69**	0.95	0.81	0.89	0.86	**0.84**
17	416	Nachimuthu	7.66	7.52	7.58	7.60	**7.56**	1.35	1.25	1.15	1.12	**1.21**	0.62	0.34	0.39	0.35	**0.39**
18	424	Selvaraj	7.71	7.64	7.52	-	**7.61**	0.96	0.85	0.98	-	**0.87**	0.78	0.66	0.62	-	**0.62**
19	427	Pettiyan (Servall)	7.95	7.65	7.55	7.59	**7.63**	1.58	1.21	1.25	1.28	**1.27**	0.62	0.38	0.55	0.54	**0.44**

20	-	Varatharajthottam	8.33	8.05	7.93	7.85	**8.01**	0.51	0.32	0.32	0.46	**0.37**	0.68	0.54	0.25	0.29	**0.38**
21	93	Velumaniammal	7.62	7.38	NC	NC	**7.40**	0.82	0.65	NC	NC	**0.65**	0.84	0.68	NC	NC	**0.63**
22	414	Batheri	NC	NC	7.51	7.42	**7.43**	NC	NC	0.23	0.25	**0.25**	NC	NC	0.36	0.48	**0.41**
23	916	Kalikutty&Rajan	7.94	7.63	7.63	7.71	**7.70**	0.50	0.31	0.47	0.39	**0.36**	0.83	0.57	0.56	0.67	**0.59**
24	911	Rangaraj	7.64	7.45	7.54	7.56	**7.52**	1.71	1.54	1.56	1.41	**1.50**	0.76	0.45	0.55	0.38	**0.45**
25	937	Rangasamy	7.69	7.56	7.63	7.79	**7.59**	0.95	0.91	0.85	0.90	**0.86**	0.64	0.54	0.54	0.46	**0.53**
26	881	NatrajGounder	7.68	7.62	7.75	7.65	**7.66**	1.51	1.14	1.27	1.31	**1.21**	0.50	0.36	0.32	0.48	**0.31**
27	876	Subbaiyan	NC	NC	7.95	7.91	**7.94**	NC	NC	0.25	0.28	**0.24**	NC	NC	0.30	0.28	**0.29**
28	884	Annamalai Gr, Thottam	7.78	7.62	7.56	7.60	**7.60**	0.53	0.26	0.27	0.25	**0.22**	0.63	0.54	0.56	0.57	**0.55**
29	131	Somanur Gr, Thottam	6.99	6.80	NC	NC	**6.85**	0.72	0.64	NC	NC	**0.56**	0.79	0.51	NC	NC	**0.52**
		Mean	**7.55**	**7.56**	**7.66**	**7.66**	-	**0.64**	**0.66**	**0.64**	**0.63**	-	**0.51**	**0.53**	**0.50**	**0.53**	-

* RSS– Repeated Sample Site * NC- Not collected

Table 5 b. Available Nitrogen, Phosphorus and Potassium content of the soil samples collected in ITC factory and surroundings area

Sample No.	SF	Sample ID	Available Nitrogen (kg ha^{-1})					Available Phosphorus (kg ha^{-1})					Available Potassium (kg ha^{-1})				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	426	Factory (Block A)	129.94	131.29	127.35	121.35	**124.06**	25.64	24.25	27.36	28.64	**24.12**	184.34	178.03	181.24	175.64	**180.22**
2	923	Factory (Block B)	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-
3	925	Factory (Block B)	99.27	103.67	NC	NC	**100.97**	17.34	22.59	NC	NC	**20.97**	167.05	163.68	NC	NC	**164.37**
4	942	Factory (Block B)	126.32	122.39	NC	NC	**123.36**	13.08	14.24	NC	NC	**13.16**	144.38	140.27	NC	NC	**141.33**
5	932	Factory (Block B)	89.59	91.25	NC	NC	**90.22**	25.65	25.67	NC	NC	**24.66**	126.12	123.16	NC	NC	**123.64**
6	411	Factory (Block A)	120.58	114.65	115.46	119.32	**117.39**	18.92	16.98	18.94	19.64	**17.52**	189.11	186.25	185.36	180.12	**185.08**
7	923	Factory (Block B)	140.57	142.83	140.65	141.84	**141.21**	29.34	31.05	29.34	29.32	**28.45**	99.04	97.91	97.85	98.64	**96.67**
8	922	Factory (Block B)	269.67	270.28	254.35	261.27	**262.75**	97.28	94.26	96.18	98.24	**95.81**	216.72	209.43	207.64	210.28	**210.38**
9	884	Factory (Block E)	126.91	128.39	129.35	126.69	**127.73**	22.82	23.42	23.84	28.67	**23.58**	174.15	169.71	181.25	184.36	**175.65**
10	893	Factory (Block E)	129.61	125.62	NC	NC	**127.12**	32.52	28.15	NC	NC	**29.34**	156.39	161.58	NC	NC	**159.99**
11	851	Factory (Block F)	140.58	141.97	143.61	146.48	**144.50**	22.37	19.36	21.45	20.87	**20.89**	162.51	158.47	157.24	161.48	**163.67**
12	850	Factory (Block F)	98.91	92.14	95.26	96.25	**95.75**	20.64	22.48	21.59	22.54	**20.43**	170.43	165.63	165.55	161.29	**166.53**

13	778	Factory (Block G)	103.94	108.29	105.65	103.24	**106.05**	23.64	23.97	22.52	24.25	**23.48**	99.64	102.38	98.45	95.70	**98.44**
14	779	Factory (Block G)	114.34	115.95	NC	NC	**114.15**	25.35	25.82	NC	NC	**25.09**	129.17	131.08	NC	NC	**129.63**
15	962	Factory (Block G)	129.05	132.41	NC	NC	**130.23**	28.37	28.23	NC	NC	**27.30**	139.61	141.26	NC	NC	**140.29**
16	141	Factory (Block D)	135.85	128.76	121.36	125.85	**128.75**	27.34	29.60	28.65	27.31	**28.94**	89.25	91.28	90.52	88.55	**87.08**
17	416	Nachimuthu	137.90	137.51	130.24	127.65	**132.21**	22.66	23.27	21.49	23.43	**22.31**	312.42	313.62	312.25	310.47	**308.73**
18	424	Selvaraj	106.81	109.34	104.67	-	**105.49**	33.24	33.08	32.36	-	**32.61**	96.28	92.70	95.66	-	**94.38**
19	427	Pettiyan (Servall)	129.13	126.34	124.63	125.67	**125.47**	27.34	30.86	29.39	29.25	**30.02**	224.27	220.84	221.35	220.85	**225.22**
20	-	Varatharajthottam	149.57	151.36	150.25	158.56	**152.39**	22.39	23.75	21.95	24.38	**23.43**	102.37	109.34	101.69	103.50	**105.16**
21	93	Velumaniammal	153.64	154.27	NC	NC	**153.46**	21.64	23.16	NC	NC	**22.90**	125.08	128.05	NC	NC	**126.07**
22	414	Batheri	NC	NC	128.56	126.91	**126.88**	NC	NC	28.75	25.52	**27.56**	NC	NC	141.36	140.75	**141.74**
23	916	Kalikutty&Rajan	137.90	132.82	131.36	128.76	**130.76**	32.23	32.21	31.57	32.65	**31.06**	83.46	84.42	82.25	85.48	**84.06**
24	911	Rangaraj	136.61	138.90	136.63	137.48	**137.75**	27.92	28.76	27.63	28.54	**27.88**	324.42	319.52	322.35	299.18	**316.10**
25	937	Rangasamy	102.92	108.16	109.49	106.96	**106.09**	38.08	35.84	35.26	36.29	**35.27**	98.15	99.50	95.52	98.73	**97.48**
26	881	NatrajGounder	131.61	129.42	127.64	128.63	**127.70**	25.31	26.43	25.64	28.88	**26.59**	233.08	227.16	225.65	228.95	**226.89**
27	876	Subbaiyan	NC	NC	165.34	168.65	**167.56**	NC	NC	18.53	20.12	**19.85**	NC	NC	108.85	112.22	**112.85**
28	884	Annamalai Gr, Thottam	97.30	95.61	96.39	97.16	**96.70**	20.07	18.38	19.28	21.15	**20.20**	189.19	186.31	185.45	181.15	**183.16**
29	131	Somanur Gr, Thottam	125.64	118.25	NC	NC	**120.95**	28.16	24.19	NC	NC	**25.18**	163.46	159.43	NC	NC	**160.95**
		Mean	**128.32**	**128.92**	**131.97**	**133.03**	-	**26.92**	**28.08**	**29.02**	**29.36**	-	**160.48**	**160.04**	**162.44**	**165.51**	-

* RSS– Repeated Sample Site * NC- Not collected

Table 5 c. Ex. Calcium, Magnesium, Sodium and Potassium content of the soil samples collected in ITC factory and surroundings area

Sample No	SF	Sample ID	Ex. Sodium (cmol (p^+) kg^{-1})					Ex. Potassium (cmol (p^+) kg^{-1})					Ex. Calcium (cmol (p^+) kg^{-1})					Ex. Magnesium (cmol (p^+) kg^{-1})				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	426	Factory (Block A)	0.61	0.85	0.75	0.79	**0.82**	1.45	1.19	1.25	1.32	**1.17**	0.71	0.62	0.64	0.69	**0.60**	0.52	0.36	0.55	0.61	**0.56**
2	923	Factory (Block B)	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	R SS	-	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-
3	925	Factory (Block B)	1.05	0.96	NC	NC	**0.94**	1.03	0.85	NC	NC	**0.89**	0.86	0.54	NC	NC	**0.50**	0.89	0.53	NC	NC	**0.51**
4	942	Factory (Block B)	0.94	0.82	NC	NC	**0.78**	1.61	1.36	NC	NC	**1.34**	1.03	1.20	NC	NC	**1.08**	0.91	0.65	NC	NC	**0.63**
5	932	Factory (Block B)	0.98	0.73	NC	NC	**0.71**	1.68	1.34	NC	NC	**1.31**	1.55	1.32	NC	NC	**1.29**	0.93	0.81	NC	NC	**0.77**
6	411	Factory (Block A)	0.90	0.75	0.72	0.88	**0.74**	1.29	1.14	1.22	1.15	**1.16**	0.48	0.46	0.48	0.51	**0.52**	0.66	0.52	0.58	0.62	**0.68**
7	923	Factory (Block B)	1.29	0.92	0.95	0.92	**0.92**	0.76	0.62	0.59	0.71	**0.60**	1.29	0.92	1.05	0.95	**0.91**	0.98	0.73	0.72	0.84	**0.60**
8	922	Factory (Block B)	0.85	0.73	0.75	0.78	**0.70**	1.54	1.28	1.21	1.45	**1.22**	0.91	0.88	0.81	0.78	**0.80**	0.79	0.72	0.73	0.79	**0.68**
9	884	Factory (Block E)	1.52	1.25	1.45	1.12	**1.14**	1.46	1.22	1.31	1.36	**1.20**	0.58	0.45	0.52	0.47	**0.42**	0.54	0.28	0.32	0.45	**0.26**
10	893	Factory (Block E)	1.29	0.89	NC	NC	**0.92**	1.31	0.87	NC	NC	**0.91**	0.80	0.57	NC	NC	**0.59**	1.59	1.32	NC	NC	**1.31**
11	851	Factory (Block F)	1.30	0.96	1.09	0.95	**0.93**	1.24	1.13	1.17	1.22	**1.15**	0.93	0.94	0.82	0.88	**0.87**	0.84	0.57	0.52	0.53	**0.59**
12	850	Factory (Block F)	0.92	0.88	0.85	0.91	**0.85**	1.51	1.27	1.25	1.18	**1.21**	0.93	0.86	0.95	0.87	**0.80**	0.62	0.37	0.37	0.55	**0.39**

13	778	Factory (Block G)	0.91	0.86	0.95	0.89	**0.86**	0.81	0.65	0.71	0.69	**0.63**	1.30	0.91	0.92	0.95	**0.90**	0.91	0.66	0.75	0.76	**0.69**
14	779	Factory (Block G)	0.93	0.68	NC	NC	**0.71**	0.83	0.68	NC	NC	**0.71**	0.76	0.62	NC	NC	**0.59**	0.59	0.43	NC	NC	**0.41**
15	962	Factory (Block G)	0.81	0.65	NC	NC	**0.63**	1.56	1.35	NC	NC	**1.31**	0.78	0.62	NC	NC	**0.60**	1.56	1.41	NC	NC	**1.39**
16	141	Factory (Block D)	1.23	1.34	1.25	1.13	**1.20**	1.54	1.32	1.38	1.45	**1.29**	0.95	0.83	0.85	0.81	**0.79**	0.76	0.62	0.61	0.55	**0.56**
17	416	Nachimuthu	2.29	2.26	2.19	1.95	**2.16**	1.72	2.08	2.01	1.82	**2.00**	0.66	0.60	0.62	0.71	**0.63**	0.58	0.33	0.49	0.53	**0.39**
18	424	Selvaraj	0.92	0.79	0.81	-	**0.79**	0.82	0.74	0.72	-	**0.68**	0.84	0.75	0.75	-	**0.70**	0.54	0.40	0.42	-	**0.36**
19	427	Pettiyan (Servall)	1.69	1.43	1.45	1.61	**1.46**	1.96	1.94	1.85	1.82	**1.89**	0.97	0.81	0.82	0.89	**0.82**	0.59	0.42	0.52	0.49	**0.49**
20	-	Varatharajth ottam	1.62	1.46	1.49	1.52	**1.42**	0.64	0.71	0.73	0.65	**0.70**	1.23	0.89	0.94	1.05	**0.87**	0.84	0.73	0.65	0.71	**0.67**
21	93	Velumania mmal	1.28	1.17	NC	NC	**1.13**	1.24	1.23	NC	NC	**1.14**	1.32	1.19	NC	NC	**1.16**	0.91	0.79	NC	NC	**0.80**
22	414	Batheri	NC	NC	0.68	0.72	**0.72**	NC	NC	0.22	0.27	**0.22**	NC	NC	1.55	1.42	**1.45**	NC	NC	0.65	0.63	**0.65**
23	916	Kalikutty& Rajan	1.54	1.31	1.51	1.41	**1.37**	0.87	0.73	0.75	0.81	**0.70**	0.91	0.67	0.76	0.88	**0.70**	0.79	0.64	0.51	0.58	**0.58**
24	911	Rangaraj	2.82	2.54	2.54	1.49	**2.27**	1.93	1.92	1.92	1.75	**1.86**	0.76	0.61	0.66	0.72	**0.63**	0.54	0.38	0.46	0.51	**0.40**
25	937	Rangasamy	0.73	0.87	0.98	0.86	**0.90**	0.69	0.58	0.57	0.68	**0.55**	0.82	0.66	0.80	0.79	**0.72**	0.36	0.23	0.29	0.36	**0.25**
26	881	Natraj Gounder	1.55	1.31	1.42	1.35	**1.32**	1.58	1.45	1.52	1.45	**1.39**	0.91	0.79	0.82	0.85	**0.78**	0.77	0.52	0.61	0.70	**0.57**
27	876	Subbaiyan	NC	NC	0.91	0.88	**0.89**	NC	NC	0.51	0.54	**0.58**	NC	NC	1.25	1.09	**1.10**	NC	NC	0.65	0.77	**0.75**
28	884	Annamalai Gr, Thottam	0.94	0.87	0.86	0.80	**0.84**	1.28	1.19	1.25	1.28	**1.18**	0.62	0.38	0.58	0.51	**0.52**	0.72	0.63	0.88	0.85	**0.76**
29	131	Somanur Gr, Thottam	0.88	0.63	NC	NC	**0.66**	1.56	1.32	NC	NC	**1.29**	0.97	0.93	NC	NC	**0.90**	1.26	1.23	NC	NC	**1.15**
		Mean	**1.24**	**1.09**	**1.15**	**1.64**	-	**1.16**	**1.13**	**1.20**	**1.25**	-	**0.86**	**0.79**	**0.82**	**0.81**	-	**0.65**	**0.69**	**0.59**	**0.62**	-

* NC- Not collected *RSS – Repeated Sample Site

Table 5 d. Ni, As and Cd content of the soil samples collected in ITC factory and surroundings area

Sample No	SF	Sample ID	Ni (ppm)					As (ppm)					Cd (ppm)				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	426	Factory (Block A)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
2	923	Factory (Block B)	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-
3	925	Factory (Block B)	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
4	942	Factory (Block B)	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
5	932	Factory (Block B)	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
6	411	Factory (Block A)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
7	923	Factory (Block B)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
8	922	Factory (Block B)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
9	884	Factory (Block E)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
10	893	Factory (Block E)	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
11	851	Factory (Block F)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
12	850	Factory (Block F)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-

13	778	Factory (Block G)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
14	779	Factory (Block G)	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
15	962	Factory (Block G)	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
16	141	Factory (Block D)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
17	416	Nachimuthu	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
18	424	Selvaraj	BDL	BDL	BDL	-	-	BDL	BDL	BDL	-	-	BDL	BDL	BDL	-	-
19	427	Pettiyan (Servall)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
20	-	Varatharajthottam	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
21	93	Velumaniammal	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
22	414	Batheri	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-
23	916	Kalikutty&Rajan	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
24	911	Rangaraj	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
25	937	Rangasamy	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
26	881	NatrajGounder	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
27	876	Subbaiyan	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-	NC	NC	BDL	BDL	-
28	884	Annamalai Gr, Thottam	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
29	131	Somanur Gr, Thottam	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-	BDL	BDL	NC	NC	-
		Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* RSS– Repeated Sample Site * NC- Not collected *BDL – Below Detectable Limit

Table 5 e. Pb and Cr content of the soil samples collected in ITC factory and surroundings area

Sample No	SF	Sample ID	Pb (ppm)					Cr (ppm)				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	426	Factory (Block A)	1.18	1.15	1.15	1.12	**1.08**	BDL	BDL	BDL	BDL	-
2	923	Factory (Block B)	RSS	RSS	RSS	RSS	-	RSS	RSS	RSS	RSS	-
3	925	Factory (Block B)	0.58	0.47	NC	NC	**0.42**	BDL	BDL	NC	NC	-
4	942	Factory (Block B)	0.37	0.27	NC	NC	**0.26**	BDL	BDL	NC	NC	-
5	932	Factory (Block B)	0.26	0.25	NC	NC	**0.22**	BDL	BDL	NC	NC	-
6	411	Factory (Block A)	0.68	0.54	0.61	0.52	**0.47**	BDL	BDL	BDL	BDL	-
7	923	Factory (Block B)	1.23	1.12	1.16	1.12	**1.10**	BDL	BDL	BDL	BDL	-
8	922	Factory (Block B)	1.23	1.14	1.09	1.01	**0.98**	BDL	BDL	BDL	BDL	-
9	884	Factory (Block E)	0.15	0.18	BDL	BDL	**0.07**	BDL	BDL	BDL	BDL	-
10	893	Factory (Block E)	1.24	1.42	NC	NC	**1.37**	BDL	BDL	NC	NC	-
11	851	Factory (Block F)	0.41	0.35	0.36	0.38	**0.28**	BDL	BDL	BDL	BDL	-
12	850	Factory (Block F)	0.46	0.33	0.28	0.35	**0.25**	BDL	BDL	BDL	BDL	-
13	778	Factory (Block G)	0.62	0.57	0.65	0.58	**0.50**	BDL	BDL	BDL	BDL	-
14	779	Factory (Block G)	0.55	0.52	NC	NC	**0.34**	BDL	BDL	NC	NC	-

15	962	Factory (Block G)	1.31	1.34	NC	NC	**1.23**	BDL	BDL	NC	NC	-
16	141	Factory (Block D)	1.45	1.38	1.25	1.38	**1.28**	BDL	BDL	BDL	BDL	-
17	416	Nachimuthu	0.51	0.29	0.35	0.28	**0.22**	BDL	BDL	BDL	BDL	-
18	424	Selvaraj	0.16	0.18	BDL	-	**0.07**	BDL	BDL	BDL	-	-
19	427	Pettiyan (Servall)	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
20	-	Varatharajthottam	0.28	0.32	0.29	0.25	**0.21**	BDL	BDL	BDL	BDL	-
21	93	Velumaniammal	0.23	0.45	NC	NC	**0.14**	BDL	BDL	NC	NC	-
22	414	Batheri	NC	NC	0.29	0.35	**0.30**	NC	NC	BDL	BDL	-
23	916	Kalikutty&Rajan	0.34	0.28	0.32	0.46	**0.39**	BDL	BDL	BDL	BDL	-
24	911	Rangaraj	0.87	0.52	0.56	0.61	**0.57**	BDL	BDL	BDL	BDL	-
25	937	Rangasamy	0.38	0.27	0.29	0.28	**0.21**	BDL	BDL	BDL	BDL	-
26	881	NatrajGounder	0.36	0.39	0.37	0.28	**0.18**	BDL	BDL	BDL	BDL	-
27	876	Subbaiyan	NC	NC	0.46	0.48	**0.51**	NC	NC	BDL	BDL	-
28	884	Annamalai Gr, Thottam	1.34	1.39	1.25	1.14	**0.67**	BDL	BDL	BDL	BDL	-
29	131	Somanur Gr, Thottam	0.19	0.16	NC	NC	**0.08**	BDL	BDL	NC	NC	-
		Mean	**0.55**	**0.51**	**0.56**	**0.55**	-	-	-	-	-	-

* RSS– Repeated Sample Site * NC- Not collected *BDL – Below Detectable Limit

Table 6 a. pH, EC and OC content of the soil samples collected in ITC factory premises

Sample No	SF	Sample ID	pH					EC (dSm^{-1})					OC %				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	409/28	Backside of raw water unit	8.18	8.21	8.22	8.15	**8.19**	0.28	0.36	0.31	0.29	**0.31**	0.86	0.89	0.81	0.83	**0.85**
2	418	Old time office	7.61	7.98	7.68	7.75	**7.76**	0.46	0.59	0.51	0.47	**0.51**	0.71	0.68	0.71	0.65	**0.69**
3	415/3	Admin block office	8.31	8.34	8.31	8.29	**8.31**	0.38	0.32	0.36	0.29	**0.34**	0.76	0.78	0.52	0.63	**0.67**
4	939/17	Bamboo garden	7.52	7.95	7.81	7.72	**7.75**	0.42	0.45	0.48	0.51	**0.47**	0.67	0.84	0.81	0.69	**0.75**
5	940/2	Coconut garden	7.37	7.42	7.40	7.35	**7.39**	1.21	1.16	1.11	0.95	**1.11**	0.54	0.56	0.52	0.57	**0.55**
6	932	Coconut farm	6.76	6.95	6.85	6.77	**6.83**	0.88	0.65	0.81	0.70	**0.76**	0.52	0.60	0.59	0.55	**0.57**
		Mean	**7.63**	**7.81**	**7.71**	**7.67**	-	**0.61**	**0.59**	**0.60**	**0.54**	-	**0.68**	**0.73**	**0.66**	**0.65**	-

* NC- Not collected

Table 6 b. Available Nitrogen, Phosphorus and Potassium content of the soil samples collected in ITC factory premises

Sample No	SF	Sample ID	Available N (kg ha^{-1})					Available P (kg ha^{-1})					Available K (kg ha^{-1})				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	409/28	Backside of raw water unit	161.31	162.28	160.22	159.75	**160.89**	23.08	25.29	23.65	22.21	**23.56**	248.28	254.68	258.82	241.18	**250.74**
2	418	Old time office	212.34	216.36	215.94	211.45	**214.02**	23.64	22.59	21.14	20.25	**21.91**	273.36	271.13	274.25	269.37	**272.03**
3	415/3	Admin block office	182.06	186.94	180.32	181.15	**182.62**	26.67	23.67	25.48	23.55	**24.84**	187.20	182.42	183.36	189.11	**185.52**
4	939/17	Bamboo garden	222.04	226.18	205.42	209.91	**215.89**	27.94	27.49	24.20	26.64	**26.57**	123.36	121.36	123.35	121.10	**122.29**
5	940/2	Coconut garden	193.37	184.29	185..26	189.23	**188.96**	27.37	29.92	25.56	28.84	**27.92**	241.14	239.25	238.65	240.27	**239.83**
6	932	Coconut farm	142.64	137.57	139.66	143.36	**140.81**	26.08	30.76	28.61	29.15	**28.65**	154.61	153.42	155.24	152.35	**153.91**
		Mean	**185.63**	**185.60**	**180.31**	**182.48**	-	**25.80**	**26.62**	**24.77**	**25.11**	-	**204.96**	**203.71**	**205.61**	**202.23**	-

* NC- Not collected

Table 6 c. Ex.Calcium, Magnesium Sodium and Potassium content of the soil samples collected in ITC factory premises

SF	Sample ID	Exchangeable Na (cmol (p⁺) kg⁻¹)					Exchangeable K (cmol (p⁺) kg⁻¹)					Exchangeable Ca (cmol (p⁺) kg⁻¹)					Exchangeable Mg (cmol (p⁺) kg⁻¹)				
		Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
409/28	Backside of raw water unit	1.41	1.99	1.75	1.68	**1.70**	1.51	1.86	1.79	1.71	**1.69**	0.91	0.98	0.95	0.82	**0.95**	0.52	0.57	0.55	0.51	**0.54**
418	Old time office	1.34	1.28	1.19	1.22	**1.51**	1.14	1.37	1.19	1.22	**1.50**	0.85	0.78	0.79	0.81	**0.85**	0.49	0.56	0.48	0.51	**0.51**
415/3	Admin block office	0.95	0.85	0.82	0.87	**1.0**	0.96	0.94	0.83	0.85	**1.08**	0.96	0.95	0.85	0.81	**0.88**	0.77	0.78	0.65	0.68	**0.72**
939/17	Bamboo garden	1.56	1.55	1.51	1.53	**1.2**	1.50	1.23	1.35	1.26	**1.10**	0.98	0.79	0.81	0.78	**0.86**	0.66	0.79	0.72	0.62	**0.70**
940/2	Coconut garden	1.58	1.51	1.42	1.45	**1.5**	1.27	1.52	1.49	1.34	**1.35**	0.62	0.76	0.75	0.68	**0.74**	0.38	0.52	0.42	0.51	**0.46**
932	Coconut farm	1.67	1.74	1.76	1.55	**1.**	0.89	0.82	0.81	0.82	**1.14**	0.52	0.85	0.81	0.75	**0.70**	0.52	0.50	0.42	0.45	**0.47**
	Mean	**1.42**	**1.49**	**1.34**	**1.35**		**1.21**	**1.29**	**1.33**	**1.28**	-					-	**0.56**	**0.62**	**0.54**	**0.55**	-

* NC- Not collected

Table 6 d. Ni, As and Cd content of the soil samples collected in ITC factory premises

Sample No	SF	Sample ID	Ni (ppm)					As (ppm)					Cd (ppm)				
			Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March., 2024	June., 2024	Mean
1	409/28	Backside of raw water unit	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
2	418	Old time office	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
3	415/3	Admin block office	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
4	939/17	Bamboo garden	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
5	940/2	Coconut garden	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
6	932	Coconut farm	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
		Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*BDL – Below Detectable Limit * NC- Not collected

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Table 6 e. Pb and Cr content of the soil samples collected in ITC factory premises

Sample No	SF	Sample ID	Pb (ppm)					Cr (ppm)				
			Sep., 2023	Dec., 2023	March, 2024	June., 2024	Mean	Sep., 2023	Dec., 2023	March, 2024	June., 2024	Mean
1	409/28	Backside of raw water unit	0.19	0.27	0.15	0.12	**0.18**	BDL	BDL	BDL	BDL	-
2	418	Old time office	0.35	0.39	0.25	0.22	**0.30**	BDL	BDL	BDL	BDL	-
3	415/3	Admin block office	BDL	BDL	BDL	BDL	-	BDL	BDL	BDL	BDL	-
4	939/17	Bamboo garden	1.24	1.27	1.21	1.10	**1.20**	BDL	BDL	BDL	BDL	-
5	940/2	Coconut garden	0.64	0.52	0.61	0.58	**0.58**	BDL	BDL	BDL	BDL	-
6	932	Coconut farm	0.86	0.73	0.72	0.80	**0.77**	BDL	BDL	BDL	BDL	-
		Mean	**0.65**	**0.63**	**0.58**	**0.56**	-	-	-	-	-	-

*BDL – Below Detectable Limit * NC- Not collected

Table 7 a. pH, EC, TDS and Sodium content of the piezometer samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	pH			EC (dSm^{-1})			TDS ($mg\ L^{-1}$)			Sodium ($mg\ L^{-1}$)		
			Sep., 2023 & Dec.,2023	March.,2024 &June., 2024	Mean	Sep., 2023 & Dec., 2023	March.,2024 &June., 2024	Mean	Sep., 2023 &Dec.,2023	March.,2024 &June.,2024	Mean	Sep., 2023 & Dec.,2023	March.,2024 &June.,2024	Mean
1	850	Block F (Mysore G. Thottam)	7.44	NW	7.24	1.41	NW	1.21	775.4	NW	774.4	99.52	NW	98.52
2	779	Block G (KLR)	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
3	938	SLF – 3	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
4	940	Coconut garden -8	7.91	NW	7.81	1.83	NW	1.73	928.2	NW	1107.2	122.39	NW	121.39
5	943	Coconut garden -9a	7.78	NW	7.68	1.25	NW	0.95	609	NW	608	53.2	NW	51.2
6	940	Coconut garden -9b	8.15	8.12	6.855	1.85	1.71	1.03	545	584.65	609.4	126.91	128.2	124.155
7	936	TNAU Trail Plot	7.52	7.58	7.315	1.54	1.45	1.225	794.6	782.24	778.4	71.19	79.25	75.945
8	936	Casurina field	7.35	NW	7.15	1.55	NW	1.25	801	NW	800	68.26	NW	67.26
9	415	Admin block office Opposite to Lorry Yard	7.25	7.22	7.09	1.24	1.28	1.18	729.6	722.54	721.05	89.04	90.24	89.72
10	411	Factory (Block A)	Closed	Closed	-	Closed	Closed	-	Closed	Closed	-	Closed	Closed	-
		Mean	**7.17**	**7.40**	-	**1.20**	**1.21**	-	**765.26**	**716.83**	-	**88.93**	**98.50**	-

*NW - No Water

Table 7 b. Potassium, Calcium, Magnesium and Carbonate content of the piezometer samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	Potassium (mg L^{-1})			Calcium (mg L^{-1})			Magnesium (mg L^{-1})			Carbonate (mg L^{-1})		
			Sep., 2023 &Dec.,2023	March.,2024 &June., 2024	Mean	Sep., 2023 & Dec., 2023	March.,2024 &June.,2024	Mean	Sep., 2023 & Dec., 2023	March.,2024 &June.,2024	Mean	Sep., 2023 & Dec.,2023	March., 2024 & June., 2024	Mean
1	850	Block F (Mysore G. Thottam)	4.35	NW	**4.6**	99.19	NW	**98.19**	46.57	NW	**45.57**	31.19	NW	**30.19**
2	779	Block G (KLR)	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
3	938	SLF – 3	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
4	940	Coconut garden -8	1.87	NW	**1.67**	91.64	NW	**91.24**	40.67	NW	**39.67**	126.16	NW	**125.16**
5	943	Coconut garden -9a	7.60	NW	**6.6**	163.4	NW	**162.4**	86.9	NW	**85.9**	115.42	NW	**117.42**
6	940	Coconut garden -9b	7.98	6.95	**6.5**	83.84	82.12	**83.47**	57.91	56.65	**58.155**	36.64	37.75	**35.92**
7	936	TNAU Trail Plot	9.45	8.92	**8.7**	99.34	98.84	**97.55**	74.61	72.26	**73.975**	119.28	116.62	**116.34**
8	936	Casurina field	8.46	NW	**8.6**	99.02	NW	**98.02**	73.31	NW	**72.31**	114.06	NW	**115.06**
9	415	Admin block office Opposite to Lorry Yard	3.15	3.22	**3.5**	90.71	91.25	**90.13**	37.35	38.85	**37.89**	26.48	26.64	**26.41**
10	411	Factory (Block A)	Closed	Closed	-	Closed	Closed	-	Closed	Closed	-	Closed	Closed	-
		Mean	**5.64**	**6.41**	-	**102.96**	**90.47**	-	**58.90**	**57.06**	-	**81.18**	**58.98**	-

*NW - No Water

Table 7 c. Bicarbonate Sulphate and Chloride content of the piezometer samples collected from the bench mark sites for continuous monitoring ofground water quality

Sample No	SF	Sample ID	Bicarbonate (mg L^{-1})			Sulphate (mg L^{-1})			Chloride (mg L^{-1})		
			Sep., 2023 &Dec.,2023	March.,2024 &June., 2024	Mean	Sep., 2023 & Dec., 2023	March.,2024& June.,2024	Mean	Sep., 2023 & Dec., 2023	March.,2024& June.,2024	Mean
1	850	Block F (Mysore G. Thottam)	278.52	NW	**277.52**	62.28	NW	**61.28**	209.43	NW	**208.43**
2	779	Block G (KLR)	NW	NW	-	NW	NW	-	NW	NW	-
3	938	SLF – 3	NW	NW	-	NW	NW	-	NW	NW	-
4	940	Coconut garden -8	313.82	NW	**312.82**	125.16	NW	**126.16**	271.91	NW	**269.91**
5	943	Coconut garden -9a	226.5	NW	**226.5**	71.25	NW	**69.25**	128.36	NW	**127.36**
6	940	Coconut garden -9b	255.64	252.32	**248.95**	94.14	93.35	**92.62**	141.26	131.24	**136.61**
7	936	TNAU Trail Plot	190.37	187.85	**186.9**	76.68	78.47	**75.94**	144.61	139.56	**140.07**
8	936	Casurina field	186.46	NW	**185.46**	73.69	NW	**75.69**	141.08	NW	**143.08**
9	415	Admin block office Opposite to Lorry Yard	290.72	289.65	**286.95**	58.46	56.52	**57.155**	210.37	207.75	**207.9**
10	411	Factory (Block A)	Closed	Closed	-	Closed	Closed	-	Closed	Closed	-
		Mean	**248.00**	**237.04**	-	**79.81**	**75.05**	-	**177.43**	**158.64**	-

*NW - No Water

Table 7 d. SAR, Calcium, RSC and SSP content of the piezometer samples collected from the bench mark sites for continuous monitoring of groundwater quality

Sample No	SF	Sample ID	SAR			RSC			SSP		
			Sep., 2023 &Dec.,2023	March.,2024& June., 2024	Mean	Sep., 2023 & Dec., 2023	March.,2024& June.,2024	Mean	Sep., 2023 & Dec., 2023	March.,2024& June.,2024	Mean
1	850	Block F (Mysore G. Thottam)	2.25	-	-	-8.81	-	-	24.12	-	-
2	779	Block G (KLR)	NW	-	-	NW	-	-	NW	-	-
3	938	SLF – 3	NW	-	-	NW	-	-	NW	-	-
4	940	Coconut garden -8	2.96	-	**2.12**	-7.67	-	**-3.64**	36.62	-	**40.02**
5	943	Coconut garden -9a	1.81	-	**0.65**	-16.28	-	**-11.25**	10.24	-	**12.6**
6	940	Coconut garden -9b	3.60	3.12	**2.105**	-9.88	-9.82	**-5.79**	26.65	22.41	**37.66**
7	936	TNAU Trail Plot	1.50	1.45	**1.17**	-12.05	-11.25	**-5.605**	14.53	12.57	**21.31**
8	936	Casurina field	1.55	-	**1.04**	-11.93	-	**-6.99**	12.17	-	**20.79**
9	415	Admin block office Opposite to Lorry Yard	2.95	2.15	**1.58**	-8.68	-7.98	**-4.425**	26.94	25.52	**33.02**
10	411	Factory (Block A)	Closed	Closed	-	Closed	Closed	-	Closed	Closed	-
		Mean	**1.43**	**1.64**	-	**-7.21**	**-3.42**	-	**27.57**	-	-

*NW - No Water

Table 7 e. Ni, As and Cd content of the piezometer samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	Ni (ppm)			As (ppm)			Cd (ppm)		
			Sep., 2023 &Dec.,2023	March.,2024& June., 2024	Mean	Sep., 2023 & Dec., 2023	March.,2024& June.,2024	Mean	Sep., 2023 & Dec., 2023	March.,2024& June.,2024	Mean
1	850	Block F (Mysore G. Thottam)	BDL	NW	-	BDL	NW	-	BDL	NW	-
2	779	Block G (KLR)	NW	NW	-	NW	NW	-	NW	NW	-
3	938	SLF – 3	NW	NW	-	NW	NW	-	NW	NW	-
4	940	Coconut garden -8	BDL	NW	-	BDL	NW	-	BDL	NW	-
5	943	Coconut garden -9a	BDL	NW	-	BDL	NW	-	BDL	NW	-
6	940	Coconut garden -9b	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
7	936	TNAU Trail Plot	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
8	936	Casurina field	BDL	NW	-	BDL	NW	-	BDL	NW	-
9	415	Admin block office Opposite to Lorry Yard	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
10	411	Factory (Block A)	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
		Mean	-	-	-	-	-	-	-	-	-

*NW–No Water *BDL – Below Detectable Limit

Table 7 f. Pb and Cr content of the piezometer samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	Pb (ppm)			Cr (ppm)		
			Sep., 2023 &Dec.,2023	March.,2024& June., 2024	Mean	Sep., 2023 & Dec., 2023	March.,2024& June.,2024	Mean
1	850	Block F (Mysore G. Thottam)	0.18	NW	**0.18**	BDL	NW	-
2	779	Block G (KLR)	NW	NW	-	NW	NW	-
3	938	SLF – 3	NW	NW	-	NW	NW	-
4	940	Coconut garden -8	0.22	NW	**0.22**	BDL	NW	-
5	943	Coconut garden -9a	0.29	NW	**0.29**	BDL	NW	-
6	940	Coconut garden -9b	0.35	0.31	**0.34**	BDL	BDL	-
7	936	TNAU Trail Plot	0.33	0.29	**0.32**	BDL	BDL	-
8	936	Casurina field	0.28	NW	**0.28**	BDL	NW	-
9	415	Admin block office Opposite to Lorry Yard	0.18	0.11	**0.15**	BDL	BDL	-
10	411	Factory (Block A)	Closed	Closed	-	Closed	Closed	Closed
		Mean	**0.14**	**0.14**	-	-	-	-

*NW–No Water *BDL – Below Detectable Limit

Table 8 a. pH, EC, TDS and Sodium content of the piezo well samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	pH			EC (dSm^{-1})			TDS (mg L^{-1})			Sodium (mg L^{-1})		
			Sep.,2023& Dec.,2023	March.,2024 & June., 2024	Mean	Sep., 2023 &Dec.,2023	March., 2024& June., 2024	Mean	Sep., 2023 & Dec.,2023	March., 2024& June., 2024	Mean	Sep., 2023 & Dec., 2023	March.,2024& June., 2024	Mean
1	426/1B	Near to Raw water Tank	NC	NW	-	NC	NW	-	NC	NW	-	NC	NW	-
2	415/3A	Opposite to Lorry Yard	7.28	NW	**7.08**	1.32	NW	**1.12**	717.8	NW	**716.8**	90.65	NW	**89.65**
3	418	Old time office	NC	NW	-	NC	NW	-	NC	NW	-	NC	NW	-
4	426/1D	Cogeneration Plant	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
5	923/2A	ETP	6.71	NW	**6.28**	1.90	NW	**1.24**	753	NW	**793.6**	69.92	NW	**65.28**
6	925/1	Hostel	7.90	7.82	**6.06**	2.39	2.05	**1.1**	699.6	NW	**697.6**	59.81	62.41	**87.105**
7	922/2	LSTC- Vagaimara thoppu	NC	7.56	**7.53**	NC	1.11	**1.23**	NC	771.62	**770.6**	NC	80.2	**83.9**
8	938/1	SLF- 1	7.26	NW	**7.16**	1.58	NW	**1.18**	757.2	NW	**755.2**	98.8	NW	**96.8**
9	938/2	SLF- 2	NW	7.15	**7.11**	NW	1.08	**1.1**	NW	719.36	**726.4**	NW	88.24	**90.27**
10	938/2	SLF- 3	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
11	939/1A1	Bamboo garden	9.10	8.30	**7.61**	1.9	1.75	**1.56**	962	1021	**1008**	130.36	123.62	**129.435**
12	939/1A2	Coconut garden	7.85	NC	**7.85**	1.3	NC	**1.71**	998.1	NC	**997.1**	125.42	NC	**124.42**
13	932	Coconut garden	7.73	7.52	**7.52**	1.98	1.75	**1.075**	609.2	NW	**608.2**	54.5	52.5	**51.3**
14	943	Coconut garden	7.17	NC	**6.17**	1.89	NC	**0.89**	550.2	NC	**549.2**	129.67	NC	**128.67**
15	932	Coconut garden	7.81	NW	**7.71**	1.96	NW	**0.96**	612.8	NW	**611.8**	60.2	NW	**59.2**
16	877/2B	Hospital medu	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
17	879/2	Hospital medu	NW	NC	-	NW	NC	-	NW	NC	-	NW	NC	-
18	141/2A	KVK	8.26	8.12	**7.76**	1.89	1.75	**1.005**	570.6	650.25	**614.35**	104.7	98.65	**74.54**
19	884/2	Kandi thottam	7.78	7.89	**7.845**	1.58	1.56	**1.305**	896.4	662.76	**774.6**	53.37	60.7	**58.485**
20	891/2B1	Kandi thottam	NC	NC	-	NC	NC	-	NC	NC	-	NC	NC	-
21	891/2B1	Kandi thottam	7.48	NC	**7.28**	1.63	NC	**1.33**	948.9	NC	**913.5**	55.67	NC	**56.69**
22	850	Coconut Field	7.61	NC	**7.36**	1.53	NC	**1.17**	937.1	NC	**826.3**	136.83	NC	**128.84**
23	779	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
24	778/2C	Coconut Field	NC	NC	-	NC	NC	-	NC	NC	-	NC	NC	-
25	962	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
		Mean	**7.24**	**7.28**	-	**1.19**	**1.23**	-	**761.10**	**773.18**	-	**87.95**	**83.17**	-

*NW–No Water * NC- Not collected

Table 8 b. Potassium, Calcium, Magnesium and Carbonate content of the piezo well samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	Potassium (mg L^{-1})			Calcium (mg L^{-1})			Magnesium (mg L^{-1})			Carbonate (mg L^{-1})		
			Sep.,2023 &Dec.,2023	March.,2024 &June.,2024	Mean	Sep., 2023 &Dec.,2023	March.,2024& June.,2024	Mean	Sep., 2023 &Dec.,2023	March.,2024 &June., 2024	Mean	Sep.,2023 &Dec.,2023	March.,2024& June., 2024	Mean
1	426/1B	Near to Raw water Tank	NC	NW	-	NC	NW	-	NC	NW	-	NC	NW	-
2	415/3A	Opposite to Lorry Yard	3.35	NW	3.15	90.65	NW	89.65	41.65	NW	39.65	27.35	NW	26.35
3	418	Old time office	NC	NW	-	NC	NW	-	NC	NW	-	NC	NW	-
4	426/1D	Cogeneration Plant	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
5	923/2A	ETP	4.35	NW	3.94	123.35	NW	117.04	66.82	NW	67.65	43.69	NW	39.81
6	925/1	Hostel	7.61	7.89	5.205	107.38	102	104.69	52.27	51.24	47.985	52.19	49.35	42.795
7	922/2	LSTC-Vagaimara thoppu	NC	3.65	3.7	NC	58.10	59.72	NC	18.5	17	NC	19.60	18.2
8	938/1	SLF- 1	3.98	NW	3.68	97.98	NW	94.98	43.64	NW	41.64	31.29	NW	28.29
9	938/2	SLF- 2	NW	3.22	3.55	NW	93.15	92.58	NW	41.25	39.14	NW	28.95	27.11
10	938/2	SLF- 3	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
11	939/1A1	Bamboo garden	1.95	1.86	1.805	99.97	95.56	97.66	40.85	38.28	39.35	24.21	23.65	21.905
12	939/1A2	Coconut garden	1.95	NC	1.85	96.26	NC	95.26	37.28	NC	36.28	123.75	NC	122.75
13	932	Coconut garden	7.4	6.9	5.65	166.4	160	164.7	85.1	82.26	84.15	116.29	112.21	115.895
14	943	Coconut garden	7.59	NC	7.29	81.82	NC	80.82	53.83	NC	54.83	34.16	NC	33.16
15	932	Coconut garden	7.24	NW	6.24	165.5	NW	164.5	85.9	NW	84.9	56.62	NW	55.62
16	877/2B	Hospital medu	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
17	879/2	Hospital medu	NW	NC	-	NW	NC	-	NW	NC	-	NW	NC	-
18	141/2A	KVK	3.58	3.56	3.425	31.8	32.5	33.1	17.8	16.5	16.6	42	39.65	39.25
19	884/2	Kandi thottam	6.29	5.25	5.095	145.08	143	142.04	66.86	64.5	63.98	39.92	38.26	37.66
20	891/2B1	Kandi thottam	NC	NC	-	NC	NC	-	NC	NC	-	NC	NC	-
21	891/2B1	Kandi thottam	5.59	NC	4.59	39.91	NC	38.91	17.42	NC	16.42	30.34	NC	29.34
22	850	Coconut Field	2.64	NC	2.39	123.42	NC	124.25	47.53	NC	51.24	31.74	NC	35.51
23	779	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
24	778/2C	Coconut Field	NC	NC	-	NC	NC	-	NC	NC	-	NC	NC	-
25	962	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-	NW	NW	-
		Mean	**5.32**	**1.21**	-	**51.32**	**125**	-	**54.00**	**32.6**	-	**87.81**	**45.9**	-

*NW–No Water * NC- Not collected

Table 8 c. Bicarbonate, Sulphate and Chloride content of the piezo well samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	Bicarbonate (mg L^{-1})			Sulphate (mg L^{-1})			Chloride (mg L^{-1})		
			Sep.,2023& Dec.,2023	March.,2024& June., 2024	Mean	Sep., 2023 & Dec., 2023	March., 2024 &June., 2024	Mean	Sep., 2023 & Dec., 2023	March., 2024 & June., 2024	Mean
1	426/1B	Near to Raw water Tank	NC	NW	-	NC	NW	-	NC	NW	-
2	415/3A	Opposite to Lorry Yard	288.46	NW	287.46	59.87	NW	58.87	211.23	NW	210.23
3	418	Old time office	NC	NW	-	NC	NW	-	NC	NW	-
4	426/1D	Cogeneration Plant	NW	NW	-	NW	NW	-	NW	NW	-
5	923/2A	ETP	186.50	NW	181.06	147.25	NW	148.27	186.0	NW	181.26
6	925/1	Hostel	172.34	168.32	166.42	137.29	135.54	133.695	124.04	123.5	125.27
7	922/2	LSTC- Vagaimara thoppu	NC	157.42	151.8	NC	38.21	36.5	NC	66.51	63.6
8	938/1	SLF- 1	274.16	NW	272.16	62.34	NW	59.34	219.12	NW	215.12
9	938/2	SLF- 2	NW	271.22	274.15	NW	55.56	54.18	NW	201.23	205.34
10	938/2	SLF- 3	NW	NW	-	NW	NW	-	NW	NW	-
11	939/1A1	Bamboo garden	315.25	310.10	314.225	125.23	126.21	122.165	268.89	260.62	265.13
12	939/1A2	Coconut garden	316.34	NC	315.34	124.45	NC	123.45	270.91	NC	269.91
13	932	Coconut garden	224.48	221.26	221.39	67.1	65.56	64.9	127.7	126.35	124.05
14	943	Coconut garden	257.70	NC	256.7	94.14	NC	93.14	143.72	NC	142.72
15	932	Coconut garden	240.14	NW	239.14	66.4	NW	65.4	118.6	NW	117.6
16	877/2B	Hospital medu	NW	NW	-	NW	NW	-	NW	NW	-
17	879/2	Hospital medu	NW	NC	-	NW	NC	-	NW	NC	-
18	141/2A	KVK	249.35	245.49	245.225	34.7	33.36	33.25	64.5	65.52	64
19	884/2	Kandi thottam	202.29	206.62	201.71	24.69	27.94	23.595	309.94	289.63	200.17
20	891/2B1	Kandi thottam	NC	NC	-	NC	NC	-	NC	NC	-
21	891/2B1	Kandi thottam	136.16	NC	135.16	124.7	NC	123.7	117.2	NC	116.2
22	850	Coconut Field	249.51	NC	248.25	158.35	NC	154.56	313.08	NC	312.43
23	779	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-
24	778/2C	Coconut Field	NC	NC	-	NC	NC	-	NC	NC	-
25	962	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-
		Mean	**104.91**	**237.69**	**224.17**	-	**92.75**	**66.70**	-	**181.12**	**148.16**

*NW–No Water * NC- Not collected

Table 8 d. SAR, Calcium, RSC and SSP content of the piezo well samples collected from the bench mark sites for continuous monitoring of groundwater quality

Sample No	SF	Sample ID	SAR			RSC			SSP		
			Sep., 2023 & Dec.,2023	March.,2024 &June., 2024	Mean	Sep., 2023 & Dec., 2023	March., 2024 &June., 2024	Mean	Sep., 2023 & Dec., 2023	March., 2024 & June., 2024	Mean
1	426/1B	Near to Raw water Tank	NC	-	-	NC	-	-	NC	-	-
2	415/3A	Opposite to Lorry Yard	2.98	-	**1.57**	-8.79	-	**-2.2**	27.28	-	**-2.2**
3	418	Old time office	NC	-	-	NC	-	-	NC	-	-
4	426/1D	Cogeneration Plant	NW	-	-	NW	-	-	NW	-	-
5	923/2A	ETP	1.44	-	**0.96**	-12.60	-	**-7.19**	16.98	-	**-7.19**
6	925/1	Hostel	1.34	1.45	**1.41**	-10.57	-8.25	**-5.08**	15.45	11.36	**-4.96**
7	922/2	LSTC- Vagaimara thoppu	NC	1.81	**1.9**	NC	-1.25	**-1.31**	NC	10.58	-
8	938/1	SLF- 1	2.58	-	**1.65**	-8.72	-	**-2.81**	27.33	-	**-2.81**
9	938/2	SLF- 2	NW	1.52	**1.57**	NW	-2.30	**-2.49**	NW	13.68	-
10	938/2	SLF- 3	NW	-	-	NW	-	-	NW	-	-
11	939/1A1	Bamboo garden	2.76	2.35	**2.20**	-8.68	-7.56	**-2.285**	37.86	38.94	**19.21**
12	939/1A2	Coconut garden	2.84	-	**2.16**	-7.89	-	**1.47**	36.95	-	**1.47**
13	932	Coconut garden	1.83	1.10	**0.65**	-16.28	-12.24	**-7.755**	10.53	11.53	**2.34**
14	943	Coconut garden	2.80	-	-	-8.81	-	-	26.33	-	-
15	932	Coconut garden	0.73	-	**0.75**	-14.30	-	**-9.53**	11.67	-	**-9.53**
16	877/2B	Hospital medu	NW	-	-	NW	-	-	NW	-	-
17	879/2	Hospital medu	NW	-	-	NW	-	-	NW	-	-
18	141/2A	KVK	3.86	2.23	**2.12**	-3.24	-2.81	**2.29**	42.64	39.62	**2.4**
19	884/2	Kandi thottam	1.90	1.85	**0.81**	-13.69	-11.27	**-7.875**	12.24	11.95	**-8.1**
20	891/2B1	Kandi thottam	NC	-	-	NC	-	-	NC	-	-
21	891/2B1	Kandi thottam	1.95	-	**1.52**	-3.51	-	**-0.12**	23.42	-	**-0.12**
22	850	Coconut Field	2.83	-	**1.94**	-10.28	-	**-5.23**	32.25	-	**-5.23**
23	779	Eucalyptus field	NW	-	-	NW	-	-	NW	-	-
24	778/2C	Coconut Field	NC	-	-	NC	-	-	NC	-	-
25	962	Eucalyptus field	NW	-	-	NW	-	-	NW	-	-
		Mean	**1.50**	**1.49**	-	**-3.87**	**-3.49**	-	**-3.87**	**26.63**	-

*NW–No Water * NC- Not collected

Table 8 e. Ni, As and Cd content of the piezo well samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	Ni (ppm)			As (ppm)			Cd (ppm)		
			Sep., 2023 & Dec.,2023	March.,2024 &June., 2024	Mean	Sep., 2023 & Dec., 2023	March., 2024 &June., 2024	Mean	Sep., 2023 & Dec., 2023	March.,2024 & June., 2024	Mean
1	426/1B	Near to Raw water Tank	NC	NW	-	NC	NW	-	NC	NW	-
2	415/3A	Opposite to Lorry Yard	BDL	NW	-	BDL	NW	-	BDL	NW	-
3	418	Old time office	NC	NW	-	NC	NW	-	NC	NW	-
4	426/1D	Cogeneration Plant	NW	NW	-	NW	NW	-	NW	NW	-
5	923/2A	ETP	BDL	NW	-	BDL	NW	-	BDL	NW	-
6	925/1	Hostel	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
7	922/2	LSTC- Vagaimara thoppu	NC	BDL	-	NC	BDL	-	NC	BDL	-
8	938/1	SLF- 1	BDL	NW	-	BDL	NW	-	BDL	NW	-
9	938/2	SLF- 2	NW	BDL	-	NW	BDL	-	NW	BDL	-
10	938/2	SLF- 3	NW	NW	-	NW	NW	-	NW	NW	-
11	939/1A1	Bamboo garden	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
12	939/1A2	Coconut garden	BDL	NC	-	BDL	NC	-	BDL	NC	-
13	932	Coconut garden	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
14	943	Coconut garden	BDL	NC	-	BDL	NC	-	BDL	NC	-
15	932	Coconut garden	BDL	NW	-	BDL	NW	-	BDL	NW	-
16	877/2B	Hospital medu	NW	NW	-	NW	NW	-	NW	NW	-
17	879/2	Hospital medu	NW	NC	-	NW	NC	-	NW	NC	-
18	141/2A	KVK	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
19s	884/2	Kandi thottam	BDL	BDL	-	BDL	BDL	-	BDL	BDL	-
20	891/2B1	Kandi thottam	NC	NC	-	NC	NC	-	NC	NC	-
21	891/2B1	Kandi thottam	BDL	NC	-	BDL	NC	-	BDL	NC	-
22	850	Coconut Field	BDL	NC	-	BDL	NC	-	BDL	NC	-
23	779	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-
24	778/2C	Coconut Field	NC	NC	-	NC	NC	-	NC	NC	-
25	962	Eucalyptus field	NW	NW	-	NW	NW	-	NW	NW	-
		Mean	-	-	-	-	-	-	-	-	-

*NW–No Water *BDL – Below Detectable Limit

Table 8 f. Pb and Cr content of the piezo well samples collected from the bench mark sites for continuous monitoring of ground water quality

Sample No	SF	Sample ID	Pb (ppm)			Cr (ppm)		
			Sep., 2023 & Dec.,2023	March.,2024 & June., 2024	Mean	Sep., 2023 & Dec., 2023	March., 2024 & June., 2024	Mean
1	426/1B	Near to Raw water Tank	NC	NW	-	NC	NW	-
2	415/3A	Opposite to Lorry Yard	0.13	NW	0.03	BDL	NW	-
3	418	Old time office	NC	NW	-	NC	NW	-
4	426/1D	Cogeneration Plant	NW	NW	-	NW	NW	-
5	923/2A	ETP	0.27	NW	0.09	BDL	NW	-
6	925/1	Hostel	0.24	0.22	0.17	BDL	BDL	-
7	922/2	LSTC- Vagaimara thoppu	NC	0.51	0.55	NC	BDL	-
8	938/1	SLF- 1	0.33	NW	0.23	BDL	NW	-
9	938/2	SLF- 2	NW	0.08	0.03	NW	BDL	-
10	938/2	SLF- 3	NW	NW	-	NW	NW	-
11	939/1A1	Bamboo garden	0.19	0.12	0.095	BDL	BDL	-
12	939/1A2	Coconut garden	0.23	NC	0.13	BDL	NC	-
13	932	Coconut garden	0.36	0.31	0.27	BDL	BDL	-
14	943	Coconut garden	0.41	NC	0.31	BDL	NC	-
15	932	Coconut garden	0.35	NW	0.25	BDL	NW	-
16	877/2B	Hospital medu	NW	NW	-	NW	NW	-
17	879/2	Hospital medu	NW	NC	-	NW	NC	-
18	141/2A	KVK	0.26	BDL	0.16	BDL	BDL	-
19	884/2	Kandi thottam	0.21	0.11	0.1	BDL	BDL	-
20	891/2B1	Kandi thottam	NC	NC	-	NC	NC	-
21	891/2B1	Kandi thottam	0.38	NC	0.08	BDL	NC	-
22	850	Coconut Field	0.37	NC	0.12	BDL	NC	-
23	779	Eucalyptus field	NW	NW	-	NW	NW	-
24	778/2C	Coconut Field	NC	NC	-	NC	NC	-
25	962	Eucalyptus field	NW	NW	-	NW	NW	-
		Mean	**0.15**	**0.21**	-	-	-	-

*NW–No Water *BDL – Below Detectable Limit

Ground water quality

The pH of the ground water samples ranged from 7.05 to 8.51 in September, 2023, 7.17 to 8.50 in December, 2023 and whereas pH was ranged from 7.14 to 8.42 during March, 2024 and from 7.12 to 8.47 during June, 2024.The EC of the samples were ranged from 0.16 to 2.82 dSm^{-1} in September, 2023, 0.16 to 2.93 dSm^{-1}, 0.85 to 2.44 dSm^{-1} and from 0.83 to 2.37 dSm^{-1} during December, 2023, March 2024 and June 2024, respectively. Based on the above results of September 2023, December, 2023, March, 2024, and June, 2024, chance for alkalinity hazard (SAR < 5) is less. All the water samples were found to have low Soluble Sodium Percentage (<60%). Variations in ground water EC may be caused by the monsoon failure and drought conditions prevailed in these region. On analyzing the heavy metal contentsof the water samples, heavy metals such as Ni, As, Cd and Cr were below detectable limits, while the lead (Pb) content ranged from 0.23 to 1.29 ppm in September, 2023, 0.15 to 1.31 ppm, 0.04 to 1.01 ppm and from 0.06 to 0.95 ppm during December, 2023, March 2024 and June 2024, respectively. Apart from the bench mark sites, samples were also collected from piezo meters and piezo well. All quality parameters of the piezo meters and piezo well water samples were under the permissible limit.

Soil quality

The pH of the soil samples ranged between 6.64 to 8.33 in September,2023, 6.80 to 8.23 in December, 2023, 7.51 to 7.95 in March, 2024 and 7.42 to 8.01 in June, 2024 samples. The EC of the soil samples ranged from 0.50 to 1.71 dSm^{-1} in September, 2023, 0.26 to 1.54 dSm^{-1} in December, 2023, 0.23 to 1.56 dSm^{-1} in March, 2024 and 0.25 to 1.41 dSm^{-1} in June, 2024. The organic content of the soil ranged from low to medium status. Most of the soil samples have very low organic carbon content (<0.5). The available nitrogen content of the samples found to be very low (<280 kg ha^{-1}). The potassium status of the most of the soil samples found to be medium range (< 280 kg ha^{-1}). On analyzing the heavy metal contents of the soil samples, heavy metals such as Ni, As, Cd and Cr were below detectable limits, while the lead (Pb) content ranged from 0.15 to 1.45 ppm in September, 2023, 0.16 to 1.42 ppm, 0.28 to 1.25 ppm and from 0.25 to 1.38 ppm during December, 2023, March 2024 and June 2024, respectively

In order to evaluate the different methods of irrigation (drip and flood irrigation) using treated effluent and well water on crop production and soil fertility, a field experiment was initiated with Fodder Maize test crop. The details of the experiment are given below.

Activity III: Field Experiment : " To evaluate the impact of ITC Kovai paper board mill treated effluent along with sludge on soil health and crop productivity"

As a crop rotation a field experiment was initiated with Fodder Maize as test crop, in order to evaluate the different methods of irrigation (drip and flood irrigation) using treated effluent and borewell water along with the application of ETP secondary clarifier sludge and ETP sludge vermicompost on crop production and soil fertility through organic matter build up in the soil. The details of the experiment are given below.

EXPERIMENTAL DETAILS

1	Crop	:	Fodder Maize
2	Spacing	:	30x15 cm
3	Date of sowing	:	19.01.2024
4	Design	:	Split-split plot design
5	Factors	:	3
6	Treatments	:	8
7	Replications	:	4
8	No. of plots	:	32
9	Area	:	0.2 acres
10	Plot size	:	4x4 m
11	Location	:	ITC PSPD field

Treatments comprised of three main factors with two levels in each factor viz.,

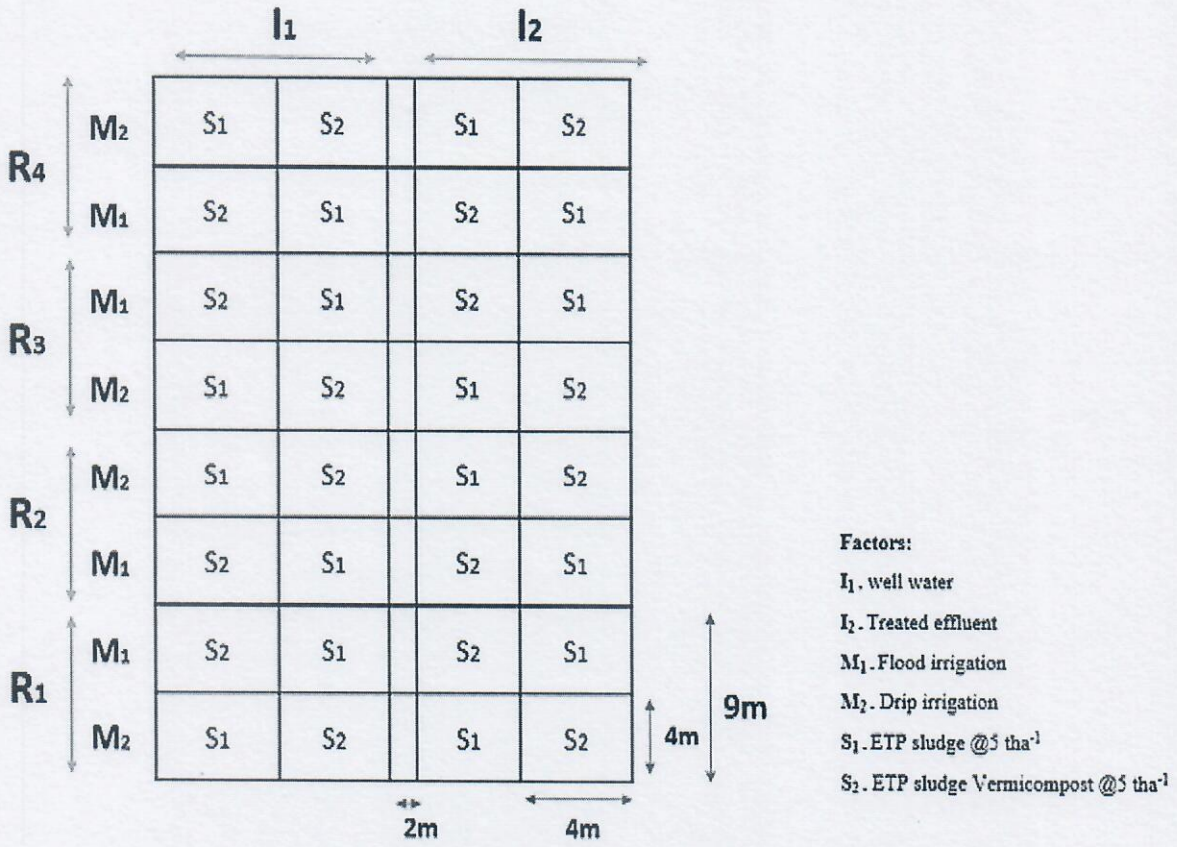
Treatments		
Factor 1	:	**Source of irrigation**
I_1	:	Bore well water
I_2	:	Treated paper board mill treated effluent
Factor 2		**Method of irrigation**
M_1	:	Drip irrigation
M_2	:	Flood irrigation
Factor 3	:	**Sludge Application**
S_1	:	ETP sludge compost @5 tha^{-1}
S_2	:	Phosphorous enriched ETP sludge compost @5 tha^{-1}

Treatment combinations		
T_1	$I_1M_1S_1$	Soil application of ETP sludge @5 tha^{-1} along with well water through flood irrigation
T_2	$I_1M_1S_2$	Soil application of ETP sludge vermicompost @5 tha^{-1} along with well water through flood irrigation
T_3	$I_1M_2S_1$	Soil application of ETP sludge @5 tha^{-1} along with well water through drip irrigation
T_4	$I_1M_2S_2$	Soil application of ETP sludge vermicompost @5 tha^{-1} along with well water through drip irrigation
T_5	$I_2M_1S_1$	Soil application of ETP sludge @5 tha^{-1} along with treated effluent through flood irrigation
T_6	$I_2M_1S_2$	Soil application of ETP sludge vermicompost @5 tha^{-1} along with treated effluent through flood irrigation
T_7	$I_2M_2S_1$	Soil application of ETP sludge @5 tha^{-1} along with treated effluent through drip irrigation
T_8	$I_2M_2S_2$	Soil application of ETP sludge vermicompost @5 tha^{-1} along with treated effluent through drip irrigation

Field layout:

The field layout was prepared by the statistical split plot design with 3 main factors, (source of irrigation, method of irrigation and ETP sludge compost application) and 4 replications. The ploughed field were split into 2 main plots, i.e., Bore well water irrigation and treated effluent irrigation plots which is further divided into many subplots. Totally 32 subplots were laid. The distance between the two main plots and the sub plots are 2m and the distance between the sub-sub plots is 1m.

Fig.1. Experimental field layout



Characterization of soil

Soil samples were collected from the experimental field before sowing of the seeds. The collected soil samples were analyzed for its chemical properties and results are presented in the table 9.

Table 9. Characteristics of soil samples collected from the experimental field

Parameters	Unit	Initial Soil Sample	Irrigation water Samples					
			Treated Effluent			Well Water		
			Drip Irrigation	Flood Irrigation	Mean	Drip Irrigation	Flood Irrigation	Mean
pH	-	7.18	7.28	7.58	**7.43**	7.84	7.48	**7.66**
EC	dSm^{-1}	1.02	0.95	0.95	**0.95**	0.92	0.95	**0.94**
OC	Per cent	0.85	1.01	1.04	**1.03**	0.85	0.84	**0.85**
Available N	kg ha^{-1}	195.87	201.5	215	**208.25**	182	191	**186.5**
Available P	kg ha^{-1}	22.25	22.01	25.21	**23.61**	20.15	21.75	**20.95**
Available K	kg ha^{-1}	318.48	378	395	**386.5**	374	382	**378**
Exchangeable Ca	cmol (p^+) kg^{-1}	0.22	0.55	0.51	**0.53**	0.55	0.65	**0.6**
Exchangeable Mg	cmol (p^+) kg^{-1}	0.35	0.21	0.29	**0.25**	0.31	0.45	**0.38**
Exchangeable Na	cmol (p^+) kg^{-1}	1.18	0.81	1.25	**1.03**	0.86	1.19	**1.03**
Exchangeable K	cmol (p^+) kg^{-1}	0.85	0.74	0.81	**0.78**	0.85	0.95	**0.9**

Table 10. Initial characteristics of the paperboard mill ETP sludge compost:

S.No.	Parameters	Units	ETP sludge compost	'P' enriched ETP sludge compost
1	pH	-	7.04	5.55
2	EC	dsm^{-1}	2.65	3.65
3	Organic carbon	Per cent	3.11	3.94
4	Total nitrogen	Per cent	1.05	1.08
5	Total phosphorus	Per cent	0.45	1.42
6	Total potassium	Per cent	0.70	0.75
7	C:N ratio	-	2.9 :1	3.6 :1

The ETP sludge compost and 'P' enriched ETP sludge compost recorded pH of 7.04 and 5.55 respectively with an EC of 2.65 and 3.65 dSm^{-1}, respectively. The organic carbon content of ETP sludge compost and 'P' enriched ETP sludge compost were 3.11 and 3.94 percent, respectively. The nutrient content of the ETP sludge compost recorded the values of 1.05, 0.45 and 0.70 per cent of N, P and K ant the Phosphorus enriched compost with nutrient content of 1.08, 1.42 and 0.75 per cent.

Field preparation

The selected field was ploughed initially to pulverize the soil. The field layout was prepared by the statistical split-split plot design with 3 main factors (source of irrigation, method of irrigation and ETP sludge application) and 4 replications. The ploughed field were split into 2 main plots i.e., well water irrigation and treated effluent irrigation plots which is further divided into many subplots. Totally 32 subplots were laid. The distance between the two main plots and the sub plots are 2m and the distance between the sub-sub plots is 1m.

Sowing

The beds were prepared in the plots with 4x4 meter size. Seeds were directly sown by dipping at the rate of 40kg/ha at the depth of 3 cm with the spacing of 30x15 cm in the main field at ITC Ltd, PSPD, Unit – Kovai at Thekkampatty.

Fertilizer application for Fodder Maize

The recommended dose of fertilizers for Fodder Maize 30:40:20 (kg/ha) kg NPK per hectare (as per the package of practices mentioned in Crop Production Guide, 2012). Top dressing with 30kg/ha of N applied 25 DAS. Raw ETP sludge and composted sludge were applied to the plots as amendment. Hand weeding was done 2 times during the crop growth.

Biometric Observations

Five seedlings per plot were selected at random for taking the biometric observations. The plant height of the seedlings 30 and 45 days after transplanting was taken.

Effect of treated effluent on of Fodder Maize growth

Effect of treated effluent on growth attributes of Fodder Maize under flood and drip irrigations were studied and the results are shown in Table 11.

Table 11. Effect of ETP sludge and treated effluent irrigation on growth of Fodder Maize

Treatment Details	Plant Height (cm) at 30 DAS	Plant Height (cm) at 45 DAS	Plant Height (cm) at 60 DAS
T_1 - $I_1M_1S_1$	41.5	108.5	159.7
T_2 - $I_1M_1S_2$	47.4	116.7	165.5
T_3 - $I_1M_2S_1$	48.6	118.2	167.1
T_4 - $I_1M_2S_2$	45.2	112.5	163.4
T_5 - $I_2M_1S_1$	52.6	129.4	174.2
T_6 - $I_2M_1S_2$	43.1	110.2	161.3
T_7 - $I_2M_2S_1$	50.7	121.9	170.5
T_8 -$I_2M_2S_2$	58.4	132.5	181.3
Mean	48.44	118.74	167.88

Plant height had significant difference between the treatments. The plant height in the treatments followed the order of T_8> T_5>T_7>T_3>T_2, T_4> T_6>T_1. It was observed higher in T8 (Soil application of ETP sludge vermicompost @ 5 tha^{-1} along with treated effluent through drip irrigation) compared to the control.

Yield :

Table 14. Fodder Maize Yield (Kg/ha^{-1})

Treatments	R_1	R_2	R_3	R_4	Mean
T_1: $I_1M_1S_1$	18302	18326	18348	18351	**18332**
T_2: $I_1M_1S_2$	18945	18998	18910	18968	**18955**
T_3: $I_1M_2S_1$	18254	18311	18298	18254	**18279**
T_4: $I_1M_2S_2$	19112	19184	19207	19165	**19167**
T_5: $I_2M_1S_1$	18412	18576	18445	18426	**18465**
T_6: $I_2M_1S_2$	18504	18612	18565	18574	**18564**
T_7: $I_2M_2S_1$	18401	18419	18447	18425	**18423**
T_8: $I_2M_2S_2$	19412	19415	19395	19402	**19406**

Field trial experiment to assess the impact of treated paper mill effluent on Fodder Maize crop was completed. It was found that T_8 (Soil application of ETP sludge vermicompost @ 5tha^{-1} along with treated effluent through drip irrigation) shows higher green fodder yield of 19406 Kg/ha^{-1}as compare to other treatment.

Plate 1 - Field View of Fodder Maize at ITC Ltd., PSPD Unit - Kovai



Sowing of Fodder Maize



Fodder Maize @ 10 DAS



Top Dressing @ 25 DAS



Fodder Maize @ 30 DAS



Fodder Maize @ 60 DAS

Conclusion:

For monitoring the quality of treated ITC paperboard effluent used for irrigation, ground water and soil samples were withdrawn at three months interval from the benchmark sites in and around the premises of ITC factory during July, 2023 to June, 2024 and analyzed for its qualities.

- From the analyses, it is concluded that, the treated ITC paperboard effluent is suitable for the irrigation since the vital quality parameters such as pH, EC, BOD, TDS and heavy metals are within the prescribed limits of the Central Pollution Control Board norms.
- In order to assess the long-term impact of effluent irrigation on ground water quality, 30 bench mark sites were selected in around factory premises, ground water samples were withdrawn at periodical intervals and analyzed. The water level of the Piezo meter and piezo well sampling sites are ranges between 4 to 7 meters. All the groundwater quality parameters are within the permissible limits. The average SAR value was found to be less than 5. It indicates that the ground water quality was not deteriorated due to use of treated effluent irrigation.
- Based on the analytical results of collected soil samples, it is revealed that the soil quality was not deteriorated in all the benchmark sites.
- Field experiment with Fodder Maize as test crop for crop rotation was initiated and it has been observed that the application of sludge ETP sludge vermicompost @ 5t ha^{-1} along with treated effluent through drip irrigation recorded significantly better growth and yield compared to other treatments.

However, continuous monitoring is essential to assess the long-term effect of treated paper board mill treated effluent irrigation on soil health and crop productivity.

25/10/24

Signature of Co-PI

25/10/24

Signature of PI / Professor and Head

Department of Environmental Sciences

ANNEXURE R12

LiFE Lifestyle for Environment

TAMIL NADU POLLUTION CONTROL BOARD

From	To
Dr.K.Ravichandran, M.Tech,P.hD., Joint Chief Environmental Engineer (M) TamilNadu Pollution Control Board 4th Floor, 34, Bharathi Park 8th cross, Saibaba Colony, Coimbatore - 11.	Dr.P.Dhevagi, Ph.D., The Professor and Head Department of Environmental Sciences, Tamilnadu Agricultural University, Lawley Rd, P N Pudur, Coimbatore.

Lr. No. JCEE (M)/TNPCB/CBE/F.200/Tech/2025, Dated: 10 .02.2025.

Sir,

Sub		TNPC Board – O/o JCEE(M), Coimbatore Zone – to conduct soil and ground water sample analysis in the Agri land of Thiru. E. Ashok Raj Kumar – requested – regarding.
Ref		1. The unit of M/s. ITC Limited, Paper Boards and Speciality Boards Divn, Unit Kovai, letter dated: 04.07.2024 addressed to the TNAU, Coimbatore. 2. Complaint received from Thiru.E.Ashok Raj Kumar, S/o Easwara Gowder, Thekkampatti Post, Seeliyur(via), Mettupalayam Taluk, Coimbatore District – 113, dated: 30.09.2024. 3. Inspection of the unit by the TNPCB officials on 09.01.2025

****

I am to invite your kind attention to the references cited and It was ascertained that the TNAU was given a project to carryout study on the impact of continuous application of treated effluent of M/s. ITC Limited, Paper Boards and Speciality Boards Divn, Unit Kovai, S.F.No. 241/1, etc., Thekkampatty Village, Mettupalayam Taluk, Coimbatore District in their own agricultural land and suggest suitable remedial measures including preparation of comprehensive Irrigation Management Plan.

In this connection, it is informed that a complaint has been received from Thiru. Ashok Raj Kumar against the unit of M/s. ITC Limited, Paper Boards and Speciality Boards Divn, Unit Kovai alleging that the unit's operation are causing damage to the

quality of water and soil of the agri land bearing S.F. No. 407/2A1, Thekkampatti Village, Mettupalayam Taluk, Coimbatore District. The said land is located adjacent to the industries compound wall.

In this regard, it is requested to include the said land in your scope of study and collect water and soil samples from that field also. Assistance for collection of sample and field visit will be provided by the O/o DEE, Coimbatore North.

The action taken on the above shall be intimated to this office early. The receipt of this letter may kindly be acknowledged.

Joint Chief Environmental Engineer (M),
Tamil Nadu Pollution Control Board
Coimbatore Zone

Copy to

1. Thiru.E.Ashok Raj Kumar, Door No.5/92, Thekkampatti Post, Seeliyur (via), Mettupalayam Taluk, Coimbatore District – for information.
2. The Occupier, M/s. ITC Ltd., Paper Boards and Speciality Boards Divn, Unit Kovai – for further follow up
3. DEE, TNPCB, Coimbatore North – for further followup action.

ANNEXURE R13

TAMIL NADU AGRICULTURAL UNIVERSITY
DEPARTMENT OF ENVIRONMENTAL SCIENCES
Directorate of Natural Resource Management

Dr. P. Dhevagi, Ph.D.,
Professor and Head (Environmental Sciences)

Coimbatore - 641 003
Tamil Nadu, India

Date: 18.03.2025

To
Dr. K. Ravichandran, M.Tech, Ph.D.,
Joint Chief Environmental Engineer (M)
Tamil Nadu Pollution Control Board
4th Floor, 34, Bharathi Park, 8 th Cross,
Saibaba colony, Coimbatore -11

No. P&H/ENS/Thiru Ashok Raj Kumar/Sample Collection/Soil and water analytical report/ 2025/17.3.2025

Sub: ENS – NLC – Thiru Ashok Raj Kumar/Sample Collection/Soil and water analytical report – Sending – Reg.

Ref: Lr. No. JCEE (m)/ TNPCB/CBE/F.200/Tech/2025 dt. 10.2.2025 From Office of the Joint Chief Environmental Engineer, TNPCB, Coimbatore -11

Sir,

Greetings,

With reference to the above, I am to inform that a field visit was made by the Scientist of Environmental Sciences, TNAU, Coimbatore on 12.2.2025 to the farmers field (Th. Ashok Raj Kumar) located near by the ITC, Thekkampatty. Soil samples from the field bearing S.F. No. 241/1 and water sample from the stream near by the land which is being used for irrigation were taken and analysed for the quality parameters and the results are annexed for your reference. In addition, the above said field, water sample will be also included as one of the bench mark sites for periodical monitoring of quality parameters which is being carried out in the ongoing ITC Scheme functioning in the Department of Environmental Sciences. This is for information and further action.

18/3/25

Professor and Head
(Dept. of Env. Sciences)

o/c

Tel: +91 422 6611 252/452 Mobile: + 91 98435 30349 Email: environment@tnau.ac.in

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Table 1. Physico-chemical characteristics of soil collected from the farmer Ashok Rajkumar (SF No. 241/1, Latitute – 11.248611 Longitude – 76.8802246)

S.No.	Parameters	Values
1.	pH	7.8
2.	EC(dSm^{-1})	0.10
3.	Organic carbon (%)	0.16
4.	Available Nitrogen (kg/ha)	360
5.	Available Phosphorus (kg/ha)	08
6.	Available Potassium (kg/ha)	224
7.	Exchangeable Sodium (Cmol kg^{-1})	0.02
8.	Exchangeable Calcium (Cmol kg^{-1})	5.8
9.	Exchangeable Magnesium (Cmol kg^{-1})	3.8
10.	Available Iron (mg/l)	1.72
11.	Available Copper (mg/l)	21.1
12.	Available Manganese (mg/l)	174.8
13.	Total Zinc (mg/l)	*BDL
14.	Total Nickel (mg/l)	*BDL
15.	Total Arsenic (mg/l)	*BDL
16.	Total Cadmium (mg/l)	*BDL
17.	Total Lead (mg/l)	*BDL
18.	Total Chromium (mg/l)	*BDL
19.	Total Mercury (mg/l)	*BDL

*BDL – Below Detectable Limit

The soil analysis reveals several key characteristics influencing its fertility and environmental impacts. The soil sample had a pH of 7.8, the soil is slightly alkaline with a low electrical conductivity (0.10 dS/m) indicating low salinity, beneficial for most crops. However, the organic carbon content is relatively low at 0.16%, suggesting that incorporation of organic amendments is necessary to enhance soil health and productivity. The available nitrogen is high at 360 kg/ha, beneficial for growth. Phosphorus is low at 8 kg/ha, which may limit plant growth unless supplemented, while potassium is moderate at 224 kg/ha, providing a good balance. Exchangeable sodium is very low, posing no sodicity risk, while calcium and magnesium levels are substantial, contributing to fertility and structure. Available iron is low, and copper is high, which could be beneficial. All heavy metals are below detection limits, indicating no significant environmental or health risks. Overall, the soil has nutrient imbalances but no heavy metal hazards, suggesting management strategies like organic matter addition, and nutrient balancing to optimize fertility and plant growth.

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Table 2. Physico-chemical characteristics of stream water

S.No.	Parameters	Values
1.	pH	7.67
2.	EC(dSm^{-1})	1.20
3.	TDS	768
4.	Sodium (mg/l)	120
5.	Potassium (mg/l)	5.8
6.	Calcium (mg/l)	148
7.	Magnesium (mg/l)	76
8.	Carbonate (mg/l)	Nil
9.	Bicarbonate (mg/l)	428
10.	Sulphate (mg/l)	40
11.	Chloride (mg/l)	96
12.	Total Nickel (mg/l)	*BDL
13.	Total Arsenic (mg/l)	*BDL
14.	Total Cadmium (mg/l)	*BDL
15.	Total lead (mg/l)	*BDL
16.	Total Chromium (mg/l)	*BDL

*BDL – Below Detectable Limit

The water sample was collected from stream near farmer's field (Latitute – 11.246122, Longitude – 76.880942) which is being used for irrigation. The water samples were analyzed for its physico – chemical characteristics (Table 2). The pH level of 7.67 falls within the acceptable range of 6.5–8.5, aligning with WHO and BIS standards, which indicates no significant risks related to corrosivity or alkalinity.

Sample also had a total dissolved solids (TDS) of 768 mg/L with low sodium, sulfate, and chloride levels are which are found to be safe limits. All tested heavy metals (arsenic, cadmium, lead, chromium, and nickel) were also found to be below detection limits, eliminating associated health risks. Overall, all the parameters tested were found to be within the limit indicating suitability of water for irrigation.

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ANNEXURE R14

LiFE
Lifestyle for Environment

தமிழ்நாடு மாசு கட்டுப்பாடு வாரியம்

அனுப்புநர்
திருமதி. செ. வனஜா, எம்.இ.,
மாவட்ட சுற்றுச்சூழல் பொறியாளர்,
தமிழ்நாடு மாசு கட்டுப்பாடு வாரியம்,
கோவை வடக்கு அலுவலகம்,
எண்.5, ராமசாமி நகர்,
கவுண்டம்பாளையம்,
கோயம்புத்தூர் – 641 030.

பெறுநர்
M/s. ITC Limited,
விவேகானந்தாபுரம் அஞ்சல்,
தேக்கம்பட்டி கிராமம்,
கோயம்புத்தூர்–641113.

க.எண்.090186879/மாசுகூபொ/தமாகவா/கோவை(வ)/உபொ/2024, நாள்:18.12.2024

அய்யா,

பொருள் : தமிழ்நாடு மாசு கட்டுப்பாடு வாரியம், கோவை வடக்கு அலுவலகம் – கோவை மாவட்டம், மேட்டுப்பாளையம் தாலூக்கா, தேக்கம்பட்டி கிராமம், விவேகானந்தாபுரம் அஞ்சல் பகுதியில் தி/ள். ஐடிசி லிமிடெட், பேப்பர் போர்டு & ஸ்பெஷாலிட்டி பேப்பர் டிவிஷன்ஸ் என்ற நிறுவனத்தின் இயக்கத்தால் அப்பகுதியில் காற்று மாசு ஏற்படுவதாகவும், குடிநீர் மாசுப்படுவதாகவும் குறித்து பெறப்பட்ட புகார் மீது எடுக்கப்பட்ட நடவடிக்கை – தொடர்பாக.

பார்வை :
1. CC.No.O.A.No.26/2021, filed before the Hon'ble NGT, Southern Zone, Chennai.
2. இவ்வலுவலகத்தில் இணை தலைமை சுற்றுச்சூழல் பொறியாளர், கோவை Memo.No.JCEE(M)/TNPCB/CBE/F.23–CBN/Tech/2024 Dated: 27.08.2024 பெறப்பட்ட நாள் : 29.08.2024.
3. இவ்வலுவலக பொறியாளர் அவர்களின் ஆய்வு நாள்: 10.12.2024.

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பார்வையில் குறிப்பிட்டுள்ள தங்களது புகார் மனுவில், கோவை மாவட்டம், மேட்டுப்பாளையம் தாலூக்கா, தேக்கம்பட்டி கிராமத்தில் இயங்கிவரும் தி/ள். ஐடிசி லிமிடெட், பேப்பர் போர்டு & ஸ்பெஷாலிட்டி பேப்பர் டிவிஷன்ஸ் என்ற நிறுவனத்தின் இயக்கத்தால் காற்று மாசு ஏற்படுவதாகவும், குடிநீர் மாசுப்படுவதாகவும் அதனால் அப்பகுதியில் குடியிருக்கும் பொதுமக்கள், குழந்தைகள் மற்றும் பெரியவர்கள் பாதிக்கப்படுவதாக புகார் மனுவில் கூறப்பட்டுள்ளது.

இப்புகார் தொடர்பாக, மேற்கண்ட இடமானது, இவ்வலுவலக பொறியாளர் 10.12.2024 அன்று ஆய்வு மேற்கொள்ளப்பட்டது. அவ்வாய்வின் பொழுது, தி/ள். ஐடிசி லிமிடெட், பேப்பர் போர்டு & ஸ்பெஷாலிட்டி பேப்பர் டிவிஷன்ஸ் நிறுவனமானது காற்று மாசு தடுப்பு சாதனங்கள் மற்றும் கழிவுநீர் சுத்திகரிப்பு நிலையம் முறையாக அமைத்து இருப்பது கண்டறியப்பட்டது,

எனவே, தொழிற்சாலையில் பொருத்தப்பட்டுள்ள காற்று மாசு தடுப்பு சாதனங்கள் மற்றும் கழிவுநீர் சுத்திகரிப்பு நிலையம் முறையாக பராமரித்து தொடர்ச்சியாகவும், திறம்படவும் இயக்கி பொது மக்களுக்கு இடையூறு ஏற்படாவண்ணம் நிறுவனத்தை இயக்குமாறு தமிழ்நாடு மாசு கட்டுப்பாடு வாரியத்தால் இதன் மூலம் அறிவுறுத்தப்படுகிறது.

18/12/24

மாவட்ட சுற்றுச்சூழல் பொறியாளர்
தமிழ்நாடு மாசு கட்டுப்பாடு வாரியம்
கோவை வடக்கு

(TRANSLATED COPY)

LIFE Lifestyle
for Environment

Tamil Nadu Pollution Control Board

From
Tmt. S. Vanaja, M.E.
District Environmental Engineer.
Tamil Nadu Pollution Control Board, Coimbatore North Office,
No. 5, Ramasamy Nagar.
Goundampalayam,
Coimbatore - 641 030.

To
M/s. ITC Limited,
Vivekanandapuram Post, Thekkampatti Village, Coimbatore-641113.

Letter No. 090186879/DEE/TNPCB/Coimbatore North/A.E/2024 dated 18.12.2024

Sir,

Sub: Tamil Nadu Pollution Control Board, Coimbatore North Office, Action taken on the complaint received regarding air pollution and water pollution caused in the area due to the operation of a company named M/s. ITC Limited, Paper Board & Specialty Paper Divisions in Vivekanandapuram Post, Thekkampatti Village, Mettupalayam Taluk, Coimbatore District – Regarding.

Ref: (1) CC. No. O.A.No.26/2021 filled before the Hon'ble NGT, Southern Zone, Chennai.

(2) Memo. No. JCEE(M)/TNPCB/CBE/F.23-CBN/Tech/2024 Dated: 27.08.2024 from Joint Chief Environmental Engineer received by this office on 29.08.2024

(3) Inspection conducted by this office Engineer on 10.12.2024

(TRANSLATED COPY)

In the complaint under reference (1), it has been stated that operation of the company M/s. ITC Limited, Paper Board & Specialty Paper Divisions at Thekkampatti village, Mettupalayam taluka, Coimbatore district causing air pollution and drinking water contamination which is affecting the public, children and adults living in the area.

With regard to this complaint, the above site was inspected by the Engineer of this office on 10.12.2024. During the inspection, it was found that the Paper Board & Specialty Paper Division of ITC Limited had properly installed air pollution control devices and sewerage treatment plant.

Therefore, the Tamil Nadu Pollution Control Board is hereby advice the company to properly and continuously maintain the air pollution control devices and sewerage treatment plant installed in the factory and operate in efficient manner so that it does not cause any inconvenience to the general public.

Sd/-
District Environmental Engineer.
Tamil Nadu Pollution Control Board,
Coimbatore North Office,

IN THE NATIONAL GREEN TRIBUNAL, SOUTHERN ZONE, CHENNAI

O.A. No. 35 of 2025

E. Ashok Kumar

... Applicant

Versus

The Ministry of Environment, Forest and Climate Change, Govt. of India

...Respondents

TYPEDSET OF DOCUMENTS

Chamber 28 Advocates & Solicitors

M/S. Rahul M Shankhar
(Ms.1240/2018)
Chandini Pradeep- Kumar
(Ms. 1929/2019)
M. Aravindan
(Ms. 8992/2022) &
Avanti Balachander
(D/3442/2021)

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COUNSEL FOR 9th RESPONDENT